

**Varazdin Development and Entrepreneurship Agency and
Faculty of Law, Economics and Social Sciences Sale - Mohammed V University in Rabat, Morocco**

In cooperation with:

**Faculty of Management University of Warsaw, Poland
Ecole Nationale de Commerce et de Gestion de Tanger - Abdelmalek Essaadi University, Morocco
Medimurje University of Applied Sciences in Cakovec, Croatia
GOVCOPP - University of Aveiro, Portugal**



Book of Proceedings

133rd esd Rabat 2026

Globalization, Development and Ecological Transition

Editors:

Mustapha Machrafi, Mario Konecki, Ivan Gospic, Ante Samodol



ISBN 978-953-6125-43-2



April, 2026

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Title ■ Globalization, Development and Ecological Transition - (Book of Proceedings)

Editors ■ Mustapha Machrafi, Mario Konecki, Ivan Gospic, Ante Samodol

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Publishing Editor ■ Domagoj Cingula

Publisher ■ Design ■ Varazdin Development and Entrepreneurship Agency / Faculty of Management University of Warsaw, Poland / GOVCOPP - University of Aveiro, Portugal / Faculty of Law, Economics and Social Sciences Sale - Mohammed V University in Rabat, Morocco / Ecole Nationale de Commerce et de Gestion de Tanger - Abdelmalek Essaadi University, Morocco / Medimurje University of Applied Sciences in Cakovec, Croatia.

Printing ■ Online Edition

ISBN 978-953-6125-43-2

The Book is open access and double-blind peer reviewed.

Our Books are available for download in a PDF format from the Economic and Social Development Conference website: <http://www.esd-conference.com>

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TERRITORIAL INTELLIGENCE AND BUSINESS TRANSFER: A LEVER FOR ENTREPRENEURIAL CONTINUITY, TERRITORIAL COMPETITIVENESS AND REGIONAL DEVELOPMENT

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ABSTRACT

Business transfer represents a major economic challenge, particularly in contexts where small and medium-sized enterprises (SMEs) play a central role in value creation and employment. While the literature has extensively examined the internal dimensions of succession, such as family governance, successor preparation, and intergenerational relationships, limited attention has been paid to the influence of the territorial environment. This paper proposes a conceptual approach that reinterprets business transfer through the lens of territorial intelligence. The objective is to demonstrate that information circulation, coordination among territorial actors, and territorial governance constitute key mechanisms that can significantly influence the success of succession processes. Drawing on a critical literature review, the study develops an integrated analytical framework based on a mediation logic, in which territorial intelligence acts as a structuring variable influencing business transfer through intermediate mechanisms. The paper highlights how territorial dynamics contribute to reducing uncertainty, facilitating access to resources, and strengthening collective support systems. In addition, this paper highlights the broader implications of business transfer for territorial development, emphasizing its role in sustaining local economic systems, reinforcing entrepreneurial continuity, and enhancing regional resilience. The contribution of this research is threefold. First, it bridges two research fields that remain insufficiently connected in the literature, namely business succession and territorial intelligence. Second, it proposes a conceptual model that links territorial dynamics to entrepreneurial continuity and territorial competitiveness. Third, it extends the discussion toward regional development by showing that business transfer may also constitute a lever for territorial resilience and local economic sustainability.

Keywords: *business transfer, family firms, territorial intelligence, territorial governance, entrepreneurial continuity, territorial competitiveness, regional development*

1. INTRODUCTION AND RESEARCH PROBLEM

Business transfer constitutes a major challenge for the continuity of the economic fabric, particularly in contexts where small and medium-sized enterprises (SMEs) play a central role in value creation and employment. Far from being limited to a mere transfer of ownership or management, it also involves broader issues related to the preservation of know-how, business continuity, and the firm's ability to adapt after the handover. In this context, family businesses occupy a particular place insofar as their functioning often relies on close interconnections between the family and the firm, as well as on tacit knowledge that is difficult to codify. However, business transfer cannot be reduced to family firms alone. It is part of a broader issue that potentially affects all businesses and, by extension, territorial economic dynamics. Despite the importance of this issue, the literature has long focused primarily on the internal dimensions of succession, emphasizing governance structures, successor preparation, and family relationships.

Although these elements are essential, they do not fully explain the conditions for successful transfer, since the process unfolds within an environment shaped by economic interactions, institutional arrangements, and networks of actors. This predominance of a firm-centered perspective has certainly made it possible to better identify the organizational and intergenerational determinants of succession. However, it also tends to relegate to the background the external conditions under which transfer takes place. Yet business transfer never occurs in an institutional or relational vacuum. It is shaped by market constraints, support mechanisms, proximity relations, information flows, and forms of coordination that may, depending on the context, either facilitate or complicate the process. Against this background, it becomes necessary to broaden the analysis and move beyond a strictly organizational reading of business transfer. Succession may be understood as a territorially embedded process, influenced by the quality of relationships among actors, the availability of information, and existing coordination mechanisms. In this respect, territorial intelligence appears to provide a particularly relevant analytical lens, as it emphasizes the circulation of information, coordination among actors, and territorial governance (Bertacchini, 2004; Pelissier, 2009). Business transfer can therefore no longer be viewed solely as an internal process within the firm. It must also be considered part of a broader territorial dynamic. Its success depends, at least in part, on the ability of the territory to anticipate transitions, support actors, and mobilize the resources necessary to sustain economic continuity. Yet the links between business transfer and territorial intelligence remain underexplored in the literature, particularly from an integrated perspective connecting territorial dynamics, entrepreneurial continuity, and territorial competitiveness. Beyond firm-level dynamics, territorial environments also play a key role in shaping economic performance and competitiveness. In this perspective, territorial competitiveness depends on the ability of regions to foster innovation, coordination, and knowledge circulation (Porter, 1990; Camagni, 2002). Moreover, SMEs, which are central to business transfer processes, are also recognized as important drivers of regional economic development and innovation (Ruchkina et al., 2017). This broader reading is particularly relevant in the context of changing local economies, where the continuity or disappearance of firms may directly affect employment, territorial resilience, and the long-term vitality of productive systems. From this perspective, the central research question of this study may be formulated as follows:

- *To what extent can territorial intelligence contribute to improving business transfer processes and, in doing so, support entrepreneurial continuity, territorial competitiveness, and regional development?*

To address this question, the study is structured around three complementary sub-questions. First, it seeks to examine the extent to which territorial dynamics, whether institutional, informational, or relational, influence business transfer processes. Second, it explores the mechanisms through which territorial intelligence may operate, particularly through information circulation, actor coordination, and territorial governance. Third, it assesses the extent to which embedding business transfer within a territorial intelligence perspective may constitute a lever for economic resilience, territorial competitiveness, and regional development. In line with these objectives, this research proposes a renewed reading of business transfer by placing it within a territorial perspective. It seeks to articulate the contributions of the literature on entrepreneurial succession with those relating to territorial intelligence in order to build an integrated analytical framework. Its contribution is threefold: first, it reconnects two theoretical fields that remain insufficiently linked; second, it develops a conceptual model linking territorial dynamics to entrepreneurial continuity and territorial competitiveness; third, it extends the analysis toward regional development by highlighting the broader territorial effects of business transfer. This contribution is both theoretical and analytical.

From a theoretical standpoint, it aims to show that succession cannot be understood solely through variables internal to the firm. From an analytical standpoint, it proposes a conceptual model based on a mediation logic, allowing a better understanding of how specific territorial dimensions translate into concrete effects on the conditions for successful transfer and on local economic continuity. The article follows a logical progression. After presenting the theoretical foundations related to family business succession and territorial intelligence, it proposes an articulation between these two fields. It then introduces the conceptual model and research hypotheses, before explaining the methodological approach adopted. The article concludes with a discussion of the main contributions, limitations, and avenues for future research.

2. THEORETICAL FRAMEWORK

2.1. Succession in Family Businesses

The transfer of businesses from one generation to another constitutes a central issue of organizational continuity, particularly in the case of family firms. It is not limited to the simple replacement of a leader, but also involves the transfer of management, ownership, and knowledge accumulated over time (Le Breton-Miller et al., 2004; Baltazar et al., 2022). From this perspective, succession cannot be viewed as an improvised transition. It requires genuine preparation of the successor, involving a gradual learning of responsibilities, but also the transmission of knowledge that is often implicit, difficult to formalize, and yet essential to the proper functioning of the business. It also requires attention to the relational dimension, since the balance among family members, employees, and business partners plays a crucial role in the smooth unfolding of the succession process (Le Breton-Miller et al., 2004). Research devoted to this issue shows that the transition from one generation to another remains a fragile stage. Many family businesses overlook the importance of this phase or do not approach it under the right conditions, which explains several recurring difficulties in the literature, notably insufficient planning, family tensions, the difficulty for the incumbent to step aside, or the lack of successor preparation (Alshibani and Alshebami, 2025; Baltazar et al., 2022). These analyses have made it possible to consolidate the understanding of the internal factors of succession. In particular, they show that succession depends neither on a single event nor on a single decision, but rather on a sequence of phases in which emotional, strategic, and organizational dimensions intertwine. In this sense, the literature on family businesses has significantly contributed to shifting attention from a patrimonial vision of succession toward a more process-oriented approach. However, it would be reductive to limit the analysis of succession to the internal dynamics of the firm alone. Succession always takes place within a broader environment composed of economic relationships, institutional support, market constraints, and informational resources. In this respect, several studies show that the circulation of information, the quality of networks, and the firm's ability to adapt to its environment also play a role in the unfolding of the succession process (Baltazar et al., 2025). In other words, succession is not played out solely within the closed space of the family or the organization. It also depends on the firm's capacity to position itself within an ecosystem of resources, support structures, and interactions. This observation leads to a qualification of dominant approaches: while internal factors are decisive, they do not, by themselves, fully explain the success or failure of succession. Thus, succession appears less as a one-time event than as a decisive transitional phase, at the crossroads of human, organizational, and strategic issues. Its success influences not only the survival of the firm, but also its capacity to preserve its activity, evolve, and remain competitive over time. Yet these approaches remain largely centered on an internal vision of the firm, leaving in the background the structuring role of territorial dynamics in the success of the transfer process. This theoretical limitation justifies the relevance of a shift in perspective.

Alongside the contributions stemming from research on family succession, it becomes pertinent to examine the extent to which the territorial environment may also be considered a full explanatory factor.

2.2. Territorial Intelligence

Territorial intelligence developed in a context where territories progressively ceased to be perceived as mere spaces for the implementation of public policies or as simple geographical frameworks. They are now understood as genuine spaces of action, shaped by relationships, exchanges, projects, and forms of collective learning. In this context, territorial intelligence seeks to understand how a territory can better mobilize its resources, improve the circulation of information, and better coordinate its actors in order to support its development (Pelissier, 2009). What makes this notion particularly fruitful is that it does not refer solely to a technical tool or to a monitoring process in the strict sense. It is part of a broader vision in which information acquires value only when it is shared, interpreted, and integrated into a collective dynamic. In other words, it is not enough for a territory to possess information. Its actors must also be able to transform it into useful knowledge, and then into capacities for action. It is precisely in this transition from information to action that territorial intelligence finds its full meaning (Bertacchini, 2004). This approach also rests on a particular way of conceiving territorial development. It is rooted more in a bottom-up logic than in a top-down one. Pelissier (2009) clearly shows that two readings coexist: one considers territorial intelligence as a local declension of economic intelligence, while the other sees it as an approach built from the territory itself, based on its needs, actors, and specific resources. This second reading appears particularly heuristic from a territorial development perspective, since it restores a central role to local actors and their capacity for cooperation. From this perspective, the territory is not only defined by what it initially possesses, but also by what it collectively manages to build. Important resources are therefore not only material. They may also be intangible, relational, organizational, or cognitive. They may involve competencies, knowledge, networks, trust among actors, or mechanisms enabling better information sharing. One of the major contributions of territorial intelligence is precisely to shed light on this collective construction process, often less visible yet decisive for the trajectory of a territory (Bertacchini et al., 2006). This collective dimension is essential. Territorial intelligence assumes that the actors of a territory, including public institutions, firms, associations, universities, and citizens, do not remain isolated from one another. On the contrary, it encourages the creation of bridges, the organization of exchanges, and the rapprochement of sometimes divergent logics around common issues. In this sense, it aligns with the idea of territorial collective intelligence, where the territory is built less through the juxtaposition of initiatives than through the connection of competencies, perspectives, and projects (Bourret et al., 2012). Information and communication technologies naturally play an important role in this dynamic, but they do not in themselves constitute its core. They facilitate the collection, storage, processing, and dissemination of information, but their usefulness depends on how they are integrated into cooperative practices. Bertacchini (2004) indeed insists on this point by associating territorial intelligence with a process that is both informational and anthropological, reminding us that territorial development does not rest solely on tools, but also on behaviors, relationships, and forms of collective appropriation. Ultimately, the interest of territorial intelligence lies in its ability to connect several dimensions that are often studied separately: information, governance, participation, coordination, and project. It thus provides a useful framework for analyzing how a territory can improve its capacity for anticipation, strengthen the coherence of its collective action, and build more appropriate responses in changing contexts (Bourret et al., 2012; Pelissier, 2009). This perspective is also consistent with studies emphasizing the importance of proximity and knowledge networks in fostering innovation and coordination among territorial actors (Balland et al., 2015).

In this respect, territorial intelligence may also be interpreted as a mechanism through which local actors create, share, and mobilize knowledge in support of collective action and regional development. However, despite the richness of this body of work, its mobilization to analyze specific organizational issues such as business transfer remains limited. This lack of systematic cross-fertilization suggests that territorial intelligence, although theoretically relevant, has not yet been fully invested as an analytical framework for entrepreneurial continuity.

2.3. Articulation Between Succession and Territorial Intelligence

The literature on succession in family businesses has long privileged an approach centered on internal dynamics, particularly family relationships, governance, and the transfer of competencies. However, this perspective now appears insufficient for grasping the full complexity of the transfer process, insofar as it tends to neglect the influence of the territorial environment in which the firm evolves. This observation highlights a blind spot in the literature, which justifies the relevance of an integrated approach linking territorial dynamics to transfer processes. Succession does not take place in a neutral space, but in a territorial system shaped by multiple interactions among actors, information flows, and coordination mechanisms. In this context, territorial intelligence makes it possible to move beyond a strictly organizational reading of succession by placing it within a broader dynamic that is both systemic and collective. Territorial intelligence may thus be understood as a process of collecting, processing, and disseminating information in the service of territorial decision-making, mobilizing a plurality of public, private, and institutional actors (Bertacchini et al., 2006; Pelissier, 2009). As such, it constitutes a strategic lever capable of transforming information into a collective resource and improving the coordination of local initiatives. From this perspective, several dimensions of territorial intelligence appear decisive for understanding the conditions of successful succession. First, the circulation of information plays a central role. Access to relevant, reliable, and shared information makes it possible to reduce the uncertainty associated with the transfer process, identify opportunities, and anticipate risks (Kassimi et al., 2025). In the context of succession, this dimension may facilitate the preparation of the successor, the identification of support resources, and the gradual integration of the successor into the local economic ecosystem. Second, coordination among territorial actors appears as a structuring element. Succession often mobilizes a set of actors, including public institutions, support structures, professional networks, experts, and economic partners, whose interaction may condition the success of the process. Territorial intelligence precisely fosters this coordination by organizing exchanges, structuring networks, and facilitating the co-construction of responses adapted to territorial realities. In a more recent approach, this coordination is part of a logic of collaborative territorial intelligence, grounded in collective learning and the co-construction of knowledge among heterogeneous actors (Chraiha and Salam, 2026). Such a dynamic may strengthen the adaptability of territories while fostering the emergence of organizational and entrepreneurial innovations. Third, territorial governance constitutes an essential structuring framework. Participatory governance, open to cooperation and coordination among actors, can create an environment more favorable to business transfer by facilitating access to resources, support mechanisms, and local networks. Conversely, fragmented or weakly articulated governance may hinder transfer dynamics (Kassimi et al., 2025). Finally, territorial intelligence is part of a broader logic of territorial value creation by contributing to the competitiveness, resilience, and attractiveness of territories (Bourret et al., 2012; Kassimi et al., 2025). It thus makes it possible to connect individual dynamics, such as business transfer, with collective territorial development issues, by transforming an organizational process into a potential lever for local development. The interest of this articulation lies in the fact that it goes beyond the simple addition of context.

It is not merely a matter of stating that the territory matters around the firm, but rather of showing that it acts through specific mechanisms likely to influence the concrete conditions of transfer. In this sense, territorial intelligence does not intervene as an analytical backdrop, but as a structuring variable explaining how certain collective resources are converted into organizational capacities. Thus, the articulation between succession and territorial intelligence highlights the determining role of informational, relational, and institutional dimensions in the success of transfer. It invites us to consider succession no longer solely as an internal process within the firm, but as a territorial phenomenon embedded in an ecosystem of actors, resources, and knowledge. This approach makes it possible to move beyond existing fragmented analyses and to place business transfer within a renewed systemic and territorial perspective. This integrated reading prepares the transition toward conceptual formalization. Once the theoretical links have been established, it becomes possible to propose a structured model making explicit the relationships among territorial intelligence, intermediate variables, successful succession, and broader territorial outcomes.

3. CONCEPTUAL MODEL AND RESEARCH HYPOTHESES

3.1. Construction of the Conceptual Model

Based on the elements developed above, it appears that succession in family businesses cannot be understood solely as an internal process, but must be repositioned within a broader territorial framework. The articulation between succession and territorial intelligence highlights the central role of dimensions such as the circulation of information, coordination among actors, and territorial governance. From this perspective, territorial intelligence may be considered a structuring variable capable of indirectly influencing the success of the transfer process. It acts by facilitating access to information, strengthening interactions among actors, and creating a more favorable institutional environment. The proposed model is thus based on the idea that territorial intelligence contributes to improving the conditions of succession through three main mechanisms, acting as an explanatory variable whose effects unfold through mediating variables. This theoretical choice is not neutral. It means that territorial intelligence is not assumed to produce a direct and uniform effect on succession. Rather, its influence depends on the way it improves the quality of the informational, relational, and institutional environment in which firms operate. The mediation logic adopted is therefore justified by the very nature of the phenomenon under study. Business transfer is not affected by the territory in an abstract way, but through concrete mechanisms by which the latter makes access to resources possible, reduces certain uncertainties, and strengthens coordination among stakeholders. In other words, the territory does not act instead of the firm. It structures a framework of opportunities and constraints that influences the conditions under which succession unfolds.

Three intermediate mechanisms are thus retained:

- the circulation of information, which reduces uncertainty, improves the visibility of available resources, and facilitates decision-making;
- coordination among actors, which makes it possible to mobilize complementary competencies, structure interactions, and strengthen support capacities;
- territorial governance, which organizes the rules of cooperation, fosters the coherence of collective action, and directs local dynamics.

These intermediate dimensions play a mediating role between territorial intelligence and successful succession. They make it possible to translate territorial dynamics into concrete effects at the firm level. This point is essential, because it allows one to move from a general intuition regarding the role of the territory to a more rigorous analytical formalization of the mechanisms at work. The proposed conceptual model is thus part of a relational reading of transfer.

It reduces neither succession to a simple family or managerial issue, nor territorial intelligence to a diffuse resource. On the contrary, it seeks to show how certain qualities of the territory may strengthen entrepreneurial continuity capacities. In this respect, it constitutes an attempt at theoretical structuring that may later be extended through empirical investigation. The model also broadens the analytical scope of the discussion by considering that successful transfer may generate effects beyond the firm itself. By contributing to entrepreneurial continuity, the maintenance of local activity, and the preservation of productive capacities, business transfer may also support territorial competitiveness and regional development. This extension remains consistent with the original logic of the paper while better aligning the conceptual proposal with broader debates on territorial performance and economic resilience.

3.2. Research Hypotheses

Based on this analytical framework, several hypotheses may be formulated. They reflect the general logic of the model, according to which territorial intelligence exerts a positive influence on certain intermediate variables, which in turn contribute to improving the conditions for successful succession.

1. Effect of territorial intelligence

- **H1:** Territorial intelligence positively influences the circulation of information within the territory.
- **H2:** Territorial intelligence fosters coordination among territorial actors.
- **H3:** Territorial intelligence contributes to the improvement of territorial governance.

2. Effect of intermediate variables on succession

- **H4:** The circulation of information positively influences the success of succession in family businesses.
- **H5:** Coordination among territorial actors facilitates the success of the transfer process.
- **H6:** Effective territorial governance improves the conditions of succession.

3. Broader territorial effects

- **H7:** Successful business transfer contributes to entrepreneurial continuity, territorial competitiveness, and regional development.

4. Overall mediation effect

- **H8:** Territorial intelligence indirectly influences entrepreneurial continuity, territorial competitiveness, and regional development through information circulation, actor coordination, territorial governance, and successful succession.

These hypotheses are of double interest. On the one hand, they ensure the internal coherence of the model by clearly linking the explanatory variable, the mediating variables, the dependent variable, and the broader territorial outcomes. On the other hand, they prepare the ground for future empirical validation, whether qualitative, quantitative, or comparative. In this sense, the conceptual model does not serve merely an illustrative function. It also provides the basis for a more robust scientific formalization of the proposed relationships.

3.3. Conceptual Model

The following figure presents the proposed conceptual model. It synthesizes the overall logic of the research by highlighting the structuring role of territorial intelligence and the mechanisms through which it is assumed to act on the success of the transfer process and on broader territorial outcomes.

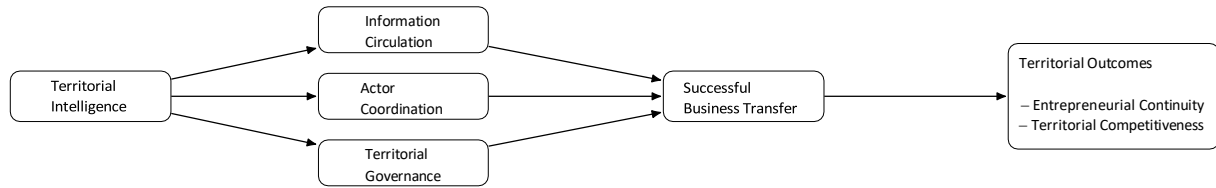


Figure 1: Conceptual model of the research

As illustrated by Figure 1, the proposed model does not postulate a direct and univocal relationship between territory and transfer. Rather, it emphasizes the existence of indirect effects, mediated by dimensions that reflect the quality of the territorial environment. This clarification reinforces the coherence of the theoretical framework and avoids an overly deterministic reading of the role of the territory.

4. RESEARCH METHODOLOGY

This research is based on an essentially conceptual approach. It relies on a critical review of the literature devoted, on the one hand, to succession in family businesses and, on the other hand, to territorial intelligence. The objective was not to immediately test a model in the field, but rather to clarify the main concepts, identify their points of convergence, and construct a coherent analytical framework. From this perspective, the adopted stance falls within the scope of an integrative conceptual article. This type of approach is particularly relevant when the existing literature remains fragmented, when the mobilized notions come from distinct fields, and when an effort of theoretical articulation proves necessary. In this case, the aim was not merely to inventory existing work, but to build an analytical grid capable of connecting two corpora that are still only weakly linked. The literature review was therefore guided by a logic of reasoned selection. The works mobilized were retained according to three main criteria: their theoretical contribution to the understanding of succession or territorial intelligence, their direct relevance to the research problem, and their ability to shed light on the mechanisms likely to connect the territorial environment with the transfer process. In this logic, particular attention was paid to seminal texts, review articles, and more recent contributions making it possible to update the reflection on territorial governance, information circulation, coordination among actors, territorial competitiveness, and regional development. This approach does not therefore fall under a systematic review in the strict sense, but rather a critical and structured review oriented toward theoretical construction. This positioning is important because it allows one to remain consistent with the purpose of the article: not to exhaust all available publications, but to identify the most relevant contributions for the emergence of a coherent explanatory framework. More concretely, several types of works were mobilized: theoretical contributions, empirical articles, as well as more recent research on territorial governance, information circulation, coordination among actors, proximity dynamics, and territorial competitiveness. This reading process made it possible to observe that the literature on succession remains largely centered on the firm itself, even though transfer often takes place within a territorial environment that may either facilitate or complicate its development. Based on this observation, the study sought to build a conceptual model capable of linking these two fields. The idea was not to add one more concept, but rather to propose a broader reading of the succession process by taking into account the territorial dimensions surrounding it. The proposed model thus results from a process of connecting the main elements identified in the literature. The approach followed a three-stage progression. First, the contributions of the literature on succession were examined in order to identify the limits of an exclusively internal reading of the phenomenon. Second, the works on territorial intelligence were mobilized to identify the dimensions likely to shed light on business transfer.

Finally, these two bodies of literature were articulated in order to derive a common explanatory logic and formalize the research hypotheses. This methodology obviously has limitations, since it does not, at this stage, rest on empirical validation. It nevertheless makes it possible to lay useful theoretical foundations for future research, particularly from the perspective of empirical testing, comparative territorial studies, or in-depth qualitative investigations involving firms undergoing transfer. Thus conceived, methodology does not constitute a mere formal section, but rather a central element of the scientific contribution of the article. It explains the way in which the conceptual framework was constructed and strengthens the analytical credibility of the theoretical proposition advanced.

5. DISCUSSION

One of the main contributions of this research is to show that succession in family businesses cannot be understood solely on the basis of what happens inside the firm. While existing studies have largely emphasized family, managerial, or organizational dimensions, they often leave in the background the environment within which transfer is embedded. In this sense, the present reflection makes it possible to complement the existing literature by explicitly integrating the territorial dimension into the analysis of business transfer. More specifically, this research differs from traditional approaches by considering the territory not as a simple peripheral framework, but as a structuring dimension of the transfer process. Contrary to readings exclusively focused on family governance, successor preparation, or intergenerational tensions, the analysis proposed here shows that certain territorial resources may modify the concrete conditions in which succession unfolds. By repositioning succession within a broader territorial framework, this research highlights the role of factors which, without being entirely absent from the literature, remain insufficiently structured in existing analyses. This is notably the case for the circulation of information, which contributes to reducing uncertainty and facilitating decision-making, or for coordination among actors, which makes it possible to mobilize resources and competencies that are often dispersed. Territorial governance also appears as a structuring element. When it fosters cooperation, information sharing, and coherence of action, it may create an environment more conducive to business transfer. Conversely, fragmented governance may intensify the difficulties already associated with the succession process. Thus, this research invites us to consider succession no longer as an isolated phenomenon, but as a situated process, influenced by a set of territorial dynamics. Territorial intelligence offers, in this respect, a relevant analytical framework for understanding these interactions and the conditions of successful transfer. In addition to existing work, the interest of the proposed framework also lies in introducing an implicit comparative logic. Whereas some approaches analyze succession as a problem primarily internal to managerial or family continuity, the perspective adopted here suggests that the quality of the territory may itself become an explanatory variable. The model therefore does not challenge the internal factors identified in the literature. Rather, it repositions them within a broader architecture in which territorial dynamics contribute to strengthening, compensating for, or sometimes weakening transfer capacities. From this perspective, business transfer can also be interpreted as a mechanism contributing to territorial resilience, ensuring the continuity of economic activities and supporting long-term regional development. In other words, the success or failure of succession may extend beyond the boundaries of the firm itself and affect the broader trajectory of local productive systems.

5.1. Theoretical Implications

From a theoretical standpoint, this research contributes to bringing closer together two fields that remain only weakly articulated: succession in family businesses and territorial intelligence.

It therefore proposes to move beyond a strictly internal reading of succession by introducing a structured territorial dimension. By mobilizing concepts such as the circulation of information, actor coordination, and territorial governance, it broadens the traditional analytical framework and enriches the understanding of the transfer process. The theoretical contribution therefore lies not only in the addition of a new context of analysis, but also in a reconfiguration of the explanatory reasoning. Indeed, the proposed model suggests that the territorial environment does not intervene in a diffuse or secondary way. It acts through identifiable intermediate mechanisms, which makes it possible to formalize more precisely the role of the territory in entrepreneurial continuity. Moreover, this research highlights the role of intermediate mechanisms translating the influence of the territory on succession. This approach opens the way to more complex models integrating indirect effects, mediation logics, or even interactions between individual and territorial variables. It also opens a space for interdisciplinary dialogue among applied economics, management sciences, and territorial analysis. This opening is important because business transfer phenomena lie precisely at the intersection of several levels of analysis that it would be artificial to treat separately. Finally, by integrating territorial competitiveness and regional development into the analytical discussion, the article broadens the implications of succession studies. It suggests that business transfer should not be treated solely as a firm-level issue, but also as a phenomenon with broader territorial and developmental significance.

5.2. Practical Implications

Beyond its theoretical contribution, this research highlights several important practical implications. On the one hand, it underlines the role that territorial actors may play in supporting transfer processes. Local authorities, chambers of commerce, business support structures, and professional networks may help reduce uncertainty by facilitating access to information, guiding business owners, and structuring support mechanisms. On the other hand, it highlights the importance of coordination among actors. The development of territorial networks, linking firms with experts or partners, as well as the creation of spaces for exchange, may strengthen the effectiveness of transfer processes. Finally, this research invites us to consider succession as a territorial issue, and not solely as an internal firm matter. From this perspective, local public policies could integrate the issue of transfer more strongly into their economic development strategies by supporting dedicated mechanisms and fostering logics of cooperation. This perspective is particularly important in territories where the disappearance or weakening of firms undergoing transfer may produce effects that extend far beyond the scale of the firm itself. In this sense, the issue of transfer concerns not only owners or successors, but also economic vitality, local employment, territorial competitiveness, and the resilience of the productive fabric.

5.3. Methodological Implications

From a methodological standpoint, this research shows the interest of conceptual approaches in the exploration of themes that remain insufficiently structured. By articulating distinct theoretical fields, it makes it possible to propose an integrated analytical framework that may serve as a basis for future empirical investigations. It also highlights the relevance of adopting an interdisciplinary approach, mobilizing contributions from economics, management sciences, and geography, in order to better grasp the complexity of territorial dynamics. More broadly, it shows that a conceptual article can produce a genuine scientific contribution provided that it does not merely juxtapose references. It is precisely the reasoned articulation of prior work, the clarification of mechanisms, and the formalization of a coherent model that give the present approach its analytical scope.

5.4. Limitations and Avenues for Future Research

This research nevertheless presents certain limitations. First, it is based on a conceptual approach, which does not make it possible to empirically test the proposed relationships. The developed model therefore remains to be validated in real contexts, notably through field studies, quantitative analyses, or mixed approaches. Second, the proposed model remains relatively general. Since territorial dynamics may vary greatly depending on the context, it would be relevant to examine how these relationships are expressed in different types of territories, whether rural or urban, dynamic regions or areas facing difficulties. Moreover, other variables could enrich the analysis, notably institutional, cultural, or sectoral factors. Some firms are indeed more strongly dependent on their territorial anchorage than others, which could modify the intensity of the proposed mechanisms. These limitations open several research perspectives. Future studies could seek to empirically test the proposed hypotheses, integrate other explanatory variables, whether cultural, institutional, or individual, or analyze the role of public policies in supporting succession. It would also be interesting to compare several territories in order to identify the configurations in which territorial intelligence exerts the most significant effects on transfer processes and territorial outcomes. The discussion thus shows that the main interest of this research is not to close the debate, but rather to open a broader research agenda. The proposed model constitutes a working basis that may be refined, nuanced, and eventually reconfigured in the light of subsequent empirical investigations.

6. CONCLUSION

This research set out to propose a broader reading of succession in family businesses by integrating the territorial dimension. It starts from the observation that classical approaches, although useful, remain primarily focused on internal firm dynamics and leave in the background the external conditions within which transfer takes place. The analysis conducted shows that territorial intelligence offers a particularly relevant framework for overcoming this limitation. By emphasizing the circulation of information, coordination among actors, and territorial governance, it makes it possible to better understand how a territory may support or, on the contrary, weaken transfer processes. The contribution of this research is therefore threefold. From a theoretical perspective, it brings closer together two fields that still interact only weakly: succession in family businesses and territorial intelligence. From an analytical perspective, it proposes a conceptual model based on a mediation logic, making it possible to explain more precisely the mechanisms through which territorial dynamics may influence transfer conditions. From a broader territorial perspective, it extends the reflection toward competitiveness and regional development by showing that business transfer may also sustain local economic continuity and resilience. From a practical standpoint, this work highlights the importance of thinking about transfer not only at the level of the firm, but also at the level of the territory, its actors, and its resources. It thus reminds us that entrepreneurial continuity does not depend exclusively on the preparation of the successor or family stability, but also on the capacity of the territory to provide a favorable informational, relational, and institutional environment. This work nevertheless remains a first step. It would benefit from being extended through empirical research making it possible to observe more concretely how territorial dimensions influence transfer trajectories in different contexts. In this sense, business transfer appears not only as an organizational challenge but also as a key component of territorial resilience and sustainable regional development. It thus highlights that business transfer does not constitute solely an organizational issue, but also a strategic lever for territorial development, contributing to the structuring, resilience, and competitiveness of local economies.

It is undoubtedly at this level that the proposed model may be refined, discussed, and eventually consolidated. Its value lies less in any definitive character than in its capacity to open a new analytical framework likely to durably enrich reflection on the links between entrepreneurial continuity and territorial dynamics.

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REGIONAL DEVELOPMENT IN BORDER REGIONS OF CENTRAL AND EASTERN EUROPE: INTERREG PROGRAMMES, TERRITORIAL COHESION AND EVALUATION CHALLENGES

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ABSTRACT

Border regions of Central and Eastern Europe are characterised by historical fragmentation, development disparities and complex socio-economic processes. In this context, Interreg programmes have become important instruments for promoting territorial cohesion, institutional cooperation and regional development. The aim of this paper is to analyse the role of Interreg programmes in regional development within border regions of Central and Eastern Europe, with particular emphasis on territorial cohesion and evaluation challenges. The paper is based on an analysis of scientific literature, European Union policy documents and selected empirical findings from the Hungary-Croatia border area. The findings indicate that Interreg programmes contribute to infrastructural development, institutional networking, knowledge transfer and cross-border integration processes. However, measuring the long-term effects and sustainability of funded activities remains a significant challenge due to the complexity of territorial development and the lack of comprehensive evaluation indicators. The paper highlights the need for additional longitudinal and multidimensional research on the long-term impacts of European Territorial Cooperation programmes.

Keywords: Regional Development; Border Regions; Central and Eastern Europe; Interreg; Cross-Border Cooperation

1. INTRODUCTION

Border regions occupy a strategically important but structurally complex position within the European Union. As argued by Scott and Wilson, borderlands extend beyond strictly legalistic and administrative definitions, emerging through patterns of interaction as well as geographical imaginaries. Consequently, borderlands represent not only elements of European heritage, but also reminders of the ambivalent nature of bordered territoriality, functioning simultaneously as a stabilising and potentially disruptive or violent force (2025, p.1). Kundera (1984:6) mention that the borders of Central Europe are “imaginary” and continuously redefined through changing political and historical circumstances. Borders themselves are multidimensional phenomena that simultaneously function as barriers, bridges, opportunities and sources of fragmentation. Their role has changed significantly through European integration processes, especially within the European Union, where border regions increasingly became spaces of territorial cooperation and interaction rather than exclusively peripheral areas separated by national borders. Interpretations such as “bridge”, “wall”, “opportunity”, “threat”, “borderless”, “re-bordering”, “de-bordering”, “part barriers, part bridges“, are only some of the descriptions given as terms concerning borders and border regions, indicating that this discussion has only just begun (O’Dowd, 2002; Topaloglou et al., 2005). As noted by Haselsberger (2014:507), borders are not just “visible lines” in space or on a map; on the contrary they are complex social constructions, with many different meanings and functions imposed on them. The cohesion policy of the European Union increasingly recognised the importance of border regions through the development of European Territorial Cooperation mechanisms such as Interreg. Border regions today account for more than 40% of the EU territory, approximately 30% of its population and 30% of its GDP (European Commission, 2017).

Nevertheless, many border areas, especially within Central and Eastern Europe, continue to experience structural disadvantages associated with peripheralisation, demographic decline, weaker innovation capacities and institutional asymmetries...; especially concerning strategic sectors of the economy, it is crucial to assess that this strategy provides growth advantages to some regions and not to others, so that nearshoring produces potential adverse consequences, going against the already complex process of decreasing regional disparities (Capello & Dellisanti, 2024:4240). Cross-border cooperation programmes therefore emerged not only as financial instruments but also as mechanisms intended to reduce territorial fragmentation, strengthen institutional cooperation and promote balanced regional development. Since the introduction of the INTERREG programmes in 1990, the European Commission has closely associated border regions with the project of European Integration and especially to the accomplishment of the Single European Market. Since then, for almost 30 years an increasing number of cross-border, interregional and transnational projects have been cofinanced by the European Union (EU) during the different INTERREG periods. (Medeiros, 2018:1). At the same time, evaluating the real long-term effects of these programmes remains methodologically challenging. Existing programme evaluation systems often focus on short-term outputs and measurable indicators, while broader territorial transformations and sustainability effects remain difficult to operationalise and monitor over longer periods of time (Pámer, 2021). The importance of understanding these long-term territorial effects is additionally emphasised within previous empirical research conducted in the Hungary–Croatia border area. The doctoral research by Ravlić (2019) highlighted that the principal research problem lies precisely in identifying the real impact of invested funds during and after the seven-year implementation period of the programme, particularly regarding the development of human potential, institutional cooperation and broader regional development effects during the sustainability phase following project completion. More recent analyses, however, suggest that despite this long trajectory of scholarly engagement, the field still lacks a comprehensive theory of cross-border integration and continues to rely heavily on case-study-driven approaches (Wróblewski, 2022). Accordingly, this paper analyses the relationship between regional development, territorial cohesion and Interreg programmes within the border regions of Central and Eastern Europe, with particular emphasis on the challenges associated with measuring long-term programme effects and evaluating territorial transformations generated through cross-border cooperation.

2. BORDER REGIONS AND REGIONAL DEVELOPMENT IN CENTRAL AND EASTERN EUROPE

The concept of territorial cohesion occupies a central position within European regional policy and increasingly shapes the strategic orientation of European Territorial Cooperation programmes. Territorial cohesion aims not only to reduce economic disparities between regions, but also to strengthen territorial integration, accessibility, institutional cooperation and balanced development across European territories (European Commission, 2017). Within border regions, territorial cohesion is particularly important due to the existence of administrative, legal and historical barriers that continue to influence cross-border interaction even after the removal of many formal border restrictions through European integration processes (Omarjee, 2022). Borders therefore continue to function simultaneously as spaces of opportunity and spaces of fragmentation, creating complex governance environments that require coordinated territorial responses (Chilla & Evrard, 2021). At the same time, while cross-border cooperations facilitated significant progress in fostering integration, its effectiveness is often undermined by structural and institutional barriers. There need for policies that move beyond funding-driven cooperation to establish genuinely collaborative frameworks grounded in shared regional objectives (Fogarasi, 2024:139).

2.1. Development of territorial cooperation

Interreg I (1990-1993) emerged in the context of the completion of the Single European Market and focused primarily on reducing the peripheral position of border regions and overcoming structural development difficulties caused by administrative separation and weak connectivity between neighbouring territories. Actions implemented during this first programming period largely focused on transport and communication infrastructure, business support, tourism development and environmental protection. The programme represented one of the first systematic attempts to address the socio-economic marginalisation of border areas through coordinated European regional development interventions (Kiosi, 2025:17). The Interreg II period (1994-1999) significantly expanded both the financial and institutional dimensions of cross-border cooperation. The programme increasingly focused on the establishment of cooperation networks, adaptation of border regions to the integrated European market and strengthening of territorial planning initiatives. Interreg II additionally introduced new dimensions of transnational cooperation through Interreg II C, aimed at addressing large-scale territorial planning issues, including environmental risks such as flooding and droughts. This programming period demonstrated that regional development within border areas could no longer be understood exclusively through infrastructural investments but required integrated territorial approaches and institutional cooperation mechanisms (Kiosi, 2025:17-18). The Interreg III programming period (2000-2006) represented an important shift in the development of European Territorial Cooperation as it formally established three major cooperation strands: cross-border cooperation (strand A), transnational cooperation (strand B) and interregional cooperation (strand C) (INTERACT, 2007). The introduction of programmes such as ESPON and INTERACT reflected the increasing importance of territorial analysis, policy learning and governance capacity building within EU regional development policy (Zoetermeer, 2010). During this period, territorial cohesion became increasingly associated with knowledge exchange, policy coordination and institutional networking across regions, rather than solely with infrastructural modernisation. Interreg IV (2007-2013) further strengthened territorial cooperation as one of the objectives of EU Cohesion Policy. The programming period focused on strengthening cross-border cooperation through joint local and regional initiatives, promoting integrated territorial development and encouraging exchange of experience between regions (Kiosi, 2025:19). The Interreg V programming period (2014-2020) introduced stronger thematic concentration, simplification and result orientation in accordance with the Europe 2020 Strategy priorities. Greater emphasis was placed on innovation, climate adaptation, low-carbon development, SME competitiveness and social inclusion. The programmes increasingly recognised that territorial cohesion also depends on institutional capacities, knowledge transfer and long-term governance quality. In this context, cross-border cooperation was increasingly understood not only as a financial mechanism but also as a process of building trust, institutional learning and social integration within border regions (Chilla & Evrard, 2021). The current Interreg VI programming period (2021-2027) reflects an even stronger orientation toward governance quality, sustainability, resilience and institutional cooperation. Two new Interreg-specific objectives explicitly focus on strengthening cooperation governance and building mutual trust among institutions and citizens in border regions. Within the Interreg VI-A Hungary-Croatia Programme 2021-2027, priorities include the development of a competitive border region, greener and low-carbon development, sustainable mobility, social inclusion and better cooperation governance (Interreg VI-A Hungary-Croatia Programme Summary, 2023). The financial allocation for Interreg programmes has increased significantly since the introduction of the initiative in 1990, reflecting the growing importance of territorial cooperation within European Union regional development policy.

During the first programming period (1990–1993), Interreg operated with a budget of EUR 4,875 million across 11 Member States. In the 1994–1999 period, funding amounted to EUR 3,600 million, while the 2000–2006 period again reached EUR 4,875 million. A substantial increase became visible during the 2007–2013 programming period, when allocations rose to EUR 8,700 million following EU enlargement and the strengthening of territorial cohesion objectives. Funding remained at a similarly high level during 2014–2020 with EUR 8,900 million allocated to European Territorial Cooperation programmes. In the current 2021–2027 programming period, Interreg funding amounts to approximately EUR 8,050 million across 27 Member States, confirming the continued strategic importance of cross-border, transnational and interregional cooperation within EU cohesion policy (Pámer, 2021:128).

2.2. Importance of territorial cooperation

The importance of territorial cooperation became increasingly visible through successive Interreg programming periods. Since the introduction of the INTERREG programmes in 1990, the European Commission has closely associated border regions with the project of European Integration and especially to the accomplishment of the Single European Market. Since then, an increasing number of cross-border, interregional and transnational projects have been cofinanced by the European Union (EU) during the different INTERREG periods (Reitel et al., 2018:7). Over time, Interreg evolved into a broader framework involving cross-border, transnational and interregional cooperation strands aimed at strengthening territorial integration and governance capacities across Europe. Cross-border cooperation programmes additionally became important instruments for strengthening institutional capacities and governance structures within border areas. Euroregions and other territorial cooperation mechanisms contributed to developing multi-level governance structures and exchange of knowledge and practices across borders (Perkmann, 2007; Popescu, 2008). Such processes are particularly important within Central and Eastern Europe where many border regions continue to experience institutional asymmetries and weaker governance capacities associated with post-socialist transformation. The findings from the Hungary-Croatia border area indicate that cross-border cooperation contributed significantly to strengthening institutional networking and territorial interaction within the observed region. The research demonstrated that nearly 90% of organisations established additional cross-border contacts during project implementation, while respondents frequently highlighted the importance of long-term institutional partnerships developed through programme activities (Ravlić, 2019). Similarly, Ravlić et al. (2020) emphasised that border regions increasingly gained importance due to the opportunities created through EU-funded territorial cooperation programmes. According to the authors, cooperation enables areas located on different sides of the border to jointly address common territorial challenges and develop coordinated development responses within structurally disadvantaged border regions. The importance of institutional cooperation becomes particularly visible in rural and peripheral border areas characterised by weaker organisational capacities and fragmented governance structures. Cross-border projects may therefore function as mechanisms for developing governance capacities, strengthening institutional trust and encouraging territorial learning processes between organisations located on different sides of the border (Perkmann, 2007). Nevertheless, empirical findings also revealed considerable asymmetries between different categories of project implementers. Institutions financed through regional or national government structures generally possessed stronger organisational and financial capacities compared to NGOs and self-financed organisations that frequently experienced difficulties related to pre-financing requirements and administrative burdens (Ravlić, 2019). Such disparities indicate that territorial cohesion processes themselves may be shaped by unequal institutional capacities within border regions.

The complexity of border regions additionally reflects the broader transformation of borders themselves. Borders are no longer understood exclusively as rigid administrative barriers but increasingly as dynamic socio-economic and territorial spaces shaped by interaction, cooperation and mobility processes (Haselsberger, 2014; Newman, 2013; Paasi, 2002). As highlighted by Ravlić et al. (2020), border regions simultaneously represent spaces of opportunity, fragmentation, integration and institutional complexity, while cohesion policy and cross-border cooperation programmes attempt to reduce development disparities and stimulate territorial integration processes. Also, despite more than three decades of Interreg implementation, the question of the real long-term impact of invested financial resources on regional development remains insufficiently explored. Although programmes have generated numerous infrastructural, institutional and social initiatives, measuring their long-term territorial effects, sustainability and multiplicative impacts remains methodologically challenging due to the complexity of border regions and the simultaneous influence of multiple external socio-economic processes (Pámer, 2021; Ravlić, 2019).

3. EVALUATION CHALLENGES AND LONG-TERM TERRITORIAL EFFECTS

Comprehensive data collection on cross-border regionalism in Europe is a complex endeavour. There have been several attempts to list or map CBC initiatives and their perimeters in Europe (Kaucic & Sohn, 2022:2381). One of the most significant challenges associated with European Territorial Cooperation concerns the evaluation of long-term programme effects within border regions. Existing evaluation systems remain strongly focused on measurable outputs and short-term implementation indicators such as the number of projects, participants, workshops or infrastructure investments. While such indicators provide important information regarding programme implementation efficiency, they frequently fail to capture broader territorial transformations and long-term regional development effects (Pámer, 2021). This limitation becomes particularly evident within structurally complex border regions of Central and Eastern Europe, where regional development processes are influenced by numerous overlapping factors including demographic trends, labour migration, economic restructuring and broader geopolitical changes. Under such conditions, isolating the precise contribution of Interreg-funded activities to regional development becomes methodologically difficult. Border regions simultaneously function as spaces of cooperation and spaces of asymmetry, where administrative fragmentation, uneven institutional capacities and legal differences continue to influence territorial cohesion processes (Scott & Wilson, 2025; EPRS, 2021). The importance of these obstacles was additionally recognised at EU level through Article 174 of the Treaty on the Functioning of the European Union, which explicitly emphasises the need to devote particular attention to cross-border regions in strengthening economic, social and territorial cohesion (EPRS, 2021). Despite decades of cohesion policy development and substantial Interreg allocations, numerous legal and administrative barriers continue to limit the effectiveness of cross-border cooperation and regional integration processes (European Commission, 2017; EPRS, 2021). The European Commission Cross-Border Review revealed that legal and administrative barriers represent the most significant obstacle to effective cross-border cooperation, with almost one half of respondents identifying them as the primary challenge (EPRS, 2021). An inventory of 239 border obstacles demonstrated that the majority originated from inconsistencies between national and regional legislation, followed by administrative barriers linked to inadequate procedural practices at local, regional and national levels (EPRS, 2021). More than 90% of identified obstacles were concentrated within policy areas directly related to regional development, including labour markets, education, healthcare, transport, mobility, trade and territorial planning (EPRS, 2021).

The same review concluded that the removal of only 20% of identified cross-border obstacles could increase GDP in border regions by approximately 2%, indicating that territorial cohesion depends not only on financial allocations but also on institutional coordination capacities and governance harmonisation mechanisms (EPRS, 2021). Consequently, evaluation challenges within Interreg programmes cannot be separated from broader governance and institutional issues affecting border regions. In response to these difficulties, the European Commission proposed the European Cross-Border Mechanism (ECBM) as part of the post-2020 cohesion policy framework. The mechanism aimed to facilitate the resolution of legal and administrative obstacles by allowing, under specific conditions, the application of the legal framework of one Member State within a neighbouring cross-border territory (EPRS, 2021). The proposal reflected increasing recognition that territorial cohesion requires more flexible governance instruments capable of overcoming administrative fragmentation in border areas. Nevertheless, the proposal also generated concerns regarding subsidiarity, legal harmonisation, administrative burden and the voluntary nature of participation, which ultimately slowed its implementation process (EPRS, 2021). The limitations of existing evaluation systems become particularly visible during the sustainability period following project implementation. The “On-going Programme Evaluation of the Hungary-Croatia IPA Cross-border Cooperation Programme 2007-2013” explicitly identified the absence of sustainability monitoring mechanisms as one of the principal weaknesses of the programme. The evaluation report stated that “there is no information, feedback about the sustainability of the funded projects as IPA did not require sustainability controls after the funding period”, concluding that the real effects of allocated support on the socio-economic development of the border region could therefore not be adequately assessed. The doctoral research conducted within the Hungary–Croatia border area additionally confirmed the existence of these evaluation challenges. The primary research problem focused precisely on the possibility of identifying the long-term effects of invested funds during the sustainability period following project completion and on understanding whether implemented activities generated broader developmental changes at the personal, institutional and regional levels (Ravlić, 2019). The findings additionally demonstrated that many important programme effects extend beyond conventional quantitative indicators. Respondents frequently emphasised increased motivation for lifelong learning, stronger local participation, enhanced cooperation between organisations and growing awareness regarding the developmental potential of local communities (Ravlić, 2019). Such effects may significantly contribute to long-term territorial development, although they remain difficult to operationalise within standard programme evaluation frameworks. Previous research additionally highlighted that there are still no sufficiently comprehensive studies capable of systematically monitoring the overall impact of implemented activities within cross-border areas of the European Union (Ravlić, Glavaš & Vojinović, 2020). This limitation is particularly visible when attempting to measure the interconnected effects of infrastructural investments, human resource development and broader territorial transformation processes over longer periods of time. Ravlić et al.(2020) further emphasise that border regions should not be observed exclusively through economic indicators, but also through social, institutional and human-capital dimensions that shape long-term regional resilience and territorial cohesion. Furthermore, the research suggested that cross-border cooperation programmes may generate important multiplicative territorial effects. Approximately 60% of respondents agreed that implemented projects encouraged additional organisations within local communities to initiate new activities and development initiatives, indicating that programme effects may continue through indirect territorial diffusion processes even after formal project completion (Ravlić, 2019).

These findings support broader discussions within territorial cohesion literature that regional development effects often emerge through gradual institutional learning, strengthened governance networks and increased local participation capacities rather than exclusively through immediate economic indicators (Pámer, 2021). The difficulty of measuring such effects indicates the necessity of developing more comprehensive and longitudinal evaluation models capable of integrating both quantitative and qualitative dimensions of territorial development. Future approaches should therefore place greater emphasis on long-term sustainability monitoring, institutional networking, governance capacities and broader territorial effects of cooperation programmes within border regions. In addition, stronger integration of spatial and GIS-based analytical approaches could contribute to more systematic visualisation of territorial disparities, investment concentration and developmental asymmetries within border areas (Ravlić, 2019).

Evaluation level	Examples
Outputs	Number of projects, workshops, infrastructure investments
Results	New partnerships, institutional cooperation, mobility
Territorial effects	Strengthened local development capacities, governance networks
Long-term effects	Territorial cohesion, institutional learning, regional resilience

Table 1: Evaluation Dimensions and Examples of Territorial Effects within Interreg Programmes
(Source: Author's compilation based on Pámer (2021), Ravlić (2019), Ravlić et al. (2020), and EPRS (2021).)

4. CONCLUSION

Border regions of Central and Eastern Europe represent territorially, institutionally and socio-economically complex spaces whose development trajectories continue to be shaped by historical legacies, administrative fragmentation and structural asymmetries. Within such conditions, Interreg programmes and broader European Territorial Cooperation mechanisms have become important instruments for strengthening territorial cohesion, institutional cooperation and cross-border integration processes. Since the introduction of the first Interreg initiative in 1990, European cohesion policy has increasingly recognised that border regions require targeted and territorially sensitive development approaches capable of addressing both economic disparities and governance-related challenges. The analysis presented in this paper confirms that Interreg programmes contribute to regional development through multiple dimensions, including infrastructural modernisation, institutional networking, knowledge transfer, mobility and the strengthening of governance capacities within border regions. Successive programming periods additionally demonstrate the gradual evolution of territorial cooperation from predominantly infrastructural interventions toward increasingly integrated approaches focused on sustainability, resilience, governance quality and social inclusion. In this context, territorial cohesion can no longer be understood exclusively as the reduction of economic disparities, but rather as a multidimensional process involving institutional trust, territorial integration, governance coordination and social participation. At the same time, the paper confirms that evaluating the real long-term effects of Interreg programmes remains methodologically challenging. Existing evaluation systems continue to rely predominantly on short-term implementation indicators and measurable outputs, while broader territorial transformations and sustainability effects remain significantly more difficult to operationalise and monitor over longer periods of time.

This limitation becomes particularly visible in structurally sensitive border regions of Central and Eastern Europe, where regional development is simultaneously influenced by demographic changes, labour migration, economic restructuring, institutional asymmetries and wider geopolitical processes. The findings presented in this paper, including empirical insights from the Hungary–Croatia border area, additionally indicate that many important programme effects extend beyond conventional quantitative indicators. Increased institutional cooperation, stronger local participation, strengthened awareness of development opportunities and enhanced motivation for lifelong learning represent important territorial effects that are frequently insufficiently captured within existing programme evaluation frameworks. Furthermore, the research suggests that Interreg programmes may generate multiplicative territorial effects through indirect diffusion processes, encouraging additional initiatives, partnerships and local development activities even after formal project completion. The paper additionally highlights that legal and administrative barriers continue to represent one of the most important obstacles to effective territorial cooperation within the European Union. Despite significant financial allocations and decades of cohesion policy development, institutional fragmentation and governance asymmetries continue to limit the full developmental potential of many border regions. The proposed European Cross-Border Mechanism therefore reflects increasing recognition at EU level that territorial cohesion requires not only financial support, but also more flexible governance instruments capable of overcoming administrative and legal obstacles in border areas. Special attention should also be devoted to the limitations associated with measuring programme effectiveness at the EU level. Existing statistical systems and programme indicators frequently fail to capture the broader social, institutional and territorial dimensions of regional development generated through cross-border cooperation. Consequently, additional longitudinal and multidimensional research is necessary, combining quantitative indicators with qualitative approaches capable of identifying long-term territorial transformations, sustainability effects and institutional learning processes within border regions. Stronger integration of spatial and GIS-based analytical approaches could additionally contribute to a more systematic understanding of territorial disparities, investment concentration and developmental asymmetries across border areas. Several limitations should also be acknowledged. Firstly, the complexity of border regions makes it difficult to isolate the precise effects of Interreg-funded activities from broader socio-economic and political processes occurring simultaneously within the observed territories. Secondly, many programme effects become visible only during longer sustainability periods following project completion, while available programme evaluation frameworks frequently do not include systematic post-implementation monitoring mechanisms. Thirdly, institutional asymmetries between different categories of project beneficiaries may influence both programme implementation capacities and the long-term sustainability of achieved results. Despite these limitations, the paper confirms that Interreg programmes continue to play an important role in strengthening territorial cohesion and regional development within border regions of Central and Eastern Europe. However, future cohesion policy approaches should place stronger emphasis on long-term sustainability monitoring, governance quality, institutional capacities and the multidimensional nature of territorial development in order to better understand and evaluate the broader effects of European Territorial Cooperation programmes.

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GENDER EQUALITY, MOBILITY IN CITIES, AND TERRITORIAL DYNAMICS: TOWARDS AN INTEGRATED CONCEPTUAL FRAMEWORK

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ABSTRACT

This communication offers a literature review linking three key areas: gender equality, women's mobility, and territorial dynamics. It reveals that each of these areas has been the subject of extensive research. However, focusing on each of these dimensions separately, or just two of them, prevents from grasping the mechanisms that connect all three, as well as their synergy—elements that are crucial for more effectiveness in these areas.

The objective of this communication is to move beyond siloed approaches to these research areas and propose an integrated analytical framework that would shed light on the interactions between gender equality, women's mobility in the city, and territorial dynamics.

This communication seeks to explore the articulations between gender equality, mobility in cities, and territorial dynamics. It draws on the concept of Equality, Mobility, Local Dynamics (EMLD) as an integrated conceptual framework, enabling the articulation of these three dimensions into a coherent system that can be implemented and generate synergies for sustainable development at local level.

Keywords: *Gender Equality, Territorial dynamics, Women's Mobility*

1. INTRODUCTION

Territorial dynamics have sparked growing interest, particularly from the scientific community and local stakeholders, giving rise to a plurality of approaches influenced by disciplines such as new economic geography, urban geography, urban planning, social sciences, and philosophy. From the foundational work of Paul Krugman¹ and his center-periphery model to the systemic approach of researchers such as Bernard Pecqueur², who understands territorial dynamics as a collective construction and participatory and inclusive governance as essential to François Ascher's³ metapolation, the literature has considerably enriched our understanding of the dynamics that shape territories. However, this literature remains, for the most part, based on “gender-neutral” analyses. In parallel, research on gender equality has seen considerable growth since the pioneering work of Esther Boserup⁴, consolidated by the contributions of the philosopher John Rawls⁵. Empirical studies on inequality by Amartya Sen and his capabilities approach have been strengthened by Esther Duflo's empirical analysis. Likewise, Claudia Goldin⁶ has highlighted the structural nature of gender inequalities in the labour market. Mobility is among the essential factors for combating gender inequality. Yet, mobility, particularly in developing countries, is often not designed to be inclusive and exacerbating these inequalities.

¹ KRUGMAN, Paul R., *Geography and Trade*, United States, MIT Press, 1993.

² PECQUEUR, Bernard, *The Territory is Dead, Long Live the Territories!* IRD Editions, France, 2005.

³ ASCHER, François, *Metapolis or the Future of Cities*, Odile Jacob, Paris, 1995.

⁴ BOSERUP, Esther, *Women Facing Development*, PUFF, coll. Paris, 1983. Translation of the book *Woman's Role in Economic Development*.

⁵ RAWLS, John, *A Theory of Justice*, a revised edition by Harvard University Press, Cambridge, Massachusetts, 1971.

⁶ GOLDIN, Claudia, “The Quiet Revolution that Transformed Women's Employment, Education, and Family,” *National Bureau of Economic Research*, Cambridge, 2006.

As for the literature on women's mobility, it has been the subject of a growing number of studies driven notably by researchers such as Susan Hanson and Jacqueline Coutras, who have shown that women's trips differ significantly from men's. Their travel patterns in cities are strongly influenced by their gender roles. However, in practice, these considerations are generally not systematically integrated into public policies at the local level. In this context, mobility becomes a barrier to gender equality and a missed opportunity for the development of the territories concerned. This articulation, for the sustainable development of a territory, currently represents a research gap. It is precisely this articulation—gender equality, mobility in cities, and territorial dynamics—that this communication seeks to explore in the context of sustainable local development. It draws on the concept of Equality, Mobility, Local Dynamics (EMLD) as an integrated conceptual framework, enabling the articulation of these three dimensions into a coherent system that can be implemented and generate synergies for development.

2. THREE RICH BUT INSUFFICIENTLY LINKED FIELDS OF ANALYSIS IN THE LITERATURE

Despite the wealth of literature on territorial dynamics and gender equality, the relationship between these two research areas has not yet been the subject of a theory or approach, despite its crucial importance for the sustainable development of the territory and the well-being of its men and women.

2.1. Gender equality is still poorly addressed in the literature on territorial issues

Paul Krugman's core-periphery model highlighted core-periphery mechanisms based on economies of scale, the spatial concentration of activities, and transportation costs. It details the agglomeration mechanisms that lead to the emergence of dominant centers and the peripheries that depend on them. However, this model, which has significantly influenced regional policies in many countries, remains limited by one of its major assumptions: worker mobility. It is based on workers assumed to be gender-neutral, whereas recent research shows differences in mobility between men and women due to their gender roles. By neglecting this difference, this model risks underestimating the specific barriers to women's mobility and, consequently, their access to employment opportunities. Furthermore, territorial dynamics have seen significant progress, notably with Bernard Pecqueur and his conception of territory as a social construct, based on the coordination of local actors, the development of specific local resources, and participatory governance. This approach, however, remains limited because it considers that all actors are called upon to contribute to territorial governance without specifying gender. By not distinguishing actors according to their gender—in other words, men and women—particularly at the governance level, the territory risks having a formal diversity of actors ensuring its governance while maintaining a majority of men, especially in decision-making positions. The underrepresentation of women in local governance bodies has consequences for public policies related to transportation, land-use planning, and security, which do not necessarily meet women's gender-specific needs, thus hindering their access to services and opportunities, and their contribution to the development of their territory. Moreover, Bernard Pecqueur emphasized, in his work co-authored with Courlet, that territory constitutes a space "for the territorialization of public policies, governance, the spatial projection of productive specialization, and specific relationships between numerous actors."⁷

2.2. Gender equality: an issue still weakly linked to territory in the literature

The notion of equality has permeated history from John Locke to John Rawls, before taking on a new dimension with Amartya Sen, who went beyond Johan Rawls's idea of formal equality.

⁷ COURLET Claude and PECQUEUR Bernard, *Territorial Economy*, PUG, Grenoble, 2022.

This American philosopher laid the foundations for a just society based on freedoms and equal opportunities, but Amartya Sen went beyond its limits by showing that equal access to basic goods does not guarantee real equality of opportunity. The capabilities approach of this Indian Nobel laureate economist, based on the concept of women's real freedoms to act and choose their lives, offers a powerful analytical framework for understanding inequalities between men and women, particularly in the context of developing countries. Applied to women, this approach shows that their capabilities are hampered by a number of factors, including access to services such as education and healthcare, access to employment, the burden of unpaid work, culture, and violence, including that which occurs in public transportation. These obstacles to equality are echoed by Claudia Goldin, who demonstrates that women's access to employment depends on education, societal norms, and technological progress. She also shows that inequalities in career paths and wages between men and women are based, in particular, on structural factors such as unpaid work at home and social norms. However, research on equality and inequality is generally not linked to territory, even though its dynamics and governance shape its development. Its main connection is public space, which has been the subject of a great deal of research. Yet, territory is different from the public space it encompasses. It is essential to see how relations of domination, social norms, and institutional inequalities are embedded in the territory and how they impact its governance.

2.3. Women's Mobility in Cities

Urban mobility constitutes a particularly fruitful field of research that has highlighted the different nature of men's and women's movements. These differences are attributed to the social division of labor, which assigns the majority of reproductive tasks to women and productive tasks to men, as illustrated by Caroline Moser's framework of triple roles: the productive role (generally assigned to men) and the reproductive and community roles (generally assigned to women). These social roles create gender-specific mobility needs, particularly in terms of transportation. Women's journeys are more frequently linked to domestic activities, accompanying children and dependent individuals. Consequently, these journeys are shorter and more frequent than those of men. Furthermore, feminist geography has highlighted the gendered nature of cities and transportation. Public spaces, bus stops, and modes of transport are designed for users in a gender-neutral way. In this context, they do not meet the specific needs of women and thus hinder their mobility. Indeed, women encounter a number of problems during their journeys, particularly related to safety, violence, and the cost of transportation, which must be addressed to allow them to travel freely.

3. A MISSING TRIAD IN THE LITERATURE

The literature on gender equality, women's mobility in cities, and territorial dynamics addresses these three dimensions individually. Some analyses focus on two of these dimensions. However, the three dimensions addressed simultaneously have not been found.

3.1 Relationships Already Developed in the Literature

While each of these three research areas is rich, their articulation has not always been the subject of theory or approach, with the exception of certain relationships that are currently well-documented, such as:

- Gender and public space (but public space is not territory);
- Gender and mobility;
- Transport and territorial development.

3.2 Systemic Relationships Visible at the Level of the Sustainable Development Goals

Based on the Sustainable Development Goals (SDGs), a causal and systemic relationship can be found between gender equality, women's mobility in cities, and territorial dynamics. Territorial dynamics structure the conditions of mobility in cities. These conditions either facilitate or hinder women's urban travel depending on whether or not it meets their gender-specific needs. Mobility can thus become a factor in accessing services and opportunities. Mobility thus becomes a strategic variable that will link SDG 11, "Sustainable Cities and Communities," and SDG 5, "Achieve Gender Equality by Empowering Women and Girls." Achieving SDG 1, "Eradicating Extreme Poverty," requires, in particular, facilitating access to resources—in other words, employment, services, and social networks. Goal 11, "Sustainable Cities and Communities," aims to provide access to safe, affordable, accessible, and sustainable transport systems for all, improving road safety, particularly through the development of public transport, with special attention to the needs of vulnerable people, women, children, people with disabilities, and older people. Achieving Goal 5, "Achieve gender equality by empowering women and girls," requires, in particular, inclusive and accessible mobility, as reflected in one of its targets: "Recognize and value unpaid care and domestic work through the provision of public services, infrastructure, and social protection policies, and the promotion of shared responsibility within the household and family, in accordance with national contexts." Achieving this goal also requires eliminating gender-based violence, as stipulated in another target: "Eliminate all forms of violence against women and girls from public and private life, including trafficking, sexual exploitation, and other forms of exploitation". Furthermore, achieving Goal 8, "Decent Work and Economic Growth," requires strengthening infrastructure so that the mobility of men and women becomes a factor enabling their employment, rather than a barrier to it. Accessible and inclusive public transportation allows men and women to benefit from the economic and social opportunities available to them. However, compared to men's mobility, women's mobility faces additional restrictions. When women do not feel safe using public transportation, they avoid it. This situation limits their access to education, healthcare, better-paying jobs, social networks, and more.

4. PROPOSAL FOR A CONCEPT COMBINING THESE THREE DIMENSIONS

Women's limited mobility creates or reinforces inequalities between men and women. It reduces their access to services and employment opportunities, as well as their participation in local governance. On the other hand, a territory with weakly inclusive governance, predominantly led by men, can, through its "neutral" policies, reinforce inequalities between its men and women. Hence a vicious circle: less mobility for women means less participation in the governance of their territory; more limited participation for women means fewer public policies that meet their needs, particularly in terms of mobility, etc. This vicious circle can become even more pronounced by considering the mechanisms described below.

4.1. From gender equality to mobility

When social relations between men and women become more equal, women and when social norms are less restrictive for women, the burden of domestic work is more shared, and public spaces become safer and more accessible, women's capabilities in terms of mobility are expanded. Women can, then, travel more and more freely.

4.2. From Mobility to Territorial Dynamics

Mobility better tailored to women's gender-specific needs increases their access to services and economic opportunities. It improves their integration into the labor market, their participation in the governance of their territory, and their contribution to its development, based on the mobilization of additional skills that were initially underutilized.

4.3. From Territorial Dynamics to Gender Equality

A territory governed in a more participatory and gender-sensitive manner can develop public policies that better meet women's gender-specific needs and interests, including more suitable services and facilities, increased safety, and improved accessibility. Local dynamics can thus become a lever for transforming gender relations.

5. EMPIRICAL ILLUSTRATION: RABAT AND SALÉ AS REVEALING CITIES FOR THE PROPOSED CONCEPT

Beyond the existing literature on which this concept was built, it also draws on data collected in the field in the cities of Rabat and Salé, through surveys and focus groups conducted in 2019 and 2026. This data provides empirical support that illustrates the proposed concept.

5.1. Public School Schedules: A Barrier to Access to Economic Opportunities for Women from Disadvantaged Backgrounds

Public school schedules emerged as a major obstacle to women's employment, which, in the absence of measures to address it, would render any policy improving women's access to employment ineffective.

5.2. Travel patterns and modes of mobility dependent on economic and social differences and reflecting the characteristics of women's urban mobility, as highlighted in the literature

5.2.1. Fieldwork in Rabat and Salé, in 2019, yielded results that mirror the literature's findings on equality and mobility.

Women's gender roles, specifically domestic activities such as housework, shopping, and childcare, including accompanying children to school or the hospital, require multiple, shorter, and more frequent trips than those undertaken by men.

Also, safety is a more important consideration during travel for women: women who work evenings in Salé are more likely to use small and large taxis, which are more flexible and safer modes of transport.

5.2.2. Mobility patterns vary depending on economic and social differences

Women primarily trips are on foot but the reasons depend on their economic and social situations. For housewives, trips are short, frequent, often chained, and mostly on foot even when the household owns a vehicle. For women working far from home, walking trips are mainly to reach public transportation or for shopping groceries.

Also the use of public transportation depends on their income, while the mode of transport depends on their sector of employment. In fact, for women working in the informal sector, trips to work, which generally combine bus and walking, occur sometimes outside peak hours and in unusual employment zone. As for women working in the formal sector, the means of transport vary by several factors:

- Those who live near their workplace, the travel is on foot.
- 66% of those living and working in Rabat use both small and large taxis, while 57% of those who live and work in Salé opt for large taxis and informal transport. This difference may be linked to the average per capita income, with Salé's being lower than the national average per capita income and Rabat's being higher.
- 88% of those living in Salé and working in Rabat opt for the tramway and/or small and large taxis.

5.3. Problems Encountered by these Women During their commutes and the Strategies Adopted to Avoid Them

5.3.1. Women dissatisfaction with their mobility

In 2019, women were very dissatisfied with their mobility for various reasons.

- 69% of the women surveyed were dissatisfied or only slightly satisfied with their safety during their commutes. Harassment is the form of violence that women most often face.

This result refers to female nurses. Male nurses are more likely to use shared taxis and tramways. Only 15% take a small taxi and 5% opt for informal transport, compared to 0% for women. Women tend to look for work within a smaller radius than men, which limits their employment opportunities and reduces their chances of obtaining better-paying jobs.

On the street, women try to ignore anyone harassing them to avoid any "dangerous reaction from someone who might be under the influence of drugs. Rkia, supported by other women, stated in a focus group: *"Because I don't respond to him, for fear he might be under the influence of drugs, I'm forced to endure his insults throughout my trip."*

In addition, in response to street crime, women avoid less frequented shortcuts, thus lengthening their daily commutes. For women, walking in alleyways sometimes involves walking in the road because sidewalks are occupied by cafes and street vendors.

Zineb (in a focus group): *"The sidewalks are overrun by cafes... You can't walk through the cafes full of men! So, I'm forced to walk in the road, even when the children are with me."*

In public transportation, 82% of the women surveyed experienced a security issue at least once in the past month. This phenomenon is more prevalent on buses, though less acute due to security measures implemented by the new company contracted to operate the urban bus service. In response to this violence, 51.6% of these women have opted for group travel, and 10% now avoid peak hours, thus reducing their employment opportunities.

- 50% of women are dissatisfied with the information provided about bus stops and schedules: apart from the final destination, they receive no other information about the routes.
- 77% of women are dissatisfied or only slightly satisfied with the punctuality of public transportation. The poor punctuality of buses forces working women to either leave home very early in the morning, exposing them to the insecurity caused by poor street lighting, or to use more expensive alternative means of transportation to keep their jobs.

Aicha (in a focus group): *"I have to pay three times what I normally pay, just to keep my job... But in the evening, I walk to avoid another expense."*

- 65% and 76% of women are dissatisfied or only slightly satisfied with the frequency and duration of wait times, respectively. To compensate for the limited availability of transportation, women in outlying areas predominantly use informal transportation despite the risks involved. Similarly, 26% of women living in Salé who work in the formal sector in the same city use informal transportation to get to work.

5.3.2. Initial Results of Fieldwork Launched in 2026

Fieldwork was launched this year to better understand the issues linking gender equality, women's mobility in the cities of Rabat and Salé, and the dynamics of their territories. These preliminary data (currently undergoing full analysis) confirm the trends observed in 2019 while also qualifying some findings. They empirically validate the proposed EMLD concept: gender equality influences women's mobility, which, in turn, reveals the shortcomings of non-inclusive urban areas.

The population was selected to ensure a diversity of socio-professional situations, with a predominantly female population supplemented by a male population to allow for comparisons of perceptions and behaviours between men and women.

- A new population added and additional indicators

Unlike the 2019 surveys, this latest fieldwork also includes a student population, aged 18 to 25, predominantly female, who are pursuing their studies in a faculty poorly served in terms of transport. Beyond reasons of convenience, the choice to include this population this time is a strategic choice that allows us to test the proposed EMLD concept with a future cohort. The mobility of this population is quite atypical, with irregular hours, multimodal journeys, and exposure to insecurity, particularly in the morning or late afternoon on their way home from university. This amplifies the specific constraints faced by women highlighted in the literature (harassment, poor lighting during their journeys, etc.). Furthermore, regarding the new indicators included, 84.1% of women with a bachelor's degree (or equivalent) support specific measures to improve women's mobility. However, 15.9% of the women surveyed disagree with these measures. This latter percentage could represent a normalization of the constraints experienced by a minority during their commutes, or a lack of awareness of their own needs, which would necessitate an awareness campaign to break this vicious cycle. Regarding the question of whether women believe that their needs are sufficiently taken into account in decisions related to transportation and mobility, 43.2% of respondents were neither agree nor disagree. This result would reveal either a lack of visibility of the decision-making processes of a young, educated female population or a normalization of constraints on women's mobility. All of these results demonstrate the need for a concept that links gender equality, women's mobility in the city, and territorial dynamics.

- Initial Differences Observed in the Field Compared to the 2019

The preliminary results from the ongoing fieldwork on women's perceptions of their mobility are quite similar to those from 2019, with a few exceptions that illustrate the evolution of women's perceptions of their mobility and validate the territorial dynamics of the proposed EMLD concept.

The first difference concerns the perception of women from disadvantaged backgrounds who are not employed: their perception of small taxis has shifted. These vehicles seem now less safe due to insults and poor behaviour from some taxi drivers, as reported during two focus groups in two neighbourhoods of Rabat: Akkari and Yacoub al Mansour. These women also take more informal transport with less fear than those using it in Salé in 2019. They resort to it when accompanying more than two, when late for a doctor's appointment, or when returning late from the hospital with their children. They justify this by noting that the taxi driver cannot pick up additional passengers during their trip, which reduces their income compared to a solo woman or a woman with a single child. Furthermore, reliance on large taxis has increased since 2019. Finally, multimodality, which was not particularly mentioned by women in 2019, likely due to their limited use of this type of transport, is becoming a concern for women in 2026, especially regarding waiting times for public transport. This post-2019 shifts highlight the urgent need for the effective integration of a gender perspective into resilient mobility strategies. Territories.

6. CONCLUSION

This communication has attempted to move beyond sectoral approaches to construct an integrative concept linking gender equality, women's mobility, and territorial dynamics. Literature and empirical data have contributed significantly to the formulation of this concept.

Articulating these three domains together reveals a key mechanism for sustainable local development. The proposed concept, *Equality, Mobility & Local Dynamics (EMLD)*, captures how gender equality shapes women's mobility and the sustainable development of territories, while women's mobility serves as a powerful indicator of territory's inclusivity.

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HOW MANY DESIGNATIONS ARE FOR VOLUNTARY GREEN EMPLOYEE BEHAVIORS IN EUROPEAN STUDIES?

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ABSTRACT

Organizational Citizenship Behavior towards the Environment (OCBE) is a key concept extending the idea of Organizational Citizenship Behavior (OCB) to include environmentally responsible initiatives and behaviors that may promote the environmental performance of the organization. As highlighted by Dennis Organ (1997), OCB refers to discretionary and voluntary workplace behaviors of employees that are not required, or rewarded by the human resources management, but contribute positively to the overall performance and success of the organization. Following a systematic literature review methodology, conducted on Web of Science and Scopus databases, forty-five OCBE-related studies in Europe were retained from the last twenty years after a methodological quality assessment. As observed in these studies, OCBE encompasses many other designations such as employee pro-environmental behavior, employee green behavior, employee eco-initiatives, and green prohibitive or promotive voice behaviors. Distinct theoretical frameworks were developed to understand OCBE using demographic, external and internal employee factors. Strategic human resources management, green management policies, leadership support, employee identification with the organization, job satisfaction, and personality traits are some of these factors. Different OCBE profiles were identified in several studies related to environmentally proactive engagement and peer cooperation and collaboration. Examples of OCBE actions by employees may include recycling materials, reducing waste and energy consumption, suggesting eco-friendly practices to colleagues, participating in eco-initiatives, or even helping the organization obtain environmental certifications like ISO 14001 and Eco-Management and Audit Scheme (EMAS). The OCBE concept aligns with the broader trend of organizations in recognizing the importance of environmental sustainability and corporate social responsibility. Encouraging OCBE can lead to improved environmental performance, processes innovation, cost savings, market competitiveness, long-time viability, and a more engaged and motivated workforce, as employees feel a sense of purpose and pride in contributing to a greener and more sustainable organization.

Keywords: *Organizational Citizenship Behavior toward the Environment, Employee Green Behavior, Pro-environmental Behavior, Green Workplace Practices, Employee Eco-initiatives*

1. INTRODUCTION

Organizations play a critical role in the development of environmental sustainability by complying with the existing regulations. Some of the widely accepted benefits are environmental impact mitigation, energy and waste cost reduction, market access, market reputation and supply chain resilience.

Additionally, individual employee initiatives are known to have a significant impact on environmental performance (Boiral & Paillé, 2012; Norton et al., 2015; Ones & Dilchert, 2012). These voluntary initiatives of employees, which are not demanded or rewarded by the organizations, are one of the central concepts of organizational citizenship behavior (OCB) that have been developed since the end of last century (Organ, 1997). In the beginning, OCBs were focused on organizational and anthropocentric issues and thus ignored ecological issues. Even so, their principal behavioral categories may also have relevant environmental applications, such as sportsmanship, organizational loyalty, individual initiative and self-development types (Boiral, 2009). An organization's environmental management system is also very important to promote not only environmental performance, but also economic performance. The most common systems are ISO14001 and Eco-Management and Audit Scheme (EMAS), which comprises of a set of processes and practices to help organizations monitor their environmental impact (Passeti & Tenucci, 2016).

1.1. Organizational Citizenship Behavior Towards the Environment (OCBE)

In this century, the environmental-applied OCB started being researched and designated as an organizational citizenship behavior toward the environment (OCBE). This behavior was defined as “individual and discretionary social behaviors that are not explicitly recognized by the formal reward system and that contribute to a more effective environmental management by organizations” that “includes different types of initiatives, such as sharing knowledge to prevent pollution in the workplace, suggesting solutions aimed at reducing waste, representing the organization at an environmental conference and collaborating with the environmental department to implement green technology” (Boiral & Paillé, 2012, p. 431). These authors were the first to publish a validated OCBE measurement scale, and its application showed three main behavior types that were eco-initiatives, eco-civic engagement, and eco-helping. Simultaneously, many other designations appeared in literature and sometimes measured different manifestations of these types of behaviors. Some examples of OCBE-related designations are extra-role pro-environmental behavior, environmentally friendly behaviors, environmentally sustainable behaviors, environmental workplace behaviors, proactive green, behaviors, responsible environmental behaviors and many others (Bentler et al., 2023; Blok et al., 2015; Mouro & Duarte, 2021; Norton et al., 2015; Szostek, 2021). OCBE has been extensively researched using different rationales depending on the different scientific researcher's expertise, such as psychological, behavioral, economic, or even their educational perspective. From the published studies, three factor groups used to explain the OCBE can be distinguished: the demographics, the external employee factors (organization context, leadership, policies, etc.), and internal employee factors (values, awareness, attitudes, social and personal norms, etc.) (Blok et al., 2015; Norton et al., 2015).

In this study, a systematic literature review was performed to select studies from the last 20 years about the OCBE in European countries to evaluate the dimensions that were investigated.

2. METHODOLOGY

2.1. Articles Selection with PRISMA

Articles selection was performed from July to August 2023, according to PRISMA guidelines for Systematic Literature Review (Page et al., 2021), following order of: research question proposal, inclusion criteria, search strategy, study selection, quality and bias risk, data extraction, data analysis, and reporting. The databases were Web of Science and Scopus, and the search was directed to Title-Abstract-Keywords using a query string with OCBE and the other equivalent terms. To ensure article quality, the selection only included indexed, and peer-reviewed articles from the last twenty years and excluded all grey literature.

Authors downloaded the retrieved articles to Mendeley, screened the abstracts and keywords to identify the articles that met all the inclusion criteria and excluded those without classification of Q1 and Q2 (SCIMAGO). Then the full text versions were retrieved and screened again to ensure their relevance to the topic, and whether they were empirical research and focused on European organizations. Reference lists of all articles in the final selection were manually checked for additional articles published using the same criteria of inclusion and exclusion.

2.2. Articles Data Extraction and Synthesis

Data extraction was conducted using the WebQDA with all full texts of the selected articles uploaded in Word format. WebQDA is a web-based qualitative data analysis software designed for qualitative research, that helps organize, code, and analyze qualitative data. The codification was performed using nineteen categories such as article characterization, research design methodology, organization and participant characterization, conclusions, and limitations. Convergent and divergent coding was discussed and validated by the researchers until they reached a consensus. Data synthesis was performed using Excel, WebQDA and Wordly.

2.3. Quality Assessment Methods

Three different methods were applied to guarantee a transparent and unbiased protocol to identify, select, appraise, and synthesize research studies. First, according to PRISMA protocol, two researchers worked independently searching the databases from the beginning until the final article selection. Second, the methodological quality of the final-selected articles was assessed using scales adapted for quantitative and qualitative studies (Letts et al.; Law et al.). Third, the articles codification in WebQDA was performed separately by 2 researchers and any disagreements or doubts were solved in discussions including a third researcher.

3. RESULTS AND DISCUSSION

3.1 Studies Selection and Quality Assessment

Following the PRISMA procedure, the first search performed in Web of Science and Scopus identified 2215 articles that were exported to the Mendeley reference manager software. The search query was [("Organizational Citizenship Behavior" OR OCB OR OCBE) AND (environment)) OR (("environmental behavior") AND (employee)) OR (("green behavior") AND (employee))]. This query was directed to indexed and peer-reviewed articles, from the last twenty years and classified as Q1 and Q2. At the end of the screening, forty-five articles were selected for further analysis and synthesis. The main factors for article exclusion were no relevance to the topic of interest or when the studied organizations were not located in Europe. Then the study methodological assessment was done using very rigorous and exhaustive scales that covered the following topics: objective, literature review, study design, sample selection, analytical rigor of data analysis, theoretical connections, overall rigor, conclusion, implications, and limitations. None of the studies were excluded as all obtained ratings above 80%, which corresponds to an excellent methodological quality. Then, the PDF articles were uploaded to WebQDA and their information was codified for further analysis and synthesis.

3.2. Studies Description

The 45 articles in the final selection were codified for their SCIMAGO quartiles, research approach, data collection, publication year, participants, organization type and sector (Table 1). Most of the studies were quantitative, using questionnaires to collect data and were mainly published in the last five years. The participants were mainly information-privileged workers or included all organization workers. Most organizations were private and operating in hospitality sector or in mixed/non-identified sectors.

SCIMAGO quartiles		Participants sources	
Q1	29	Educational institutions	3
Q2	16	Social networks	8
Research Approach		Organization workers	13
Quantitative	38	Information-privileged workers	21
Qualitative	6	Organization type	
Both approaches	1	Public	6
Data collection		Private	30
Questionnaires	36	Non-profit organization	2
Interviews	6	Not identified	11
Focus Groups	6	Organization sector	
Observation	3	Hospitality	12
Documents	2	University	4
Publication year		Retail	3
2004-08	1	Industry	9
2009-13	1	Service	2
2014-18	8	Not identified/Mixed sectors	17
2019-23	35		

Table 1. Studies description.

Figure 1 presents a map with the publications number in each country and those with more publications are Portugal, Germany, and the Netherlands. There are some studies covering more than one country in Europe (3 articles), or including non-European countries (1 article) and even without specifying them (2 articles). It would be expected to have more than 26% of European countries involved in publications about this topic, due to their environmental policies.

Likewise, it would be expected to have a greater representation of Nordic and Scandinavian countries, given that they are in prominent positions in the Environment Performance Index, which is headed by Denmark (<https://epi.yale.edu>). However, perhaps this is the reason for these results, since countries with greener policies may feel less need to develop studies in this area.

3.3 OCBE Dimension Designations

All the variables/dimensions in the quantitative studies were codified using the exact designations that were proposed by the authors. Excluding the control demographic variables, all the other codes of employee behaviors and their related factors accounted from 2 to 12 dimensions (Figure 2), although the most common were studies with four dimensions.

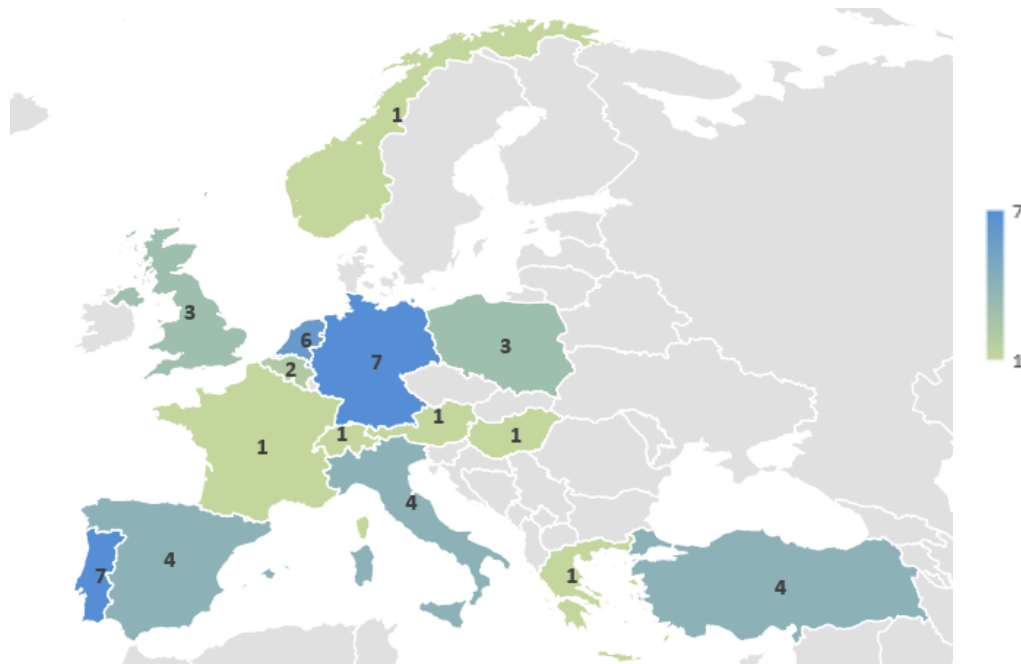


Figure 1. World map with the publications numbers per country (with Bin technology, © Australian Bureau of Statistics).

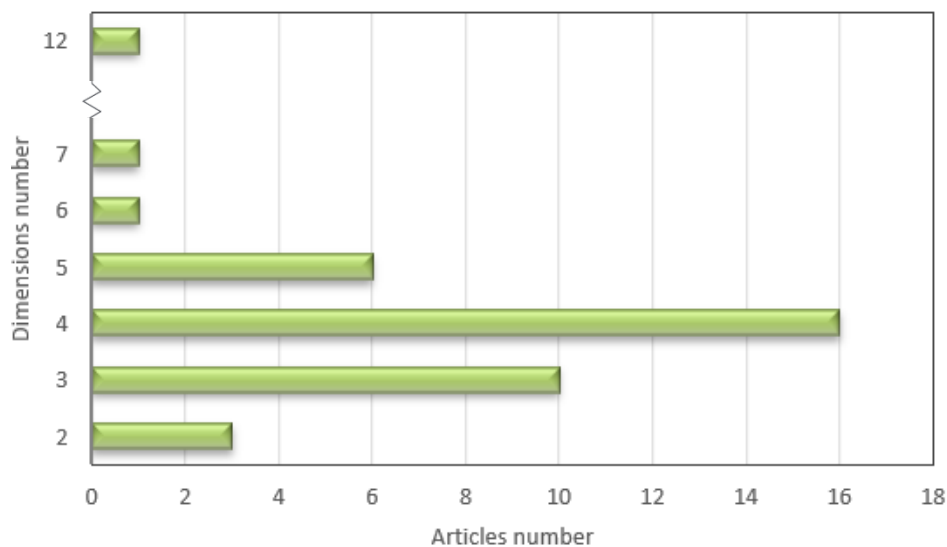


Figure 2. Dimensions number per article.

The variety of designations for the same dimensions is so huge that it is difficult to understand and follow up on the current state-of-the-art. In the present 39 quantitative studies, there were a total of 155 dimensions with 110 different designations. This means that only 29% of the dimensions were used at least in one study. Figure 3 shows a word cloud using half of the most common dimensions and the higher the letter sizes are, the more frequently they were used in the present literature. In this case, OCBE, PEB (pro-environmental behavior), EGB (employee green behavior) were the three most used designations for environmental employee behavior. Employee-organization identification and PBC (perceived behavioral control) are internal employee factors that are common in five studies. Other not-so-common internal factors are employee well-being, personality traits, pro-environmental attitudes, and personal beliefs, etc.

Other most common dimensions observed in Figure 3 are green training, green human resources management, and corporate social responsibility. These dimensions were investigated in three studies and are all contextual or external employee factors. All these external and internal employee factors are antecedents in the theoretical frameworks as they affect OCBE. From the word cloud analysis, none of OCBE outcomes are observed because all the studies were more focused on the factors affecting OCBE than its consequences or outcomes. Even so, it is widely accepted that environmental performance, cost-saving and employee engagement are OCBE outcomes (Norton et al., 2015; Szostek, 2021).



Figure 3. Words cloud with the 50 most used common dimensions (OCB – Organizational Citizenship Behavior; OCBE - Organizational Citizenship Behavior for the Environment; EGB – Employee Green Behavior; PEB – Pro-environmental Behavior; PBC – Perceived Behavior Control). There are some designations that are easy to conclude that are related to the same behaviors (like OCBE and green workplace practices), but it is not so obvious the relations for others. Because of that, all the dimension definitions and used items were compiled (data not shown). Following this analysis, OCBE was effectively the most common designation in European studies from the last twenty years, but there are many others related to OCBE as indicated in Table 2.

counterproductive work behavior	green knowledge sharing behavior
descriptive norms	green prohibitive voice behavior
employee green behavior	green promotive voice behavior
employee pro-environmental behavior (private and public)	green service recovery performance
employees' eco-initiatives	green workplaces practices
employees' pro-environmental and pro-social behavior	intention for future PEB
employees' suggestions for improvement at work	intention to act.
energy conservation behavior	OCBE (direct and indirect)
green advocacy	private green behavior
green innovative work behavior	pro-environmental behavior
	pro-environmental coworker climate

Table 2. List of OCBE-related designations.

Some of the OCBE dimensions were studying, totally or partially, similar behaviors. However, others were studying different behaviors under the same designation. Table 3 presents an extracted sample of the most representative and different designations related to employee pro-environmental behaviors.

Designation	Definition and Measures
OCBE (Paillé et al., 2019)	Behaviors related to undertaking environmental actions in the workplace, staying informed, volunteering to organization actions, and encouraging colleagues. Example item: "Suggesting new practices that could improve the environmental performance of the company."
Employee green behavior (EGB) (Khattak et al., 2021)	Behavior divided into task-related (performed in an environmentally sustainable way) and proactive behavior (discretionary eco-initiatives). Example items: "Today, I fulfilled responsibilities specified in my job description in green-friendly ways." And "Today, I did more for the environment at work than I was expected to."
Pro-environmental behavior (PEB) (Blok et al., 2015) (Mouro & Duarte, 2021)	Behaviors directed to recycling, reusing, water and energy conserving and environmentally sustainable shopping in work. Example item: "I use a mug for drinking coffee/tea." Behaviors directed to defending the importance of eco-engaging, volunteering to eco-initiatives and suggesting eco-solutions in work. Example item: "offer to participate in environmental protection initiatives promoted by my organization."
Green voice behaviors (prohibitive or promotive) (Nourafkan et al., 2023)	Communication behaviors of situations that are detrimental or enhancing the environmental sustainability of the organization. Example items: "Dare to voice out opinions on things that might affect efficiency in the work unit, even if that would embarrass others and "Make constructive suggestions to improve the unit's operation."
Private green behavior (PGB) (Paillé et al., 2019)	Behavior adopted by employees in their work or private sphere to benefit as much as possible the environment or affect the least possible. Example item: "Buying products that are made from recycled materials."
Employees eco-initiatives (Gusmerotti et al., 2023)	Behavior related to individual initiatives to promote environmental performance in work. Example item: "I always weigh environmental risks and impacts while carrying out my work activities."
Green Advocacy (Crucke et al., 2022)	Behaviors to convince colleagues to have more green-friendly actions. Example item: "I work with my group members to create a more green-friendly workplace."
Green innovative work behavior (Aboramadan et al., 2022)	Behaviors related to innovative solutions suggested by employees to promote environmental sustainability in work. Example item: "I search out new green-related technologies, processes, techniques and/or product ideas."
Intention for future PEB (Bentler et al., 2023)	Behaviors that will be expected for future and promote environmental sustainability. Example item: "In everyday life/During work, I try to eat regional and seasonal products."

Table 3. OCBE designations, definitions and measures.

The OCBE-related designations were in general using items related to individual and voluntary actions of employees in their workplace, like volunteering and encouraging colleagues to organization projects (Khattak et al., 2021; Mouro & Duarte, 2021; Paillé et al., 2019). Other designations were focused on employees' actions related to recycling materials and minimizing waste and water consumption (for example, see Blok et al., 2015). The pro-environmental behavior (PEB) designation was used with different behavior types/items by different authors. In truth, both are employee behavior towards the environment, but increase the confusion when analyzing the state-of-the-art. There are other studies using only some of the OCBE types identified by Boiral & Paillé (2012), such as employees eco-engaging, eco-initiatives and eco-helping colleagues (Crucke et al., 2022; Gusmerotti et al., 2023). The employees' expectations of performing OCBE in the future (Bentler et al., 2023), eco-innovative behaviors (Aboramadan et al., 2022) and prohibitive and promotive voice behaviors (Nourafkan et al., 2023) are another examples. In all 39 quantitative studies, it was demonstrated that OCBE is effectively a key factor in benefiting the environmental performance of organizations. An analysis of the selected studies (none referenced) using a qualitative approach focused on OCBE in Europe was also performed. The organizations were in the sectors of hospitality, natural resources, university, and non-identified sectors. The evaluated OCBEs were related to proactive engagement, peer cooperation and collaboration, materials and energy consumption, waste generation and management, mobility, and others. The used instruments were documents, observation, interviews and focus groups with employees and/or managers. All these studies conclude that OCBE propels organizations into lower environmental impacts, better economic sustainability, and a more inclusive and equitable society.

4. CONCLUSION

OCBE is, in the author's opinion, the best designation for individual and voluntary behavior as represents a continuum with the Organizational Citizenship Behavior theory developed in the last century and still widely researched and applied to organizations. This does not mean that other multiple designations are inappropriate, but care should be taken in this area to facilitate the understanding of the present state-of-the-art.

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DECODING REGULATORY COMPLEXITY: THE IMPACT OF DIGITAL ADVISORY PLATFORMS AND HEALTHCARE AI OPERATIONS ON PUBLIC ACCESSIBILITY TO SOCIAL SECURITY

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ABSTRACT

The complexity of social security frameworks often creates a barrier between regulatory intent and public comprehension, leading to sub-optimal healthcare utilization and civic disengagement. This paper explores the intersection of Educational Technology (EdTech) and computational social science to address this gap, alongside the critical role of backend healthcare automation. By examining the digital transformation of public advisory services and institutional workflows, we investigate how specialized digital platforms translate dense regulatory jargon into accessible knowledge. Focused on the evolving landscape of social security in Morocco, this study presents a theoretical model for a digital advisory space powered by a Healthcare AI Ops platform. Grounded in technology acceptance theories, the paper argues that civic-oriented EdTech, supported by robust institutional AI operations, is a fundamental driver for citizen empowerment and equitable healthcare access.

Keywords: Artificial Intelligence, Digital Advisory, Healthcare

1. INTRODUCTION

The democratization of legal and regulatory knowledge is a critical challenge in modern public administration. In the realm of social security and healthcare utilization, the gap between the rights granted by the state and the public's understanding of those rights can severely limit the efficacy of social programs. In Morocco, ongoing socio-economic reforms necessitate innovative approaches to ensure citizens can navigate their benefits. This paper explores the role of specialized digital advisory platforms designed to decode regulatory complexity. Furthermore, it argues that public accessibility is inextricably linked to provider efficiency; resolving regulatory bottlenecks requires automation across clinical and administrative workflows.

2. THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.1 EdTech Beyond the Classroom: Civic Technology

Traditionally, Educational Technology is evaluated within formal academic institutions; however, its application in public administration represents a vital frontier. This research extends the Technology Acceptance Model (TAM) to evaluate how citizens interact with platforms designed to explain social security benefits, focusing on perceived ease of use when confronting complex legal texts.

2.2 Research with a Social Vision Supported by Operational Efficiency

Translating regulatory frameworks requires more than mere digitization; it demands a social vision that prioritizes end-user empowerment. However, educating the public is only half the equation. When healthcare providers are burdened by manual processes, the delivery of social benefits stalls. The literature highlights that when backend systems are automated, healthcare utilization becomes more efficient and proactive, directly benefiting the citizen's experience.

3. CASE STUDY CONTEXT: HAJJI CAPITAL AS A HEALTHCARE AI OPS ECOSYSTEM

To ground the theoretical framework, this paper analyzes the architecture of Hajji Capital, operating as a comprehensive Healthcare AI Ops platform. While digital advisory interfaces serve the citizen directly, Hajji Capital provides the essential backend infrastructure for clinics, hospitals, diagnostic centers, and healthcare groups. This dual approach ensures that when citizens understand their rights, the healthcare system is actually equipped to process them efficiently.

Key Architectural Pillars of the Platform: Hajji Capital operationalizes this vision through specialized Healthcare Packs designed to eliminate systemic friction.

Prior Authorization Automation: Streamlining the complex approval processes between healthcare providers and social security entities.

Revenue Cycle Automation: Accelerating reimbursement speeds and creating stronger institutional controls.

AI Medical Documentation & Non-Clinical Workflow Automation: Reducing the administrative burden on medical staff, allowing for clearer patient communication regarding care and coverage.

Healthcare Cybersecurity: Ensuring that sensitive patient data and social security information remain protected within the digital ecosystem.

4. METHODOLOGY

To evaluate the impact of this integrated AI Ops and advisory model, this study employs an applied econometric approach mixed with institutional performance metrics.

Data Collection: Data is derived from pilot implementations of Hajji Capital's premium implementation packs within targeted healthcare groups, combined with simulated public interactions with the advisory interface.

Variables: The primary dependent variables are the "Comprehension Index" of social security benefits (patient-side) and "Reimbursement Speed" (provider-side). Independent variables include the deployment of proprietary workflow intelligence and the frequency of platform interaction.

Analytical Model: A multivariate regression model is utilized to isolate the impact of AI workflow automation on administrative time reduction and its downstream effect on patient satisfaction and regulatory comprehension.

5. FINDINGS AND DISCUSSION

Measurable Institutional ROI: Initial deployments indicate that standardizing delivery and utilizing software-assisted workflows create a measurable ROI. By lowering the administrative burden and facilitating faster reimbursement, healthcare providers reported a significant decrease in operational friction.

Bridging the Gap via Workflow Intelligence: The Hajji Capital platform successfully decoded specific complexities that previously hindered public access. By utilizing proprietary patterns from implementation data and automation learning, the platform improves product defensibility and continuously refines how regulatory rules are processed.

Platform Repeatability: The transition from bespoke service implementation to standardized, repeatable software modules proved crucial. It allowed the operational benefits to scale rapidly across different clinics and hospital networks, uniformly improving the patient's interaction with the social security apparatus.

6. CONCLUSION AND POLICY IMPLICATIONS

The implementation of comprehensive Healthcare AI Ops platforms represents a transformative shift in how social security is managed and communicated. By applying specialized digital technology to both public advisory systems and institutional administration, we can dismantle the barriers created by regulatory complexity. The evidence suggests that a modular product suite—spanning reimbursement, documentation, authorization, and cybersecurity—not only empowers citizens but also ensures healthcare systems remain financially and operationally viable. Looking forward, the 10-year vision relies on establishing a regional leader in healthcare AI operations, starting with the MENA region and expanding internationally through enterprise buyers. Future research should focus on the longitudinal impacts of these enterprise-grade platforms on national healthcare economics and sustainable social well-being.

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CRISIS MANAGEMENT AND DISASTER VOLUNTEERING INTENTIONS: A COMPARATIVE STUDY OF CROATIAN BUSINESS ECONOMICS STUDENTS AND EU-27 REFERENCE GROUPS

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ABSTRACT

In crisis management research, prosocial behavior such as disaster volunteering is studied as social capital and organizational resilience. Business economics students, as future managers and decision-makers, are a population whose prosocial intentions are significant for organizational responses to crises. Croatian business economics students experienced the 2020 Zagreb and Petrinja earthquakes during the COVID-19 pandemic, providing a context to examine how disaster exposure relates to volunteering intentions. This study compares disaster exposure and prosocial volunteering intentions between Croatian business economics students and three reference groups: EU-27 students, the EU-27 general population, and the Croatian general population. A cross-sectional comparative analysis was conducted on a purposive sample (N=103), replicating the European Union Special Eurobarometer 547 methodology. Z-tests for independent proportions were used to test the hypotheses. The results fully support H1, showing that Croatian business economics students reported significantly higher disaster exposure (83%) than all three reference groups (EU-27 students 41%, EU-27 general population 38%, Croatian general population 69%). H2 received partial support, where Croatian business economics students' volunteering intentions (27.9%) were significantly higher than those of the EU-27 general population (16.6%), while the differences from EU-27 students (26.6%) and the Croatian general population (21.7%) were not statistically significant. This study provides the first comparative analysis of business economics students' intentions using the European Union Special Eurobarometer 547 dataset, and contributes to the literature on prosocial behavior and crisis preparedness. The findings show that disaster exposure does not linearly translate into volunteering intentions. Factors such as the time lag, contextual circumstances, and social support may shape this relationship. From a business and management perspective, organizations cannot rely on spontaneous prosocial mobilization in crisis contexts. Formal volunteering programs and human resource strategies, in business education and in organizations, can support the prosocial capacity of future managers and contribute to organizational crisis preparedness and community resilience.

Keywords: *Business continuity, Crisis management, Disaster volunteering, Human capital, Organizational resilience*

1. INTRODUCTION

Prosocial behavior involves various voluntary activities that individuals or groups conduct to benefit other people (Eisenberg et al., 2006; Penner et al., 2005; Crone & Achterberg, 2022, Pfattheicher et al., 2022), without a guarantee of reciprocity, and are important for social cohesion (Pancotto et al., 2024; Wu & Hong, 2022). Social capital determines the speed and quality of community recovery (Aldrich, 2012).

Rahman & Zhu's (2024) findings suggest that the environment shapes prosocial behavior, that is communities with higher socioeconomic status and community infrastructure are more prone to prosocial behavior, such as sharing and volunteering. Norris et al. (2008), as well as Aldrich et al. (2018), stated that the foundations of community disaster resilience are based on human capacities and social capital. Volunteering and the intent to volunteer are considered important aspects of prosocial behavior. As argued by Whittaker et al. (2015), volunteering strengthens the bonds among society members and improves community resilience. Volunteering is positively associated with level of education, income, being an active member of a certain religion, and involvement in the local community (Penner et al., 2005). Volunteers without training in disaster response in times of disasters are more exposed to physical and mental health risks than professionally trained personnel. In comparison to trained rescue workers, who are the key responders in disasters, trained volunteers are beneficial in providing less complex assistance to the community in emergency response situations (Liu & Robinson, 2013). A person's traumatic experience, such as a natural disaster, can propel prosociality, that is, engagement of citizens in both donations and volunteering and helping, which can improve overall resilience in times of crises (Vollhardt, 2009). Disasters can strengthen prosocial behavior through increasing emotions and empathy in citizens and driving the human desire to contribute to others. Hoenow et al. (2025), in their study analyzing floods in Germany, emphasized that this outcome depends on the context and circumstances before, during, and after the crisis. Earthquakes are considered catastrophic events that place survivors in vulnerable positions, where prosocial behavior is in correlation with the level of devastation and decreases over time (Rao et al., 2011). Earthquakes can cause post-traumatic stress, due to the unexpected nature of natural disasters, and affect prosocial behavior, whereas research on Chinese adolescents after the Ya'an earthquake and the trauma they have experienced showed that social support had a greater effect on prosocial behavior (Liu et al., 2021). A study focusing on the 2011 Great East Japan Earthquake found that people were more altruistic, made donations, and stated that they had felt happier due to such charitable behavior (Ishino et al., 2015). Prosocial behavior after disasters, such as the Great East Japan Earthquake, depends on both the level of exposure and age, where experimental research from Japan suggests that citizens over the age of 65 are more inclined toward prosocial actions and cooperation than younger age groups (Sawada et al., 2023). According to Zaki (2020), one aspect that disasters have on individuals is in the improvement of prosocial behavior and feelings of community belonging and altruism. Disasters can positively affect volunteering and donations, which is known as disaster convergence, the allocation of help and resources towards a crisis point. In addition, the same author stated that in dire situations, catastrophe compassion is present, meaning people are ready to help others, while simultaneously positively affecting the people that contribute, such as an increase in happiness and well-being. On a broader level, it enhances resilience. Prosocial behavior, especially disaster volunteering, has implications for organizational crisis resilience and business continuity. In the post-pandemic context, organizational capability to mobilize internal and external resources for appropriate crisis response is becoming a significant determinant of business continuity. Employees' and future managers' volunteering capacities represent a form of social capital, which impacts the costs and speed of recovery from crisis. Regarding business and organizational management research, prosocial behavior of future decision-makers is significant as:

- It contributes to increased organizational resilience through the use of human capital component, and is regarded as one of the most significant areas of research in the resilience field (Linnenluecke, 2017).
- It impacts the development of corporate social responsibility (CSR) in organizations. Business education affects development of managers' ethical and social values (Christensen et al., 2007).

- It is associated with organizational ability to mobilize resources, which has been identified as one dimension of organizational responses to external threats (Linnenluecke, 2017).
- It has implications for human resources strategy design and employee volunteering engagement programs (Rodell et al., 2016).

Disaster experience may influence individuals' risk perception (Labaš, 2025), and crisis preparedness has been studied as a relevant factor among university students (Patel et al., 2023). Prosocial orientation impacts future managers, and it subsequently influences how organizations allocate resources and respond to disasters. Organizational resilience research identified employee strengths and organizational responses to external threats, including resource mobilization, as significant research streams (Linnenluecke, 2017). Understanding organizational resilience through disaster-related prosocial intentions among business students is important for management research. The comparison between students across EU countries and their levels of past exposure to crises and disasters allows insight into whether disaster experience may influence future managerial attitudes and preparedness for crises (Linnenluecke, 2017; Pancotto et al., 2024). However, existing prosociality research mainly focuses on general population responses and professional responders, often overlooking business decision-makers as a distinct group. Among various demographic groups that can significantly contribute to disaster recovery, university students represent a unique and understudied population that possesses physical and cognitive capabilities, as well as social flexibility to contribute to disaster resilience (Patel et al., 2023). A number of studies have found lower prosociality and willingness to donate among business economics students compared to other disciplines (Sundemo & Löfgren, 2025; Bauman & Rose, 2011; Frank et al., 1993), as well as more self-interested than non-economic students (Miragaya-Casillas, 2023). Little is known about how disaster exposure influences prosocial behavior among business economics university students, as a significant social capital group of future managers, entrepreneurs, and decision-makers in different institutional and cultural contexts. Business economics students are a focus group due to their future decision-making importance as company and public service leaders. Their prosocial behavior can have a positive effect on response to future crisis from a managerial perspective, and impact their engagement. Unlike general volunteering or medical students (Bailie et al., 2024), business managers and economists can contribute to organizational crisis management through key organisational functions such as supply chain management, financial planning, human resource management and resource allocation, employing their expertise to foster community resilience (Linnenluecke, 2017). There is a need to better understand business economics students' preferences for prosocial behavior and how disaster exposure contributes to crisis management strategies development and future community engagement and resilience. Croatian business economics students have, to a large extent, experienced the double shock of the earthquakes- the Zagreb earthquake (Markušić et al., 2020) and the Petrinja earthquake (Atalić et al., 2023) in 2020, along with COVID-19 trauma exposure and other disasters such as floods. This context provides the opportunity to examine how such exposures shape prosocial behavior in future decision-makers and their disaster-related volunteering, and the possibility to compare with other groups using the European Union Special Eurobarometer 547: Disaster risk awareness and preparedness of the EU population (European Commission, 2024). Despite extensive research on post-disaster prosociality, to the best of our knowledge no previous studies have systematically compared business economics students' volunteering intentions across different disaster exposure contexts in the EU. This research examines differences in disaster exposure and prosocial volunteering intentions between Croatian business economics students and three comparison groups: EU-27 students, the EU-27 general population, and the Croatian general population.

Understanding these differences contributes to the development of crisis management strategies, organizational resilience, and the mobilization of local social capital, which are essential for economic resilience and post-disaster recovery. This research addresses two main questions:

RQ1: Do Croatian business economics students exhibit higher disaster exposure than selected reference groups (EU-27 students, EU-27 general population, and the Republic of Croatia general population)?

RQ2: Do differences in disaster exposure translate into varying prosocial behavior as manifested by disaster volunteering intentions?

Accordingly, two main hypotheses, along with subsequent sub-hypotheses, are formed:

- H1: Croatian business economics students have experienced a statistically significantly higher level of disaster exposure in the past 10 years in comparison to the reference groups.
- H1a: Croatian business economics students have experienced a statistically significantly higher level of disaster exposure in the past 10 years in comparison to the EU-27 students.
- H1b: Croatian business economics students have experienced a statistically significantly higher level of disaster exposure in the past 10 years in comparison to the EU-27 general population.
- H1c: Croatian business economics students have experienced a statistically significantly higher level of disaster exposure in the past 10 years in comparison to the Croatian general population.
- H2: Croatian business economics students exhibit statistically significantly higher disaster volunteering intentions in comparison to the reference groups.
- H2a: Croatian business economics students exhibit statistically significantly higher disaster volunteering intentions in comparison to the EU-27 students.
- H2b: Croatian business economics students exhibit statistically significantly higher disaster volunteering intentions in comparison to the EU-27 general population.
- H2c: Croatian business economics students exhibit statistically significantly higher disaster volunteering intentions in comparison to the Croatian general population.
- H1 intends to establish differential trauma exposure as a contextual variable that may moderate prosocial behavior (Liu et al., 2021), whereas H2 tests whether trauma effect (Vollhardt, 2009; Liu et al., 2021) or professional socialization (Sundemo & Löfgren, 2025) is more influential in shaping prosocial behavior.

The aforementioned goal was achieved with the use of a primary survey, the results of which are compared with the findings of the Special Eurobarometer 547 survey (European Commission, 2024) on three levels: in relation to the EU-27 member states students, the EU-27 general population, and the Republic of Croatia general population. Based on the observed differences and particularities, implications for organizational crisis management and disaster preparedness are discussed. The paper is structured into five sections. Introduction section provides a theoretical literature overview on prosocial behavior, disaster resilience, and organizational crisis management, with a focus on business economics students as future managers, along with research questions and hypotheses. The second section describes the research methodology, including the sample, research procedures, and applied statistical methods. The third section presents the empirical research results, while the fourth section discusses the findings. The fifth section conclusion highlights key findings, paper limitations, and suggestions for further research.

2. METHODOLOGY

This paper is based on a cross-sectional, comparative quantitative research and analysis of Croatian business economics students' prosocial behavior and intention to volunteer in disasters. Data was collected using a structured research survey questionnaire on a sample of the University of Zagreb, Faculty of Economics & Business, Integrated University Undergraduate and Graduate Programme in Business Economics higher year students (3rd, 4th, and 5th years). The study included a comparison of the obtained findings with a representative sample of EU-27 students from various faculties and study programs of member states, the general EU-27 population (15+ years of age), and the general population of the Republic of Croatia (15+ years of age). This approach, together with the consistent application of the Eurobarometer methodology, enabled both international and national comparisons of various observed societal segments. The Special Eurobarometer 547: Disaster Risk Awareness and Preparedness of the EU Population was conducted in February and March of 2024 and published in September of the same year (European Commission, 2024). Comparison is important due to the contextualization of results in relation to the relevant European Commission data and for ensuring a high level of relevance. This research applied the original Eurobarometer methodology, that is, the questions were replicated from the module QC-Disaster risk awareness and preparedness of the EU population, from a Special Eurobarometer 547 (European Commission, 2024). The data for this research were collected through a single survey replicating the Special Eurobarometer 547 questionnaire. While a previous study (Labaš, 2025) analyzed aspects related to Croatian business economics students' awareness of disaster risks and preferences for sources of information, this paper specifically examines the distinct aspect concerning disaster exposure and prosocial volunteering intentions. Findings presented here are independent and contribute to the field. The use of this standardized questionnaire, which contains identical previously methodologically validated and officially translated questions in the Croatian language (as well as translations to other official EU languages, ensured cultural and linguistic equivalence), thereby enabling the implementation of the replication study with the targeted audience (Walker et al., 2017), business economics students at the University of Zagreb, Faculty of Economics & Business, majoring in Analysis and business planning, and with it, the connected elective course. The questionnaire contained closed-type questions, including multiple-choice and attitude assessment scales (e.g. agreement scales), ensuring compatibility. This approach ensures international comparability and enabled direct statistical comparison among the target sample (N=103) and the reference groups- the general population of the Republic of Croatia, the general population of the EU-27, and the stratum "Student" of EU-27 member states from the official Eurobarometer report. The research method applied was purposive sampling, specifically the criterion sampling strategy. Participants were purposefully selected to ensure the homogeneity of respondents. Respondents met the defined inclusion criteria: 1) business economics student status, 2) attendance at higher years of study, with a certain level of academic maturity and study experience, and 3) enrollment in courses that address management topics, monitoring environmental changes, and risk. The selection of this group is based on the assumption that business economics students represent future managers and business leaders whose education increasingly incorporates ethics, CSR and sustainability (Christensen et al., 2007), and future strategic planners, are key actors in building the resilience of organizations and society. The research was conducted in the winter semester of 2025, with one reminder sent to the target group of students. A mixed-mode data collection strategy was used, using an identical survey instrument for online completion through Google Classroom and for live surveys in the classrooms of the Faculty of Economics & Business Zagreb. Collected data from the classroom-conducted paper survey was manually transcribed into the main digital database, ensuring data consistency and integrity.

The target population of this study consists of higher years students of business economics at the University of Zagreb, Faculty of Economics & Business, primarily in the Analysis and Business Planning major. The sampling frame is the official list of enrolled students in the 3rd, 4th, and 5th years of the specified field of study and the associated elective course for the academic year 2025/2026. The sampling frame consisted of 220 students, which achieved complete matching between the population and the sampling frame. All students in the sampling frame were invited to participate, and responses were collected from N=103 respondents who fully completed the survey questionnaire, which makes a response rate of 46.8%. The final sample was predominantly female (64%), and the most significant age group was 18 to 24 years (89%). Participation in the study was voluntary. Participants had the opportunity to withdraw from completing the questionnaire at any time without consequences, and the confidentiality of all data was guaranteed and maintained. Regarding the size of the target population (N=220), the number of respondents (N=103, a 46.8% response rate) is adequate for quantitative analysis. In comparison, in the Special Eurobarometer survey 547 to evaluate student attitudes in Croatia and all other EU countries, around 100 respondents per each country were surveyed, as part of the stratified sampling design (European Commission, 2024). The use of the same questionnaire instrument in the context of a significantly smaller, more homogeneous purposive sample in a single institution context, allows for comparability of results across different population strata. It ensures internal consistency and a high level of measurement reliability for the comparative analysis. Limitations regarding the generalizability of findings are addressed in the limitations section. To obtain clearer insight into respondents' attitudes and ensure the statistical validity of H2 results (given the unequal sample sizes), responses on current and planned engagement in voluntary work supporting emergency responder organisations or community-based disaster resilience initiatives were grouped into two categories. This grouping follows the Theory of Planned Behavior (TPB) (Ajzen, 1991), which considers behavioural intention a strong predictor of actual behaviour, and the findings of Liu et al. (2021), suggesting that disaster-induced post-traumatic growth may lead to increased willingness to support the community. The categorisation therefore distinguishes future-oriented prosocial intentions from past or absent engagement. The two groups are:

1. Active intentions: respondents are currently engaged in voluntary work or planning to engage in the future.
2. Past engagement or no current intentions to engage in voluntary work: respondents who do not have plans, as well as respondents with past experience, but no intention to return to voluntary activities in the future.

Data preparation and initial cleaning were done using Microsoft Excel. Subsequent statistical inferential analyses were done in IBM SPSS Statistics, where the Z-test for independent proportions was used for hypothesis testing. The Z-test for independent proportions was selected because the analysis compares proportions of dichotomous outcomes (disaster exposure: yes/no; active volunteering intention: yes/no) between groups, rather than means of continuous variables. The Z-test is appropriate for comparing proportions between samples of substantially different sizes, such as the Eurobarometer reference data and the target student sample.

3. RESULTS

Based on the questions asked in this empirical research from the Special Eurobarometer 547 survey, the respondents demographic structure consists of 37 (36%) male respondents compared to 66 (64%) female respondents.

The age structure was 92 (89%) 15-24 years; 10 (10%) 25-39 years; 1 (1%) 40-54 years, and 0 (0%) from the category 55+ years. Such results indicate that the respondents are mostly members of Generation Z, whereas it is also possible that in the age category 25-39, part (or all) of the respondents belong to Generation Z. Furthermore, results in Table 1 present personal direct or indirect disaster exposure in the last 10 years, with the exception of the COVID-19 pandemic, as stated in the Special Eurobarometer 547 study (European Commission, 2024).

Crisis exposure	Croatian business economics students (N=103)	EU-27 students (N=2632)	EU-27 general population (N=26411)	Croatian general population (N=1002)
Yes, major accidents (e.g. industrial or chemical accidents, oil spills, major transport accidents)	0 (0.0%)	92 (3.0%)	700 (3.0%)	44 (4.0%)
Yes, nuclear accidents	0 (0.0%)	29 (1.0%)	336 (1.0%)	18 (2.0%)
Yes, critical infrastructure disruption (e.g. electricity black-outs, disruption to gas or drinking water, etc.)	16 (16.0%)	85 (3.0%)	1133 (4.0%)	57 (6.0%)
Yes, human health emergency (e.g. a highly contagious disease outbreak)	3 (3.0%)	162 (6.0%)	1453 (6.0%)	165 (17.0%)
Yes, animal or plant disease outbreak	7 (7.0%)	72 (3.0%)	748 (3.0%)	141 (14.0%)
Yes, floods (e.g. river or coastal flood, heavy rain event, etc.)	19 (18.0%)	309 (12.0%)	2454 (9.0%)	177 (18.0%)
Yes, wildfire, forest fires	14 (14.0%)	173 (7.0%)	1519 (6.0%)	100 (10.0%)
Yes, geological disasters (e.g. landslides, earthquakes, volcanic eruptions, etc.)	47 (46.0%)	80 (3.0%)	916 (3.0%)	257 (26.0%)
Yes, extreme weather events (violent storms, droughts, heatwaves, cold waves, etc.)	6 (6.0%)	287 (11.0%)	3237 (12.0%)	207 (21.0%)
Yes, terrorist attacks	2 (2.0%)	83 (3.0%)	795 (3.0%)	20 (2.0%)
Yes, cybersecurity threats (e.g. cyberattacks, cybercrimes, etc.)	0 (0.0%)	144 (5.0%)	1223 (5.0%)	60 (6.0%)
Yes, political or geo-political tensions (e.g. civil unrest, social divisions, etc.)	7 (7.0%)	147 (6.0%)	1267 (5.0%)	45 (5.0%)
Yes, mass population displacement in emergencies (e.g. sudden influx of refugees due to conflicts in neighbouring countries)	16 (16.0%)	181 (7.0%)	1480 (6.0%)	91 (9.0%)
Yes, other	1 (1.0%)	29 (1.0%)	317 (1.0%)	23 (2.0%)
No, you haven't experienced any disasters in the past ten years	18 (17.0%)	1545 (59.0%)	16423 (62.0%)	315 (31.0%)
Don't know	6 (6.0%)	12 (0.0%)	125 (0.0%)	5 (0.0%)

Table 1: Disaster Exposure by Type and Demographic Group
(Source: Authors' research and data from Special Eurobarometer 547 report (European Commission, 2024))

Note: Question text: "With the exception of COVID-19, have you personally experienced - directly or indirectly - a disaster in the past 10 years? This includes disasters experienced in your region and elsewhere in the European Union, for example when travelling." Multiple responses were possible; totals may exceed 100%.

By assessment of Table 1, which states 13 disaster categories (without COVID-19) over the past 10 years, it is notable that geological disasters are experienced by 46% of Croatian business economics students in comparison to 3% of EU-27 students and the EU-27 general population. This accounts for 15 times more exposure to earthquakes, as a result of the 2020 Zagreb and Petrinja earthquakes, which mainly affected surveyed business economics students. Also, significant critical infrastructure disruptions differences are notable (16% Croatian business economics students vs. 3% EU-27 students vs. 6% EU-27 general population). Another notable difference is in floods disaster category (18% Croatian business economics students vs. 12% EU-27 students vs. 9% EU-27 general population). Neutral respondents who answered a question of previous disaster experience in the last 10 years with "Don't know" were excluded from further analysis, in order to maintain focus on respondents with clearly defined response, and enhance interpretive clarity. After excluding 6 respondents who answered "Don't know", the final analytical sample comprised 97 Croatian business economics students. The same procedure was done with all three reference groups. In order to evaluate H1 of whether Croatian business economics students have personally experienced more disasters in the past 10 years than the reference groups, data analysis was performed using a Z-test for two independent proportions. Descriptive statistics regarding the prevalence of disaster experience among the reference groups are presented in Table 2.

Group	Sample size (N)	Disaster exposure (%)
Croatian business economics students	97	83.0%
EU-27 students	2,620	41.0%
EU-27 general population	26,286	38.0%
Croatian general population	997	69.0%

*Table 2: Descriptive Statistics of Disaster Exposure
(Source: Authors' research and data from Special Eurobarometer 547 report
(European Commission, 2024))*

In Table 2, descriptive statistics indicate that a significant number of Croatian business economics students (83%) have been exposed to disaster events in the past 10 years in comparison to 41% of EU-27 students, 38% of the EU-27 general population, and 69% of the Croatian general population.

Reference group	Difference (%)	Z-score	p-value
EU-27 students	+42.0%	8.21	< .001
EU-27 general population	+45.0%	9.10	< .001
Croatian general population	+14.0%	2.87	.004

*Table 3: Z-test Results for Differences in Disaster Exposure (H1)
(Source: Authors' research and data from Special Eurobarometer 547 report
(European Commission, 2024))*

Note 1: Percentage difference of Croatian business students disaster exposure vs. reference groups

Note 2: All Z-tests met the minimum sample size requirement ($np > 5$ and $n(1-p) > 5$)

Table 3 shows the results of the Z-test for Independent Proportions, where it can be observed that Croatian business economics students, compared to all three reference groups, have a higher disaster exposure percentage. More specifically, the largest difference is in comparison to the EU-27 general population- 45.0% higher ($Z=9.10$, $p<.001$), followed by similar difference in comparison to EU-27 students- 42.0% higher ($Z=8.21$, $p<.001$). Additionally, in comparison to the Croatian general population, Croatian business economics students had a 14% higher disaster exposure percentage ($Z=2.87$, $p=.004$). In Table 4, a summary of hypothesis testing is presented.

Hypothesis	Reference Group	Difference	Statistical significance (p)	Hypotheses Status
H1a	EU-27 students	83% vs. 41%	$< .001$	Supported
H1b	EU-27 general population	83% vs. 38%	$< .001$	Supported
H1c	Croatian general population	83% vs. 69%	.004	Supported

Table 4: Summary of Hypothesis 1 Testing Results

(Source: Authors' research and data from Special Eurobarometer 547 report (European Commission, 2024))

Note: All comparisons used the Croatian business economics student sample ($N=97$) as the primary reference group.

Table 4 provides a summary of hypothesis tests, where Z-tests for independent proportions indicate that all three research sub-hypotheses (H1a, H1b, and H1c) are statistically supported, confirming that H1 is fully statistically supported: Croatian business economics students have a significantly higher level of disaster exposure in comparison to all three reference groups. Next, in Table 5, the analysis of H2 shows that Croatian business economics students exhibit statistically significantly higher disaster volunteering intentions in comparison to the reference groups.

Volunteering experience and intentions	Croatian business economics students ($N=103$)	EU-27 students ($N=2632$)	EU-27 general population ($N=26411$)	Croatian general population ($N=1002$)
Yes, already currently engaged in voluntary work	4 (4.0%)	232 (9.0%)	1881 (7.0%)	58 (6.0%)
Yes, plan to engage in voluntary work in the future	20 (19.0%)	456 (17.0%)	2450 (9.0%)	156 (16.0%)
No, but have engaged in voluntary work in the past	15 (15.0%)	336 (13.0%)	4955 (19.0%)	258 (26.0%)
No, never engaged in voluntary work and do not plan to do so	47 (46.0%)	1559 (59.0%)	16869 (64.0%)	514 (51.0%)
Don't know	17 (17.0%)	49 (2.0%)	256 (1.0%)	15 (1.0%)

Table 5: Volunteering Experience and Intentions for Disaster Resilience Across Reference Groups

(Source: Authors' research and data from Special Eurobarometer 547 report (European Commission, 2024))

Note. Frequencies are followed by percentages in parentheses.

In Table 5, it can be observed that the surveyed Croatian business economics students stated higher plans to engage in voluntary work in the future (19%), which is above the stated intended plans of the respondents in the EU-27 students (17%), the EU-27 general population (9%), and the Croatian general population (16%). In addition, the percentage of Croatian business economics students who have never engaged and do not plan to engage in voluntary work is lower (46%) than in the analyzed reference groups, EU-27 students (59%), EU-27 general population (64%), and Croatian general population (51%).

Volunteering category	Croatian business economics students (N=86)	EU-27 students (N=2583)	EU-27 general population (N=26155)	Croatian general population (N=986)
Active engagement or intentions to engage	24 (27.9%)	688 (26.6%)	4331 (16.6%)	214 (21.7%)
Past engagement or no current intentions to engage	62 (72.1%)	1895 (73.4%)	21824 (83.4%)	772 (78.3%)
Total	86 (100.0%)	2583 (100.0%)	26155 (100.0%)	986 (100.0%)

Table 6: Active Volunteering Intentions and Engagement Across Reference Groups (N adjusted)

(Source: Authors' research and data from Special Eurobarometer 547 report (European Commission, 2024))

Note. Frequencies are followed by percentages in parentheses. The sample size (N) was adjusted by excluding "Don't know" responses to focus on established behavioral intentions. Active engagement or intentions to engage: respondents are currently engaged in voluntary work or planning to engage in the future. Past engagement or no current intentions to engage in voluntary work: respondents who do not have plans, as well as respondents with past experience, but no intention to return to voluntary activities in the future.

The results in Table 6 present the percentage of respondents actively engaged or with intent to engage in disaster volunteering and those who do not wish to take part or have past experience across 4 selected groups. Croatian business economics students have the highest percentage of active engagement or intention to engage (27.9%), compared to the EU-27 students (26.6%), the EU-27 general population (16.6%), and the Croatian general population (21.7%). In order to analyze H2 and determine whether statistically significant differences in volunteering intentions exist between Croatian business economics students and selected reference groups, as operationalized in the Methodology section, the Z-tests for independent proportions were conducted. To determine the statistical significance of the differences in volunteering intentions between Croatian business economics students and the three reference groups, a series of Z-tests for independent proportions was conducted in Table 7. This analysis specifically tests the "Active or intended engagement" category.

Reference group	% Difference	Z-score	p-value
EU-27 students	+1.3%	0.27	.787
EU-27 general population	+11.3%	2.83	.005
Croatian general population	+6.2%	1.33	.183

*Table 7: Z-test Results for Differences in Active Volunteering Intentions (H2)
(Source: Authors' research and data from Special Eurobarometer 547 report
(European Commission, 2024))*

Note 1: Percentage difference of Croatian business students “Active engagement or intentions to engage” vs. reference groups.

*Note 2: All Z-tests met the minimum sample size requirement ($np > 5$ and $n(1-p) > 5$).
Statistical significance is observed at $p < .05$.*

Table 7 shows the results of the Z-test for Independent Proportions, where it can be observed that Croatian business economics students compared to all three reference groups have higher active engagement or intentions to engage in disaster volunteering activities compared to three reference groups. More specifically, the largest difference is in comparison to the EU-27 general population- 11.3% higher ($Z=2.83$, $p=.005$), followed by a similar difference in comparison to the EU-27 students- 1.3% higher ($Z=0.27$, $p=.787$). Also, in comparison to the Croatian general population, Croatian business economics students have a 6.2% higher active engagement or intentions to engage in disaster volunteering activities ($Z=1.33$, $p=.183$). In the following Table 8, a summary of hypothesis 2 testing is presented.

Hypothesis	Reference group	Difference	Statistical significance (p)	Hypotheses status
H2a	EU-27 students	28% vs. 27%	.787	Not Supported
H2b	EU-27 general population	28% vs. 17%	.005	Supported
H2c	Croatian general population	28% vs. 22%	.183	Not Supported

*Table 8: Summary of Hypothesis 2 Testing Outcomes
(Source: Authors' research and data from Special Eurobarometer 547 report
(European Commission, 2024))*

*Note: All comparisons used the Croatian business economics student sample
($N=86$) as the primary reference group.*

Table 8 provides a summary of hypothesis tests, where Z-tests for independent proportions indicate that research sub-hypothesis H2b is statistically supported, confirming that H2 is partially statistically supported: Croatian business economics students have a significantly higher level of active engagement or intentions to engage in disaster volunteering activities. H2a and H2c were not statistically supported, meaning that even though sampled Croatian business economics students have higher active engagement or intentions to engage in disaster volunteering activities (28%) in comparison with EU-27 students (27%) and Croatian general population (22%), the differences are not statistically significant.

4. DISCUSSION

The main findings are that Croatian business economics students have been significantly more exposed to disasters in the last 10 years, most notably geological disasters and, within them earthquakes in Zagreb and Petrinja in 2020. However, their exposure does not entirely transform into more prosocial behavior regarding intentions to volunteer in disasters in comparison to selected reference groups.

This contradicts the notion that disaster trauma leads to prosocial behavior (Vollhardt, 2009) and implies the existence of other determinants, such as time lag from the disaster (Rao et al., 2011), that influence the prosocial behavior of future business decision-makers. Research results clearly indicate that the sampled population of Croatian business economics students has experienced a statistically significantly higher level of disaster exposure in the past 10 years in comparison to the three reference groups (EU-27 students, EU-27 general population, and Croatian general population), thereby strongly supporting H1. The difference is mainly due to the 2020 Zagreb and Petrinja earthquakes when compared to the EU-27 student and the EU-27 general population. Such trauma experience with geological disasters is 15 times more experienced than in the EU-27 students and the EU-27 general population, creating a baseline for comparing and understanding prosocial intentions, as well as disaster volunteering intentions.

Besides geological disasters, Croatian business economics students reported higher exposure to critical infrastructure disruptions (16% vs. 3% EU-27 students and 6% Croatian general population) and floods (18% vs. 12% EU-27 students and 9% EU-27 general population, and Croatian general population 18%). Higher exposure compared to the Croatian general population (83% vs. 69%) likely reflects the concentration of respondents in the Zagreb area affected by the 2020 earthquakes. Hypothesis 2, examining whether Croatian business economics students exhibit statistically significantly higher disaster volunteering intentions in comparison to the reference groups, was partially supported. Croatian business economics students had significantly higher disaster volunteering intentions (27.9%) compared to the EU-27 general population (16.6%, $p=.005$), supporting H2b. However, differences were not statistically significant when compared to EU-27 students (26.6%, $p=.787$) or the Croatian general population (21.7%, $p=.183$), leading to the rejection of H2a and H2c.

Since H2b was supported ($p=.005$), where Croatian business economics students demonstrated a significantly higher volunteering intention (27.9%) in comparison to the EU-27 general population, it is partially consistent with Vollhardt (2009) that difficulties can lead to a rise in altruistic responses. Regarding previous literature findings of business students as seeking individual economic gain and less willing to volunteer and donate (Sundemo & Löfgren, 2025; Bauman & Rose, 2011; Frank et al., 1993), the results of this study indicate that surveyed Croatian business economics students who have experienced earthquakes are ready to contribute positively to their community. It makes findings relevant regarding business students general prosociality.

This indicates that disaster experience and trauma exposure (Vollhardt, 2009; Liu et al., 2021) may affect professional socialization (Sundemo & Löfgren, 2025). A possible explanation is that surveyed students were enrolled in courses addressing crisis management, risk management, and environmental monitoring which could have strengthened awareness of community engagement. Since the results did not support H2a, that Croatian business economics students exhibit statistically significantly higher disaster volunteering intentions in comparison to the EU-27 students, it provides an important insight that Croatian business economics students exhibit similar disaster volunteering intentions as EU-27 students (28% vs. 27%), exhibiting a universal student willingness to be more socially engaged. The obtained results also suggest that the difference in disaster exposure (83% vs. 41%) does not entirely determine prosocial behavior. Findings suggest that besides disaster exposure, determinants such as education and social context, influence prosocial intentions.

A possible explanation is that even though the earthquake exposure was largely present and the number of Croatian business economics students were exposed to earthquake, they have slightly higher prosocial intentions to volunteer in disasters, which can be due to the effect that prosocial behavior decreases over time after disasters (Rao et al., 2011) and since the earthquakes in Zagreb and Petrinja occurred in 2020, after several years, the potential prosocial motivation could be lower, where the initial effects of catastrophe compassion (Zaki, 2020) are not as present as immediately after the disaster. Prosocial outcomes, in view of Hoenow et al. (2025), are viewed as dependent on context and situations pre-crisis, during, and after crises. COVID-19 restrictions during the 2020 earthquakes may also have limited opportunities for post-disaster volunteering. According to Liu et al. (2021), social support had a greater effect on prosocial behavior after an earthquake than trauma exposure, which in the Croatian context could imply that social support was inadequate in providing structured institutional professional channels that would allow business economics students to apply their specific competencies to contribute to fostering sustainable prosocial intentions. Also, the results did not support H2c, which stated that Croatian business economics students exhibit statistically significantly higher disaster volunteering intentions in comparison to the Croatian general population (28% vs. 22%), implying that business economics students to a large extent reflect the national sentiment of solidarity regarding volunteering. Regarding Sawada et al. (2023) findings that in an earthquake in Japan, citizens over 65 showed higher prosocial behavior, the results of this study indicate that surveyed Croatian business economics students, who largely are members of Generation Z (89% aged 18-24), displayed prosocial disaster response intentions, and in comparison had no statistically significant differences with the Croatian general population, which included all age groups. Even though Croatian business economics students were exposed to more disasters, in comparison with EU-27 students who have been exposed to fewer disasters, both groups have stated similar levels of intention to volunteer in disasters. Such results suggest that disaster exposure and trauma are not adequate by themselves to entirely drive prosocial behavior and disaster volunteering intention. Study results also challenge the notion in the literature that business students are less prosocial (Sundemo & Löfgren, 2025).

Findings also provide valuable insights for universities and emergency management organizations. With results showing that 28% of Croatian business economics students expressed active volunteering intentions, there is a potential to engage the rest of the surveyed students to contribute to the disaster resilience of the community. It is significant, as they possess specific professional competencies in organizational management, financial planning, and analytical decision-making. The results can be notable in the use of their analytical and management competencies, as opposed to traditional volunteer roles in the field. Also, their obtained disaster-related volunteering experience can be used and prioritized in the private sector, contributing to increasing company resilience. Since the surveyed Croatian business economics students were part of a purposive sample and were enrolled in courses that taught risk management, crisis management, and environmental monitoring, they were previously exposed to principles of crisis and disaster management. Business curricula can help channel disaster experience into structured community engagement. Such an approach has implications for curriculum design, where disaster management and community engagement lectures can enhance prosocial results and the development of professional competencies. From the business perspective, results indicate that disaster exposure on its own does not create automatic capacity for organizational resilience through prosocial behavior of future managers. Results suggest several implications:

1. Crisis communication- organizations cannot rely on spontaneous prosocial mobilization of employees.
2. Human resource strategies- formal corporate volunteering programs enhance prosocial behavior.
3. Risk management- organizational crisis plans should take employee engagement into account.
4. Supply chain resilience- takes into account external social capital (volunteers, local community) as a valuable element of crisis preparedness.

Regarding business and management perspective, the findings link the prosocial volunteering of future business decision-makers to organizational crisis preparedness. The results suggest that formal volunteering engagement programs and specific human resource strategies may enhance prosocial capacity in addition to spontaneous mobilization.

5. CONCLUSION

This study investigated the relationship between disaster exposure and prosocial disaster volunteering intentions among Croatian business economics students and three reference groups (EU-27 students, EU-27 general population, and Croatian general population), providing the first comparative analysis using the Special Eurobarometer 547 survey and dataset (European Commission, 2024), and positioning their disaster volunteering intentions in a broader European and national context. The main findings indicate that while Croatian business economics students experienced significantly higher disaster exposure (2020 Zagreb and Petrinja earthquakes) occurring during the COVID-19 pandemic, this exposure does not linearly translate into proportionally higher disaster volunteering intentions compared to selected reference groups. The research statistically demonstrated that surveyed Croatian business economics students were more exposed to disasters (83%) (specifically earthquakes in Zagreb and Petrinja in 2020) in comparison to the EU-27 students (41%, $p < .001$), EU-27 general population (38%, $p < .001$), and Croatian general population (69%, $p = .004$). Therefore, Hypothesis 1 was fully supported (H1a, H1b, and H1c), accounting for differences in the baseline of experienced disasters and trauma. Regarding Hypothesis 2 findings provided partial support. That is, Croatian business economics students exhibited statistically significantly higher disaster volunteering intentions (27.9%) than the EU-27 general population (16.6%, $p = .005$), supporting H2b, whereas their volunteering intentions were not statistically significantly different from the EU-27 students (26.6%, $p = .787$) (H2a) and the Croatian general population (21.7%, $p = .183$) (H2c). This suggests that besides the disasters and trauma the Croatian business economics students were exposed to, it did not entirely determine prosocial disaster volunteering behavior. The gap between disaster exposure and disaster volunteering intention can be ascribed to a time lag since the 2020 disasters, contextual factors such as the COVID-19 pandemic, which at the time did not enable prosocial activities usual post-disaster, and availability of social support to process trauma. This study challenges the common view in literature that business students are less prosocial (Sundemo & Löfgren, 2025; Bauman & Rose, 2011). Our results show that personal disaster exposure can foster prosociality when it interacts with professional training. For students in risk and crisis management, such coursework seems to provide the necessary tools to apply their own disaster experiences toward broader community resilience. The findings also indicate that exposure to disasters does not automatically translate into prosocial mobilization without institutional support. While 28% of Croatian business economics students stated disaster volunteering intentions (similar to EU-27 students), universities and crisis management authorities should more effectively use their strategic competencies as social capital for community resilience.

Unlike typical emergency management volunteers, they can contribute through business and management competencies in supply chain management, finance, and organizational crisis coordination, and can have impact on disaster response. It suggests that crisis management strategies should create ways for business economics students to apply their analytical and managerial competencies to community resilience. When interpreting the results, along with the contributions, specific methodological limitations are considered. The use of a purposive sampling strategy, which focused on business economics students at the University of Zagreb, Faculty of Economics & Business, majoring in Analysis and business planning who enrolled in courses that directly addressed risk management, crisis management, and environmental monitoring, has the potential to reduce the generalizability of findings to the broader population of business economics students who have not been exposed to such course content. Also, the sample was collected at a single large public faculty of economics and business, which may limit generalizability. However, University of Zagreb, Faculty of Economics & Business represents the largest business and economics higher education institution in Croatia, making it an appropriate exploratory case study. Findings could represent a group of business economics students that are not representative for the entire Croatian business economics student population due to their specific crisis management competencies, as well as their geographical location affected by the Zagreb and Petrinja 2020 earthquakes. The sample size of Croatian business economics students (N=97 after excluding neutral responses) is substantially smaller than the reference groups. Such large variability in sample sizes could affect statistical power to detect smaller differences in prosocial behavior. Since the sub-hypotheses H2a and H2c were not supported, it could reflect a Type II error, as the observed differences in active volunteering intentions were relatively small (1.3% and 6.2%). The cross-sectional research study design does not enable tracing changes in disaster volunteering intentions over time, or immediately after the Zagreb and Petrinja 2020 earthquakes. The data are based on self-reported responses, which can be subject to potential social desirability bias. Another concern is that since participation was voluntary, there is a possibility of self-selection bias, meaning that students who agreed to participate may differ in certain characteristics from those who did not participate in the study. Future research should expand the stratified business economics student sample to include different universities beyond the Zagreb disaster exposure context, in order to provide a broader national insight into prosocial disaster volunteering intentions. Longitudinal studies of the same students would provide insight into the evolution of business economics students' volunteering intentions and the detection of future managerial practices in their professional careers, as well as their moderators. Comparison with students from different fields, such as medicine or engineering, would allow for a determination of whether students are similar or different regarding prosocial behavior and their professional socialization. Qualitative research with focus groups and interviews could provide answers to what roles and activities business economics students can take in disaster volunteering and their possible contribution to community resilience. In conclusion, this study contributes to business and management research by examining the prosocial behavior of business economics students. As future managers, they represent a human capital component of organizational resilience. The findings show that the prosocial potential of future business decision-makers does not automatically translate into volunteering intentions. It depends on contextual factors and requires active institutional support. Since prosocial orientation is often formed before individuals enter the workforce, programs at universities can prepare business economics students to contribute to community resilience and to organizational responses to crises.

ACKNOWLEDGEMENT: *The author acknowledges the use of AI tools for language editing during manuscript preparation. All scientific content, analyses, and conclusions are the author's own.*

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THE IMPACT OF SOCIAL DIALOGUE ON MINIMUM WAGE AND EMPLOYMENT: A COMPARATIVE ANALYSIS OF SLOVAKIA, THE CZECH REPUBLIC AND AUSTRIA

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ABSTRACT

Social dialogue constitutes a key institutional mechanism through which labour market actors coordinate interests related to employment, wages, and working conditions. This article examines the impact of social dialogue on minimum wage development and employment outcomes through a comparative analysis of Slovakia, the Czech Republic, and Austria. The analysis is based on an original benchmarking index of social dialogue quality, trend analysis, correlation matrices, and simple regression models. The results reveal substantial cross-country differences in the institutionalisation and effectiveness of social dialogue. While Austria exhibits a strong and systematic relationship between social dialogue quality, wage setting, and labour market stability, Slovakia and the Czech Republic display weaker and less consistent linkages. The findings suggest that the quality of social dialogue, rather than its formal existence, plays a significant role in shaping labour market outcomes.

Keywords: *social dialogue, minimum wage, employment, labour market stability, comparative analysis*

1. INTRODUCTION

Social dialogue is widely recognised as one of the fundamental pillars of the European social model and an essential mechanism for coordinating labour market relations. Through communication, consultation, and negotiation between social partners and public authorities, social dialogue contributes to the regulation of wages, working conditions, and employment relations. In the context of increasing economic uncertainty, structural change, and recurrent crises, the capacity of labour market institutions to ensure stability and predictability has gained renewed relevance. Minimum wage policy and employment levels represent two central indicators of labour market performance. Minimum wages serve both as a protective instrument for low-income workers and as a component of broader wage-setting systems, while employment levels reflect the overall capacity of the labour market to absorb labour supply. The extent to which social dialogue influences these outcomes, however, varies significantly across countries depending on institutional arrangements, collective bargaining coverage, and the degree of coordination among social partners. This article addresses the following research question: To what extent does the quality of social dialogue influence minimum wage development and employment outcomes in selected countries? Using Slovakia, the Czech Republic, and Austria as comparative cases, the article aims to assess how differences in social dialogue quality are reflected in labour market outcomes and to identify the mechanisms through which social dialogue contributes to labour market stability.

2. THEORETICAL BACKGROUND AND CONCEPTUAL FRAMEWORK

Social dialogue represents one of the fundamental pillars of the European social model and is formally enshrined in the Treaty on the Functioning of the European Union (Articles 151–156 TFEU). European institutions regard social dialogue as an indispensable instrument for promoting social justice, competitiveness, and good governance.

Within the European Union, social partners—representatives of employers and employees—are recognised as key actors who, through negotiations and consultations, participate in the formulation of European social and labour law legislation (European Parliament, 2026). The essence of social dialogue is shaped by two fundamental concepts: the social and dialogue. The term *social* refers to phenomena related to human society, social groups, and the relationships among them. It encompasses processes and interactions that arise and take place within social systems and social relations. The concept of *dialogue*, in turn, denotes communication or the exchange of information between two or more actors, the defining features of which are continuity, coherence, and mutual interaction. The resulting concept of social dialogue thus encompasses all forms of communication, consultation, negotiation, and exchange of information between social partners—employers, employees, and, where appropriate, governmental or public authorities. From a substantive perspective, social dialogue constitutes a method through which employers and employees influence economic and social processes in society, particularly by negotiating the conditions of labour relations, wage policy, occupational safety and health, and employees’ rights. A fundamental prerequisite for the effective functioning of social dialogue is the equality of the partners involved, their readiness to engage in negotiations, and a shared commitment to seeking compromise solutions to issues of broader societal interest. The modern form of European social dialogue emerged in 1985, when the President of the European Commission, Jacques Delors, initiated the so-called Val Duchesse process, which brought together the most representative organisations of employers and workers within a common framework for negotiations. This process laid the foundations for the harmonisation of labour-law standards and contributed to the adoption of major European framework agreements, notably in the areas of parental leave (1995), part-time work (1997), and fixed-term work (1999) (European Parliament, 2026). Through this initiative, Delors fundamentally shaped the subsequent direction of European social policy and earned the designation of the architect of modern “Social Europe” (Jacques Delors Institute, 2025). From a functional perspective, social dialogue represents a method of mediating interests between employers and employees within the economy and a mechanism through which the conditions governing their mutual relations are negotiated. This method operates not only at the level of individual enterprises, but also across the economy as a whole, including sectoral and cross-sectoral levels. Its primary objective is to prevent social conflicts that could disrupt economic stability and to achieve social peace, understood as a state in which conflicts are resolved through agreement and mutual respect (European Commission, 2016). Together with social partnership, social dialogue thus co-constitutes the structural foundation of the European social model, the objective of which is to ensure a balance between economic performance and social protection. As confirmed by the new Pact for Strengthening Social Dialogue in Europe adopted in 2025, the European Union considers social dialogue to be one of the key prerequisites for sustainable prosperity, social justice, and competitiveness (Europe Direct Poprad, 2025).

2.1. Social partners

Social partners constitute key actors of social dialogue and collective labour relations. They are organised entities representing the interests of employees and employers that engage in negotiation processes with the state in order to influence the formulation of social, economic, and labour policies. In accordance with the criteria of the International Labour Organization, social partners are understood to include workers’ organisations (including trade unions, confederations, and associations) and employers’ organisations with comparable structures, which act on behalf of their members in matters of common interest (ILO). In the conditions of the Slovak Republic, the institutionalisation of social partnership began to take shape in the early 1990s following the political transformation.

A significant milestone was the establishment of the Council for Economic and Social Agreement of the Slovak Republic, which emerged as a result of an agreement between the government, employers, and trade unions and served as the central tripartite body of social dialogue. Its role was to discuss key issues of economic and social development and to coordinate the interests of social partners at the macro level (Office of the Government of the Slovak Republic). At present, this function is performed by the Economic and Social Council of the Slovak Republic, which was established as a consultative and negotiating body of the Government of the Slovak Republic and social partners under the legal framework laid down by Act No. 103/2007 Coll. on Tripartite Consultation. In order for social dialogue among social partners at the state level to function effectively and predictably, it was necessary to establish a clear legislative framework governing the relationships, competences, and processes among the individual actors of social partnership. This need was addressed by the adoption of the Act on Tripartite Consultations at the National Level, which set out the legal conditions for the organisation and implementation of social dialogue. The purpose of this Act is to promote effective social dialogue between the state, employers, and employees as a means of addressing economic and social development, employment growth, and the maintenance of social peace (Act No. 103/2007 Coll.). The Act regulates tripartite consultations at the national level, within which the state and social partners, through their representatives, discuss and negotiate fundamental issues of economic and social development, including employment-related matters. The legislation explicitly states that the objective of these consultations is to reach agreement on key social and economic issues, thereby establishing a basic mechanism of participatory decision-making within tripartite relations (Act No. 103/2007 Coll.). At the same time, it defines the social partners, the conditions of representativeness, and the functioning of the Economic and Social Council of the Slovak Republic. Through this legal framework, a stable and predictable system of social dialogue is ensured, enabling social partners to actively participate in public policy-making and to contribute to social peace and the coordination of societal interests.

2.1.1. Employers

Employers constitute one of the key groups of social partners within the system of social dialogue. As actors in economic life, they represent the interests of business entities in relation to the formulation of labour-law regulations, economic and social policy, wage regulation, and broader issues concerning the functioning of the labour market. Their common objective is to promote a stable, competitive, and predictable business environment that supports employment, productivity, and economic growth. At the national level, employers are organised into associations that ensure their collective representation vis-à-vis the state and other social partners. According to the Act on Tripartite Consultation, representative employers are defined as organisations that bring together employers from several sectors of the economy, have territorial coverage in at least five regions, and represent enterprises employing a total of at least 100,000 employees (Act No. 103/2007 Coll.). These criteria are essential for ensuring the representativeness and legitimacy of employers' organisations in tripartite negotiations.

2.1.2. Employees

Employees as a social partner participate in the system of social dialogue through their representative organisations, namely trade unions and their higher organisational forms, particularly trade union federations and confederations. Under the legal framework of the Slovak Republic, trade unions constitute the primary instrument of collective employee representation and fulfil an important role in the protection of employees' labour, social, and economic rights.

Their main task is to ensure fair working conditions for employees, especially in the areas of remuneration, working time, occupational safety and health, and social security. As participants in social dialogue, trade unions are involved in decision-making processes concerning employees' rights and broader socio-economic issues at the company, sectoral, and national levels (CELSI, 2021). The legal status of trade union organisations in the Slovak Republic is regulated by the Labour Code, which defines a trade union as a civic association authorised to operate at an employer once it has notified the employer of the commencement of its activities and submitted a list of its representatives. Trade unions are entitled to conduct collective bargaining with employers, the outcome of which is the conclusion of a collective agreement. Collective agreements serve as instruments for regulating working conditions, wage and employment entitlements, and relations between employers and employees, as well as between their respective organisations. The conditions governing the establishment, registration, modification, and dissolution of trade union organisations are laid down in the general legal framework regulated by the Act on the Association of Citizens (Act No. 83/1990 Coll.).

2.2. The Impact of Social Dialogue on Employment

Social dialogue plays a significant role in shaping employment outcomes by influencing the institutional environment in which labour market decisions are made. Through structured communication, consultation, and negotiation between employers, employees, and public authorities, social dialogue contributes to the coordination of interests related to job creation, job security, working conditions, and labour market adjustment. Its impact on employment is therefore primarily indirect, operating through institutional stability, policy coordination, and conflict prevention rather than through immediate job creation mechanisms. One of the key channels through which social dialogue affects employment is labour market stability. High-quality social dialogue facilitates predictable and coordinated decision-making, which reduces uncertainty for employers and employees alike. In environments where social partners regularly engage in negotiations and reach consensual agreements, employers are more likely to plan employment levels over a longer time horizon, while employees benefit from greater job security. This contributes to smoother employment dynamics and mitigates abrupt employment fluctuations, particularly during periods of economic slowdown. Social dialogue also influences employment through its role in policy formulation and implementation. At the national and sectoral levels, social partners participate in shaping employment policies, labour-law regulations, and active labour market measures. Their involvement enhances the legitimacy and acceptance of policy measures, increasing the likelihood of effective implementation. Policies developed through social dialogue are more likely to balance flexibility and security, thereby supporting employment sustainability rather than short-term cost-cutting strategies that may lead to job losses. Another important mechanism is the contribution of social dialogue to crisis management and adjustment processes. During economic or social crises, effective social dialogue enables coordinated responses, such as negotiated working-time adjustments, temporary wage moderation, or employment retention schemes. International experience shows that countries with well-functioning social dialogue structures tend to preserve employment more effectively during crises, as social partners are able to jointly design adjustment strategies that distribute costs more evenly and prevent mass layoffs. At the same time, the impact of social dialogue on employment depends critically on its quality and institutional maturity. Where social dialogue is fragmented, irregular, or heavily dependent on political cycles, its ability to influence employment outcomes is limited. In such contexts, employment developments are driven primarily by macroeconomic conditions and political decisions, while social dialogue plays a predominantly consultative or legitimising role. This pattern is particularly evident in countries with weak collective bargaining coverage and limited sectoral coordination.

Overall, social dialogue does not act as an automatic driver of higher employment levels. Rather, it functions as a stabilising and coordinating mechanism that shapes the conditions under which employment evolves. High-quality social dialogue contributes to employment stability, reduces labour market volatility, and enhances the resilience of employment relationships, especially in times of economic uncertainty. Its effectiveness, however, is contingent upon institutional continuity, representativeness of social partners, and the capacity to translate negotiated outcomes into practice.

2.3. The Impact of Social Dialogue on Minimum Wage Development

Social dialogue plays an important role in shaping minimum wage outcomes by influencing the institutional and political processes through which wage floors are determined and adjusted. Unlike market-driven wage formation, minimum wage setting represents a regulatory intervention in the labour market, the design and legitimacy of which are strongly conditioned by the extent and quality of social dialogue between employers, employees, and the state. One of the primary channels through which social dialogue affects minimum wage development is institutional coordination. In systems where social dialogue is well institutionalised and closely linked to collective bargaining, minimum wage adjustments tend to reflect negotiated compromises between social partners, balancing income protection for workers with cost considerations for employers. Such coordination reduces the risk of abrupt or politically motivated wage changes and contributes to greater predictability of wage development. High-quality social dialogue also enhances the legitimacy and acceptance of minimum wage policies. When social partners are meaningfully involved in the decision-making process, minimum wage outcomes are more likely to be perceived as fair and economically justified. This increases compliance, reduces conflict, and limits the risk of unintended labour market effects, such as employment displacement or informalisation. In contrast, where social dialogue is weak, fragmented, or largely consultative, minimum wage development is often dominated by political decision-making rather than negotiated consensus. In such contexts, minimum wage increases may become instruments of short-term political strategy, insufficiently anchored in labour market conditions or productivity trends. As a result, the relationship between social dialogue and minimum wage development becomes unstable and less predictable. Social dialogue further influences minimum wage outcomes through its interaction with collective bargaining coverage. In countries with extensive sectoral or national collective bargaining, minimum wages often function as a supplementary safety net, while negotiated wage floors play a dominant role in wage coordination. Conversely, in systems with low collective bargaining coverage, minimum wage policy assumes a central regulatory role, increasing the importance of effective social dialogue to mitigate potential distortions. Empirical evidence from comparative analyses suggests that the impact of social dialogue on minimum wage development varies substantially across institutional contexts. In highly coordinated systems, social dialogue exhibits a strong and systematic relationship with minimum wage outcomes, contributing to wage stability and coherence. In less coordinated systems, the influence of social dialogue is weaker and more indirect, with minimum wage development shaped primarily by political and macroeconomic factors. Overall, social dialogue does not mechanically determine minimum wage levels. Rather, it functions as a mediating and stabilising mechanism that shapes how minimum wage policies are formulated, adjusted, and implemented. Its effectiveness depends on institutional maturity, representativeness of social partners, and the extent to which negotiated outcomes are translated into binding policy decisions. Strengthening the quality of social dialogue therefore represents a key condition for ensuring predictable, balanced, and socially sustainable minimum wage development.

3. JUSTIFICATION FOR THE SELECTION OF COUNTRIES FOR COMPARISON

The objective of the study is to compare relevant and practically applicable insights for the formulation of recommendations aimed at improving social partnership in the Slovak Republic. For this reason, the selection of countries was guided by the intention to combine two key requirements:

- to maximise comparability (similar geographical, economic, and regulatory framework),
- to capture different levels and modes of functioning of social dialogue (variability in the quality of social dialogue across countries).

For comparison with the Slovak Republic, two countries were selected: the Czech Republic (CZ) and Austria (AT). These countries fulfil both requirements, as they are closely connected in terms of geographical proximity and economic interdependence, while at the same time representing three distinct performance levels of social dialogue, broadly conceptualised in this study as high, medium, and weaker. The selection of countries is based on the following criteria, which enhance the methodological robustness of the comparison. Slovakia, the Czech Republic, and Austria form a Central European area characterised by intensive economic and labour-market linkages, including trade, investment flows, cross-border commuting, and labour mobility. This geographical proximity reduces the risk that observed differences in outcomes are primarily driven by geographically specific factors, such as fundamentally different economic structures or distant geopolitical conditions. It therefore allows analytical attention to be focused on the institutional configuration and quality of social dialogue. All three countries are also Member States of the European Union, which implies that they operate within the same overarching regulatory framework in the fields of labour law, social standards, and internal market rules. The EU framework establishes a common baseline of minimum standards, enabling differences to be interpreted primarily as a result of national institutions, practices, and the quality of social dialogue rather than divergent legislative philosophies. The purpose of the country selection is to capture three contrasting configurations of social dialogue within a single region. Austria represents a case in which social dialogue is traditionally regarded as highly developed, characterised by strong interest coordination, stable institutions, and a well-established culture of negotiation. The Czech Republic reflects a medium level of social dialogue development, where functional elements of tripartism and collective bargaining exist, but their intensity and reach are generally less coordinated and less systemic than in Austria. The Slovak Republic represents a case in which social dialogue is assessed as weaker, with greater fluctuations in continuity, influence, and the capacity to consistently generate consensus among social partners. Such a selection enables an examination of how differing levels of social dialogue quality are reflected in the analysed socio-economic indicators, including employment, labour mobility, and wage growth, while other contextual conditions remain relatively comparable. Methodologically, this approach corresponds to what is known in comparative research as a “most similar systems design”. The countries share many relevant characteristics (regional proximity, EU membership, economic interconnectedness), yet differ in the key dimension under investigation—the quality and effectiveness of social dialogue. This research design is particularly suitable for identifying the mechanisms through which social partnership may contribute, or fail to contribute, to socio-economic outcomes.

4. BENCHMARKING INDEX OF QUALITY OF SOCIAL DIALOGUE

The Benchmarking Index of Social Dialogue is a composite index designed to benchmark the quality of social dialogue across four groups of indicators: legislation (L), institutions (I), representativeness (R), and outcomes of social dialogue (O).

The index is constructed in a way that allows for the differentiation between a highly functional model typical of Austria, a moderately functional model observed in the Czech Republic, and a weaker model characteristic of the Slovak Republic, while remaining measurable on the basis of available data and documentary sources. After evaluating the individual dimensions of social dialogue quality through sub-indicators, the next step is the construction of a synthetic overall index of social dialogue quality. This index makes it possible to summarise a complex and multidimensional assessment into a single indicator, thereby enhancing the clarity of cross-country comparison and providing an analytical basis for the subsequent evaluation of the socio-economic impacts of social dialogue. In the literature on industrial relations and social partnership, synthetic indices are commonly used as tools for capturing differences in the quality of institutional arrangements, while emphasising the need for transparency of weights and a clear linkage between inputs and outputs (outcomes).

In this study, the Benchmarking Index of Social Dialogue (BISD) does not represent a normative evaluation of country performance, but rather an analytical instrument that enables the identification of the relative position of Slovakia vis-à-vis comparable countries, the detection of discrepancies between formal institutional prerequisites and actual outcomes, and the creation of a quantified basis for formulating recommendations aimed at improving the system of social partnership in the Slovak Republic. The inputs to the overall BISD index are the aggregated values of the sub-indices L (legislation), I (institutions), R (representativeness), and O (outcomes), calculated as the arithmetic mean of individual indicator scores on a scale from 0 to 5. For the purpose of constructing the BISD, these values are normalised by dividing them by the maximum value of 5. In determining the weights, the principle of balance between the formal prerequisites of social dialogue (legislation, institutions, representativeness) and the actual outcomes, which represent the ultimate test of system functionality, was applied. Based on this approach, the following weights were assigned: legislation 25%, institutional capacity 25%, representativeness 20%, and outcomes 30%.

The higher weight attributed to outcomes reflects the fact that the objective of social dialogue is not merely the existence of rules and institutions, but their capacity to generate stable, implemented, and socio-economically relevant results. This approach is consistent with analytical frameworks used in evaluations of social dialogue at the EU and OECD levels. The overall BISD index is calculated according to the following formula:

$$\text{BISD} = 100 \times (0.25 \times 5L + 0.25 \times 5I + 0.20 \times 5R + 0.30 \times 5O)$$

The resulting index value ranges from 0 to 100, with higher values indicating a higher quality of social dialogue.

Sub - index	Austria	Czech Republic	Slovakia
Legislation	4,50	3,00	3,33
Institutions	4,67	2,83	2,33
Representativeness	4,80	2,80	2,40
Outcomes	4,57	2,86	2,14

*Table 1: Input Values for the Measurement of BISD
(Source: Author's own calculations)*

Country	BISD
Austria	91,0
Czech Republic	57,0
Slovak Republic	50,5

Table 2: Final BISD Values
(Source: Author's own calculations)

Austria achieves a very high BISD score (91), which confirms its position as a highly coordinated and functionally advanced model of social partnership. The high score results from consistently strong values across all four dimensions, with particularly outstanding performance in the representativeness of social partners, institutional capacity, and the tangible outcomes of social dialogue. This finding supports conclusions in the literature that the Austrian model of social partnership contributes to the stability of labour relations, regulatory predictability, and social peace. The Czech Republic records a medium BISD value (57), reflecting a relatively balanced yet capacity-constrained model of social dialogue. Stronger aspects include the legislative framework and basic institutional arrangements, while weaker performance is primarily associated with the representativeness of social partners and the limited systemic impact of social dialogue outcomes. The Czech Republic thus represents a transitional model situated between highly coordinated and more weakly coordinated systems of social partnership. The Slovak Republic attains the lowest BISD value (50.5) among the compared countries. This result points to a pronounced mismatch between a relatively solid legislative framework and weaker institutional capacity, representativeness, and outcomes of social dialogue. The lowest scores in the outcomes sub-index confirm that systemic weaknesses are reflected in limited collective bargaining coverage, lower regulatory predictability, and weaker trust in social dialogue.

This conclusion is consistent with analytical findings on post-transformation models of social partnership in Central and Eastern Europe. Overall, the quality of social dialogue across the analysed countries exhibits a clear hierarchy—Austria as a highly functional and consistent model, the Czech Republic as a medium, partially coordinated model, and the Slovak Republic as a system characterised by significant capacity and performance deficits. At the same time, the results indicate that the principal difference between Slovakia and the comparison countries does not lie primarily in legislation, but rather in the ability of the social partnership system to function as an effective mechanism for the formulation and implementation of socio-economic policies. The overall BISD index therefore provides a solid analytical framework for the subsequent analysis linking the quality of social dialogue with developments in employment, labour mobility, and wage growth in the Slovak Republic, as well as for the formulation of prospective options for improving the system of social dialogue.

4. CONCLUSION

This study examined the role of social dialogue and social partnership in shaping selected labour-market outcomes, with particular attention to minimum wage development and employment, through a comparative analysis of Slovakia, the Czech Republic, and Austria. The central analytical premise was that the quality of social dialogue, rather than its formal existence, represents a key determinant of labour market stability and predictability. The results demonstrate that social dialogue in the analysed countries exhibits substantial qualitative differences, which are reflected in distinct socio-economic outcomes.

The Benchmarking Index of Social Dialogue Quality (BKSD) revealed a clear hierarchy among the three cases: Austria as a highly functional and consistently coordinated model, the Czech Republic as a medium, partially coordinated model, and the Slovak Republic as a system characterised by significant capacity and performance deficits. Importantly, these differences are not primarily rooted in legislation, as all three countries operate within a comparable EU regulatory framework, but rather in institutional capacity, representativeness of social partners, and the ability of social dialogue to generate tangible outcomes. Austria's very high BKSD score confirms the presence of a mature and deeply institutionalised system of social partnership. Strong representativeness of social partners, well-established institutions, and a long-standing culture of negotiation enable social dialogue to function as an effective mechanism of interest coordination. In this context, social dialogue is closely integrated into wage-setting processes and labour market governance, contributing to regulatory predictability, stable labour relations, and social peace. Empirical analyses support the conclusion that, in Austria, social dialogue is systematically linked to both minimum wage development and employment stability. The Czech Republic represents an intermediate configuration. While the legislative framework and basic institutional arrangements for social dialogue are in place, the overall capacity of the system remains limited. Weaker representativeness of social partners and the reduced systemic impact of negotiated outcomes constrain the ability of social dialogue to perform a fully stabilising function. As a result, social dialogue in the Czech Republic plays a more supportive and coordinative role, rather than acting as a central mechanism of labour market regulation. This is reflected in moderate BKSD values and weaker, though still observable, links between social dialogue quality and labour-market indicators. The Slovak Republic emerges as the weakest case among the compared countries. Despite a relatively solid formal framework, social dialogue is marked by fragmented collective bargaining, lower representativeness of social partners, and limited outcome effectiveness. The lowest scores in the outcomes dimension of BKSD indicate that systemic weaknesses translate into restricted collective bargaining coverage, lower regulatory predictability, and weaker trust in social dialogue. Empirical findings further suggest that developments in minimum wage and employment in Slovakia are driven predominantly by political and macroeconomic factors, with social dialogue playing a largely consultative or legitimising role rather than functioning as a genuine co-regulatory mechanism. Across all three cases, the analysis confirms that social dialogue does not automatically lead to higher employment or faster wage growth. Its contribution lies primarily in its stabilising and coordinating function. High-quality social dialogue reduces labour-market volatility, facilitates negotiated adjustment to economic change, and enhances the legitimacy and sustainability of policy decisions. Conversely, where social dialogue lacks continuity, institutional strength, and outcome orientation, its capacity to influence labour-market developments remains limited. The comparative design, based on a "most similar systems" approach, allowed the identification of mechanisms through which social dialogue contributes—or fails to contribute—to socio-economic outcomes under otherwise comparable conditions. The findings underline that the decisive factor is not the presence of social dialogue institutions per se, but their institutional maturity, representativeness, continuity, and ability to translate negotiations into implemented results. Overall, the conclusions point to the need for a qualitative strengthening of social dialogue, particularly in countries with weaker systems of social partnership. Enhancing sectoral collective bargaining, reinforcing institutional capacities, stabilising social dialogue beyond political cycles, and increasing the real impact of negotiated outcomes emerge as key conditions for improving labour-market stability. In this sense, social dialogue should be understood not as a symbolic or purely consultative process, but as a strategic governance mechanism capable of shaping socio-economic development in a predictable, coordinated, and socially sustainable manner.

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RATIONAL EXPECTATIONS THEORY AND THE TERM STRUCTURE OF TREASURY BONDS IN MOROCCO

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ABSTRACT

This study focuses on analyzing the validity of the expectations theory in Morocco by examining the influence of short-term interest rates on long-term bond yields. In theory, the relationship between short-term interest rates and long-term yields is supposed to reflect market expectations of future rates, in line with expectations theory. Two econometric models were used to test this theory. The first model explores the relationship between expected changes in long-term yields and the slope of the yield curve. The second model examines the relationship between the expected average variation in future short rates and the slope of the yield curve. The data used covers the period from 2007 to 2024. The results reveal the limited validity of the expectations theory in the Moroccan context. In particular, the coefficients associated with changes in long-term rates do not always corroborate theoretical predictions, suggesting that other economic factors may also influence bond yields. This study highlights the importance of considering additional approaches for a better understanding of interest rate dynamics in Morocco.

Keywords: *Rational expectations theory, Term structure of interest rates, Yield curve spread*

1. INTRODUCTION

The theory of rational expectations is a central assumption in economics, according to which economic agents use all available information to form expectations about future economic variables. This theory has important implications for interest rate dynamics, as the slope of the yield curve is often used as an indicator of market expectations about future rates and economic activity. The study of the term structure of interest rates plays an essential role in the analysis of financial markets, as it offers insights into how long-term bond yields are determined by expectations of future interest rates and risk premia. Expectations theory, developed by Fama (1984) and enriched by Campbell and Shiller (1987, 1988, 1991), suggests that long-term bond yields are essentially averages of expected short-term yields, adjusted by risk premiums. This theory is based on two main assumptions: firstly, that future short-term bond yields influence long-term bond yields, and secondly, that risk premiums, although unobservable, remain constant over time. Previous research has shown that, although expectations theory provides a sound basis for understanding the structure of rates, its validity can vary according to economic conditions and the specific characteristics of financial markets. Shiller (1990) and Fama and Bliss (1987) revealed that variations in the slope of the yield curve can often be explained by expectations of future rates, but the results may be sensitive to periods of economic volatility or local market peculiarities.

In particular, studies such as those by Campbell and Shiller (1991) have highlighted discrepancies between theoretical forecasts and empirical data in certain economic contexts. In this context, the study of the term structure of interest rates in Morocco provides a relevant opportunity to assess the validity of the expectations theory within an emerging economic environment. The behavior of the yield curve is shaped by monetary conditions, the structure of the financial market, and national macroeconomic dynamics, all of which may influence the empirical relevance of theoretical predictions. This analysis aims to test the two main theoretical representations of the term structure: on the one hand, the relationship between the expected change in long-term yields and the slope of the curve, and on the other hand, the average expected change in future short-term rates and the slope of the curve. By examining these aspects, we aim to determine whether expectations theory applies to the Moroccan market, and to understand the implications for economic decision-makers and investors. Our study also examines the effectiveness of the yield curve and expected rate changes in forecasting economic developments in Morocco over the period 2007-2024 by formulating our research problem as follows:

To what extent does the expectations theory succeed in explaining the relationship between the slope of the Moroccan Treasury yield curve and the future evolution of Treasury bond yields?

To address this issue, we first propose a review of the theoretical and empirical literature, examining the conceptual foundations of the yield curve and rational expectations theory. This is followed by a description of the theoretical models used for this study, detailing selected variables such as zero-coupon interest rates at different maturities, the slope of the yield curve, and expected changes in long and short rates. We then present the results of our study, based on econometric estimates, and discuss their implications for the validity of rational expectations theory in the Moroccan context.

2. LITERATURE REVIEW AND DEVELOPMENT OF HYPOTHESES

Theoretical literature review

Several key economists influenced pioneering work on forecasting future interest rates from the slope of the yield curve, under the aegis of rational expectations theory. Firstly, Fisher (1930) was one of the first to study the relationship between long-term interest rates and expected short-term rates. He proposed that long-term interest rates are essentially averages of expected future short-term rates, with a term premium added to compensate for the risk of longer maturities. This idea was fundamental to the development of rational expectations theory applied to interest rates, establishing an essential theoretical framework for subsequent research in this field. Next, Hicks (1939) further developed interest rate theory, asserting that the yield curve reflects market expectations of future rates. According to Hicks, a rising yield curve suggests that investors expect short-term interest rates to rise, while a falling curve indicates an expectation that future rates will fall. The term structure of interest rates is central to modern finance, and according to Hicks, long-term rates can be interpreted as a weighted average of expectations of future short-term rates. This theory highlights the fact that investors form their expectations efficiently by integrating all available information, which influences the term structure of interest rates. As a result, the theory of rational expectations, formalized by Muth (1961), has become a central pillar of economic and financial analysis. This theory postulates that economic agents make optimal use of all available information to form their expectations about future economic variables. This theoretical framework is widely applied to the study of interest rates and the yield curve, serving as a foundation for more recent work in this field. In addition, Modigliani and Sutch (1966) made a significant contribution with the introduction of models of market segmentation and liquidity preferences.

They argued that the yield curve is influenced not only by expectations of future rates, but also by investors' preferences for assets of different maturities. This perspective has enriched our understanding of the determinants of the yield curve by integrating investor behavior into the analysis. To continue the evolution of ideas on interest rates, Lucas (1972) and Sargent (1978) modernized these concepts by integrating rational expectations into macroeconomic models to analyze interest rate dynamics. Lucas emphasized that economic agents do not simply extrapolate past trends, but use complex models to forecast future monetary policies and their impact on interest rates. Their work has formalized the relationship between expectations of future interest rates and the structure of the yield curve, consolidating the theoretical foundations previously established. In conclusion, this in-depth review of the theoretical literature on the term structure of interest rates shows how conceptual models and underlying economic theories enrich our understanding of the complex dynamics of financial markets. These theories continue to provide an essential framework for interpreting interest rate variations and anticipating future economic trends, offering valuable insights for researchers, policymakers, and financial practitioners alike.

Review of empirical literature

The prediction of future interest rates by the slope of the yield curve, under the aegis of rational expectations theory, has attracted considerable interest in the economic and financial literature. In this section, we review the major empirical contributions in this field, highlighting studies that have tested the validity of this relationship in various economic contexts. To further understand the limitations of expectations models, Shiller (1979) studied expectations models of the term structure and found that real long-rate series differ significantly from rational ex-post series, calling into question the validity of linearized expectations models. In particular, he pointed out that these models show certain limitations in their ability to fully capture long-term interest rate dynamics. His results indicate that long rates are too volatile to be explained by rational expectations models, suggesting the existence of unanticipated transitory effects that disrupt long rates. To test these expectations, Shiller (1979) used inequalities derived from the linearization of the models and found that the standard deviations of real long rates often violate these inequalities, indicating excessive volatility. In this vein, Fama (1984) brought an empirical dimension to the subject by testing the hypothesis that forward spreads contain all the information needed to predict future movements in short-term interest rates. Although the theory was partially validated, Fama (1984) also found that variable risk premiums play a significant role. In addition, Campbell and Shiller (1987) introduced a significant innovation by using cointegrated process theory to test a present value model of interest rates. They demonstrated that if the present value model is correct, a linear combination of variables must be stationary. Applying a VAR model, they compared unrestricted optimal forecasts with the model's restricted forecasts to assess its accuracy. Their results revealed that, although the models could be statistically rejected for both stocks and bonds, the differential between long-term and short-term interest rates approximated the present value of expected short-term interest rate changes quite well. Moreover, they observed that deviations from the present-value model for bonds are less persistent than those for equities, underlining the challenges and limitations of rational expectations models in explaining long-term interest rate dynamics. Following these advances, econometric models have formalized and empirically explored this theory. For example, Nelson and Siegel (1987) introduced a flexible framework for parameterizing the yield curve, capturing variations in the levels and slopes of rates at different maturities. This model has been widely used to estimate and interpret market expectations, and to analyze the implications for portfolio and risk management strategies. Complementing this work, Shiller and McCulloch (1990) highlighted advances in the theoretical understanding of the term structure of interest rates, while also noting the limitations of current models.

They observed that, although existing theoretical models offer important insights, they still fail to fully account for empirical observations. In particular, time-varying term premiums remain poorly understood, and existing models fail to provide consistent forecasts of their evolution. In addition, they pointed out that the majority of bonds are held by institutions rather than representative consumers, which complicates the application of theoretical models based on consumption utility. Consequently, Shiller and McCulloch (1990) called for further research to better understand the dynamics of term premiums and their relationship with other economic variables. Building on these thoughts, Campbell and Shiller (1991) proposed more rigorous tests of rational expectations theory by examining the relationship between short-term and long-term interest rates. They found that, while long rates incorporate information about expectations of future short rates, rate differentials also reflect changing risk premiums. This complexity adds a further dimension to the simple relationship expected by rational expectations theory. Similarly, Fama and Bliss (1987) examined term premiums and their relationship with business cycles. Their study showed that expected one-year returns for maturities of up to five years vary with the business cycle, being generally positive in good times and negative in bad. They concluded that forward rates have a limited ability to forecast short-term variations in interest rates, but this ability improves for longer forecast horizons, suggesting a slow mean reversion of interest rates. This observation suggests that term premiums partly reflect investors' expectations of future economic conditions and that their behavior can be modeled as a function of the business cycle. Following this work, Fama (1990) extended previous research on the information contained in the structure of long-term rates by including countries other than the United States. The results obtained are similar to those for the United States, especially for long maturities. However, the ability to forecast changes in one-year interest rates is slightly weaker, with significant forecasting ability observed only at the five-year horizon. These results indicate a partial consistency of rational expectations models on an international scale, while highlighting the persistent challenges in accurately forecasting short-term interest rates. Continuing this line of thought, Campbell and Shiller (1991) argue that arbitrage models can explain how credit spreads (SPREADs) reflect economic agents' expectations of future short-term interest rates. According to arbitrage theory, investors arbitrage between short-term and long-term bonds based on their expectations of future interest rates and inflation. This leads to a relationship between the slope of the yield curve and expectations of economic growth. Examining this relationship, Campbell and Shiller (1991) analyze how yield curve spreads can predict future interest rate movements. Their study points out that yield curve inversions can serve as early indicators of economic recessions. Complementarily, Jondeau and Ricart (1997) studied the predictive power of the slope of interest rates in France over the period 1980–1995. They find that, although the overall information content is low, some slopes have notable predictive power for specific horizons. For example, slopes relative to the two-year rate contain information on the future evolution of short rates, while slopes relative to the three-year rate provide indications of the future evolution of short and long rates. In addition, some slopes (such as those between 2 and 1 year, and between 5 and 1 year) show predictive power on future inflation.

Hypothesis development

To assess the validity of expectations theory on the Moroccan sovereign bond market, it is crucial to define clear and testable hypotheses. These hypotheses, based on the fundamental principles of expectations theory, will enable us to examine the application of this theory in the Moroccan context. We therefore propose the following hypotheses:

H1: the slope of the yield curve reflects expectations of changes in long-term interest rates.

The first hypothesis concerns the relationship between long-term yields and the slope of the yield curve. According to expectations theory, the bond yield curve, and in particular the spreads between short- and long-term yields, should provide some indication of anticipated changes in long-term interest rates. This assumption is based on the idea that the variation in long-term yields can be explained by the difference between short-term yields, taking into account the risk premium. In practice, this means that the yield curve, representing the yields of different securities as a function of their duration, should reflect market expectations of future interest rate variations.

H2: the slope of rates reflects anticipated changes in short-term rates.

The second hypothesis examines the relationship between the expected average change in short-term interest rates and the slope of the yield curve. According to this hypothesis, expected changes in short-term interest rates should be proportional to the slope of the yield curve. In other words, the expected change in short-term rates should follow a predictable pattern based on the current yield curve. This suggests that forecasts of future short-term rates are largely a function of the current slope of the yield curve, and that any deviation from this relationship can be attributed to additional factors such as anticipation errors or variations in risk premiums. In summary, the hypotheses tested provide an insight into the validity of expectations theory in Morocco, and enable us to determine the extent to which forecasts of short rates and the yield curve influence long-term bond yields. These hypotheses will be tested by comparing observed yields and expected variations with theoretical expectations. The success of this comparison will enable us to verify whether the yield curve can indeed serve as a reliable indicator of future economic expectations, and how variations in short-term rates fit into the forecast of long-term yields. In the event of a significant deviation, this could indicate that factors other than expected yields are influencing long-term yields, suggesting the presence of specific risk premiums or other contextual elements specific to the Moroccan market.

3. RESEARCH METHODOLOGY***Theoretical model***

The return on a long-term security (*maturity* n) can be broken down into two parts: the average of the returns expected at date t from successive investments, made in $t, t + m, \dots, t + n - m$, in short-term securities (*maturity* m), and an unobservable risk premium (called the capitalization premium), noted $c_t^{(m,n)}$.

This equation can be expressed as follows¹:

$$i_t^{(n)} = E_t h_t^{(m,n)} + c_t^{(m,n)} \quad (1)$$

where $i_t^{(n)}$ represents the yield at date t on a security with maturity n ; $h_t^{(m,n)} = \frac{m}{n} \sum_{k=0}^{\frac{n}{m}-1} i_{t+km}^{(m)}$ is the return on capitalization, i.e. the average of the returns on successive investments made in $t, t + m, \dots$, and $t + n - m$, in securities with maturity m ; $\frac{n}{m}$ is assumed to be an integer.

We restrict ourselves here to the case of zero-coupon bonds, due to the data used for the empirical application.

¹This equation, originally proposed by Shiller (1979), is in fact a linear approximation of the non-linear relationship of no arbitrage opportunity between a short and a long investment. Shiller et alii (1983) showed that the approximation error is small enough to be neglected in practical applications.

A second risk premium, called the carry premium and denoted $\varphi_t^{(m,n)}$, is defined by the following equality:

$$E_t h_t^{(m,n)} = i_t^{(m)} + \varphi_t^{(m,n)} \quad (2)$$

where $h_t^{(m,n)} = (ni_t^{(n)} - (n-m)i_{t+m}^{(n-m)})/m$ represents the carry yield, i.e. the yield obtained by buying a security of maturity n in t and reselling it in $t+m$, where $(m < n)$. The relationship between the slope of rates and future interest rates is generally approached from the angle of term structure expectations theory. This theory has been extensively studied by researchers such as Campbell and Shiller (1987, 1988, 1991), Shiller (1990), Fama (1984), and Fama and Bliss (1987). Based on the joint hypothesis of the absence of arbitrage opportunities² and the rationality of the expectations³, this theory assumes that capitalization and carry premiums must remain constant over time, although they may vary according to maturities m et n : $c_t^{(m,n)} = c^{(m,n)}$, $\varphi_t^{(m,n)} = \varphi^{(m,n)}$, $\forall t$.

An extensive literature has examined the implications of expectations theory. Campbell and Shiller (1987, 1988, 1991) proposed formulations derived directly from equations (1) and (2), using the slope of rates as the regressor⁴.

The first representation is based on the relationship between the expected variation over m periods in the yield on a long-term security and the slope of rates. This relationship is obtained by rearranging the terms of equation (2):

$$\frac{n-m}{m} (i_{t+m}^{(n-m)} - i_t^{(n)}) = \alpha_1 + \beta_1 S_t^{(m,n)} + \varepsilon_{1,t+m}^{(n-m)} \quad (3)$$

where: $S_t^{(m,n)} = i_t^{(n)} - i_t^{(m)}$ is the slope in t between rates at n and m periods.

To simplify notation, the indices for maturities m and n are omitted, although they are theoretically present. Expectation theory stipulates that the parameters associated with maturities m and n must verify: $\alpha_1 = \varphi^{(m,n)}$, $\beta_1 = 1$.

The second representation is based on the relationship between the expected long-term average variation in future short rates and the slope of rates. It is obtained by subtracting the current short rate $i_t^{(m)}$ from both members of equation (1):

$$S_t^{*(m,n)} \equiv h_t^{(m,n)} - i_t^{(m)} = \alpha_2 + \beta_2 S_t^{(m,n)} + \varepsilon_{2,t+n-m}^{(m)} \quad (4)$$

In this equation, $S_t^{*(m,n)}$ represents the average variation in future short rates between periods t and $t+n$. The residual term $\varepsilon_{1,t+m}^{(n-m)}$ is interpreted as the ex-post excess return of an n -period security, bought in t and resold after m periods, compared with an m -period investment. This residual is made up of two elements: the anticipation error and a potentially variable component of the carry premium.

² The absence of arbitrage opportunities is a key assumption, stipulating that investors cannot make risk-free profits by exploiting price differences between securities with different maturities.

³ Investors' expectations are assumed to be rational, meaning that they integrate all available information efficiently and reflect future economic prospects impartially.

⁴ Other formulations have also been studied, notably based on the forward rate (Fama, 1984, 1990; Fama & Bliss, 1987).

As the data overlap, the residual term has a priori, even when expectations are rational, a moving average component MA of order $(m - 1)$, if m is expressed in months⁵. In a similar way, $\varepsilon_{2,t+n-m}^{(m)}$ is defined as the ex-post excess return of an n -period investment over a series of successive investments in securities of maturity m over period n . This term includes an MA (moving average) component of order $(n - m - 1)$.

Variables and data

To assess the validity of the rational expectations theory of the term structure of interest rates, it is first necessary to present the variables of the models studied.

Note that the data were collected from official financial reports published by Bank Al-Maghrib and the High Commission for Planning, covering the period from January 2007 to April 2024 on a monthly basis. **Zero-coupon interest rates** correspond to Treasury bill yields for various maturities and eliminate the effects of coupon reinvestment, providing a more accurate measure of yields over a given period. Their use is widely supported in the academic literature, notably by Fabozzi (2007), who points out that zero-coupon rates correct for desynchronization due to different coupon payment patterns, providing a purer measure of expectations of future interest rates. In addition, Campbell and Shiller (1991) show that these rates provide a more solid basis for testing the hypotheses of rational expectations theory. Furthermore, Fama (1984) argues that the analysis of zero-coupon rates can reveal crucial information about investors' risk premiums and expectations, which are often masked in conventional coupon bond yields.

Calculating intermediate maturities

Intermediate maturities are estimated using linear interpolation⁶, a simple technique widely used when no direct data are available for these periods (Fama, 1984). This method is chosen for its robustness and ease of application in the context of our study. It is expressed as follows:

$$y = y_1 + \left(\frac{y_2 - y_1}{x_2 - x_1} \right) \times (x - x_1)$$

Calculation of zero-coupon rates

Having calculated the intermediate T-Bill rates, we now proceed to convert them into zero-coupon rates using the iterative conversion method. This method is widely recognized and used in the financial literature, notably by Ingersoll and Ross (1985), who applied this technique to estimate zero-coupon rates from observed yields as part of their term-structure model of interest rates. Hull (2018) and Sundaresan (2009) also describe similar methods for constructing zero-coupon yield curves. The iterative formula used for this conversion is:

$$z_t = \left(\frac{((1+Y_t)^t)}{\prod_{i=1}^{t-1} (1+z_i)} \right) - 1$$

where Y_t represents the observed rate of return for a treasury bill of maturity t and z_i are the zero-coupon rates for previous maturities.

⁵ The expectations error concerns the forecast in t of a rate observed in $t + m$. So, as soon as $m > 2$, the forecasts made in t and $t + 1$ for $t + m$ and $t + m + 1$ are based on partially common information. Even if expectations theory is valid and expectations are rational, this overlapping phenomenon is the source of a moving-average component in the process followed by the residual.

⁶ This method is based on the assumption that variations between available maturity rates are linear, allowing for a simple and effective estimation of missing rates.

This approach allows each zero-coupon rate⁷ to be calculated based on observed yields and previously calculated zero-coupon rates. Compared to other estimation methods, it stands out for its simplicity and robustness, making it the preferred choice for many practical applications, including in our case.

For the Slope of the Yield Curve $S_t^{(m,n)}$ reflects the comparison of long-term rates with short-term rates and is used to assess market expectations, showing how investors perceive the future evolution of interest rates as a function of duration. A positive slope indicates that long-term rates are higher than short-term rates, often interpreted as an expectation that future rates will rise. It is calculated as the difference between long-term and short-term interest rates, i.e.

$$S_t^{(m,n)} = i_t^{(n)} - i_t^{(m)}.$$

The capitalization return, $h_t^{(m,n)}$, represents the average expected return at date t on successive investments in short-term securities with a maturity of m periods, over a total period of n periods. By decomposing the total return into its short-term components, this variable makes it possible to assess the contribution of short-term returns to the overall return over an extended period. It plays a central role in testing the hypotheses of rational expectations theory, by providing a point of comparison between long-term returns and expected returns on short-term securities.

For Portage Yield, which is denoted $h_t^{(m,n)}$, it measures the difference between the return that would have been obtained by holding the long-term security for its entire duration, and that obtained by selling it after m periods, and buying another security with a shorter maturity. This variable makes it possible to determine the profitability of an investment strategy consisting of holding a long-term security against the possibility of reinvesting in short-term securities during the holding period. By highlighting the yield differentials between long-term and short-term securities, the carry yield makes it possible to assess market expectations and the associated risk premiums.

Whereas the Long Rate Variation measures the change in yields on long-term securities over a given period. In other words, it corresponds to the expected change in long-term interest rates between time t and $t + m$, and is used to assess expectations of future rates. It is represented by the difference between observed yields on long-term securities at two different points in time. Mathematically, it is often expressed as follows:

$$\text{Change in long rates} = i_{t+m}^{(n-m)} - i_t^{(n)}$$

where $i_t^{(n)}$ is the yield on a long-term security with maturity n at date t , and $i_{t+m}^{(n-m)}$ is the yield on a long-term security with maturity $n - m$ at date $t + m$. This variable is crucial for assessing how yields on long-term securities vary over time, and for testing investors' expectations of future interest rates.

⁷ It should be noted that the use of zero-coupon rates allows researchers to avoid the biases introduced by coupons and thus obtain a clearer picture of investors' expectations regarding future interest rates. This makes it possible to test the assumptions of rational expectations theory more reliably by comparing the difference between observed zero-coupon rates and expected future interest rates, in line with the theory.

Finally, **the Expected Change in Short-Term Rates** reflects the expected evolution of yields on short-term securities over a future period. This variable is used to assess how short-term interest rate forecasts relate to future economic conditions. It is calculated by subtracting the current short-term interest rate from the average of expected short-term rates for that period.

The formula is written as follows:

$$S_t^{*(m,n)} \equiv h_t^{(m,n)} - i_t^{(m)}$$

where $h_t^{(m,n)}$ is the capitalization yield, i.e. the average of short-term securities yields over the period t to $t + n - m$, and $i_t^{(m)}$ is the short-term interest rate at date t . This variable is essential for comparing observed short-term interest rates with those expected over a given period, providing a view of the market's future interest rate expectations.

Econometric specification of the model

Characterization and preliminary testing of the econometric model

In this study, we examine the validity of the expectations theory in the Moroccan context by employing two formulations of the relationship between the yield curve slope and expectations of future Treasury bill rates. These two approaches are designed to evaluate whether the slope of the yield curve can serve as a reliable predictor of future interest rate movements. Prior to the econometric estimation, preliminary analyses were carried out to assess the statistical properties of the series. Stationarity tests, conducted using the Augmented Dickey-Fuller (ADF) method across different maturity pairs, allowed us to determine the nature of the data-generating processes for the selected variables. The results of these tests are summarized in the table below.

Long-term rate variation					SPREAD variable				
	Exog	Lags	Stat	Integration		Exog	Lags	Stat	Integration
LTRV (1,2)	C	0	-3,55***	I(0)	SPD (1,2)	C	0	-3,38**	I(0)
LTRV (1,3)	C	0	-2,81*	I(1)	SPD (1,3)	C	0	-4,08***	I(0)
LTRV (1,4)	C	0	-3,78***	I(0)	SPD (1,4)	C	0	-2,65*	I(1)
LTRV (1,5)	C	0	-3,78***	I(0)	SPD (1,5)	C	0	-2,65*	I(1)
LTRV (1,6)	C	0	-3,49**	I(0)	SPD (1,6)	C	0	-2,85*	I(1)
LTRV (2,3)	C	0	-2,93***	I(0)	SPD (2,3)	C	0	-4,63***	I(0)
LTRV (2,4)	C	0	-2,50	I(1)	SPD (2,4)	C	0	-4,08***	I(0)
LTRV (2,5)	C	0	-3,23**	I(0)	SPD (2,5)	C	0	-3,39**	I(0)
LTRV (2,6)	C	1	-3,52**	I(0)	SPD (2,6)	C	0	-4,36***	I(0)
LTRV (3,4)	C	0	-2,57	I(1)	SPD (3,4)	C	0	-3,37**	I(0)
LTRV (3,5)	C	0	-2,15	I(1)	SPD (3,5)	C	0	-3,03**	I(0)
LTRV (3,6)	C	0	-2,85*	I(1)	SPD (3,6)	C	0	-3,15**	I(0)

Table 1. Level of integration of variables in the first representation

(Source: calculated by the authors.)

Notes: *, ** and *** represent significance at 10%, 5% and 1%.

ADF: Augmented Dickey-Fuller test (H0=non-stationarity).

KPSS: Kwiatkowski, Phillips, Schmidt, and Shin test (H0=stationarity).

Exogenous: this is the model adopted: c=with constant and without trend.

Stat: *rejection of H0 at 10%, **rejection at 5%, ***rejection at 1%.

Analysis of the results of this initial representation shows that the variable relating to the Long-Term Rate Variation (LTRV) is stationary at level in seven out of twelve cases, suggesting partial temporal stability of this series according to the maturities considered.

On the other hand, the remaining five maturity pairs show non-stationarity at level, thus classifying them as first-order integrated series, denoted I(1). The results are similar for the SPREAD variable: nine out of twelve pairs are stationary, while only three are first-order integrated. This heterogeneity in the results reflects the fact that some variables are stationary in level, while others only become so after initial differentiation. For the second representation, the application of the ADF test also confirms the heterogeneity of integration orders within the series analyzed. The detailed results, presented in the table below, highlight the coexistence of stationary series at level I(0) and first-order integrated series I(1).

Expected Short-Term Rate Variation					SPREAD Variable				
	Exog	Lags	Stat	Integration		Exog	Lags	Stat	Integration
ESRV (1,2)	C	0	-4,92***	I(0)	SPD (1,2)	C	0	-3,38**	I(0)
ESRV (1,3)	C	0	-2,09	I(1)	SPD (1,3)	C	0	-4,08***	I(0)
ESRV (1,4)	C	0	-1,47	I(1)	SPD (1,4)	C	0	-2,65*	I(1)
ESRV (1,5)	C	0	-1,20	I(1)	SPD (1,5)	C	0	-2,65*	I(1)
ESRV (1,6)	C	0	-0,94	I(1)	SPD (1,6)	C	0	-2,85*	I(1)
ESRV (2,3)	C	0	-0,48	I(1)	SPD (2,3)	C	0	-4,63***	I(0)
ESRV (2,4)	C	2	-2,27	I(1)	SPD (2,4)	C	0	-4,08***	I(0)
ESRV (2,5)	C	0	-3,26**	I(0)	SPD (2,5)	C	0	-3,39**	I(0)
ESRV (2,6)	C	0	-1,55	I(1)	SPD (2,6)	C	0	-4,36***	I(0)
ESRV (3,4)	C	0	-0,56	I(1)	SPD (3,4)	C	0	-3,37**	I(0)
ESRV (3,5)	C	0	-0,56	I(1)	SPD (3,5)	C	0	-3,03**	I(0)
ESRV (3,6)	C	0	-2,61*	I(1)	SPD (3,6)	C	0	-3,15**	I(0)

Table 2. Level of integration of variables in the second representation

(Source: calculated by the authors.)

Notes: *, ** and *** represent significance at 10%, 5% and 1%.

ADF: Augmented Dickey-Fuller test (H0=non-stationarity).

KPSS: Kwiatkowski, Phillips, Schmidt, and Shin test (H0=stationarity).

Exogenous: this is the model adopted: c=with constant and without trend.

Stat: *rejection of H0 at 10%, **rejection at 5%, ***rejection at 1%.

With regard to the ESRV variable, only two maturity pairs, namely (1,2) and (2,5), are stationary in level. In contrast, the other ten pairs are non-stationary in level, which means that they are integrated of order one, I(1). For the SPREAD variable, most of the maturity pairs analyzed are zero-order integrated, I(0), reflecting stationarity in level. Only three combinations, namely (1,4), (1,5), and (1,6), show first-order integration, I(1). These results highlight a mixed configuration, characterized by the coexistence of stationary “I(0)” series and non-stationary integrated order one “I(1)” series, with no series being integrated order two, I(2).

Explanation of the chosen estimation method

In this study, the ARDL model was chosen as the estimation method due to the mixed integration structure observed among the variables analyzed. Indeed, unit root tests reveal that some series are stationary in level, I(0), while others only become stationary after differentiation, I(1), with none being integrated of a higher order, I(2). This characteristic makes the ARDL model particularly suitable, as it allows variables of different levels to be combined in the same specification, while simultaneously capturing short-term dynamics and long-term equilibrium relationships. Thus, the ARDL model is used for the two representations studied. The first, based on the relationship between the expected change in the long-term rate at horizon m and the slope of the yield curve, can be specified as follows:

$$\frac{n-m}{m} \left(i_{t+m}^{(n-m)} - i_t^{(n)} \right) = \alpha_0 + \sum_{i=1}^p \alpha_i \left[\frac{n-m}{m} \left(i_{t+m}^{(n-m)} - i_t^{(n)} \right) \right] + \sum_{j=0}^q \beta_j S_{t-j}^{(m,n)} + \varepsilon_t \quad (5)$$

The second representation, based on the anticipated average variation in future short-term rates and the slope of the yield curve, is formulated as follows:

$$S_t^{*(m,n)} = \alpha_0 + \sum_{i=1}^p \alpha_i S_{t-i}^{*(m,n)} + \sum_{j=0}^q \beta_j S_{t-j}^{(m,n)} + \varepsilon_t \quad (6)$$

The estimation using the ARDL approach requires the fulfillment of several criteria. The first step involves testing the stationarity of the variables to ensure their suitability for this model. Unit root tests confirm that all series are either stationary in levels, I(0), or become stationary after first differencing, I(1), with no variables integrated of order two, I(2), thereby fully justifying the use of this technique. Once this condition is verified, the next step is to specify an ARDL model for each maturity pair, selecting the optimal number of lags for both the dependent and explanatory variables.

This step is crucial to adequately capture the temporal dynamics of each series and to avoid under- or over-specification of the model. Subsequently, a Bounds Test for cointegration is applied to each maturity pair to assess the existence of a stable and significant long-term relationship between the SPREAD and expected interest rates. This test determines whether the variables move together in the long run despite their individual dynamics, thereby confirming the presence of an underlying economic equilibrium between the yield curve slope and future rate expectations. If the cointegration test indicates a significant long-term relationship, it suggests that the slope of the yield curve incorporates a long-term informational component capable of explaining future interest rate movements.

In this case, the analysis can focus solely on the long-term coefficient of the SPREAD, without requiring a short-term error correction model (ECM), since the primary objective is to evaluate the long-term relationship. Conversely, if no cointegration relationship is found, the long-term equilibrium is rejected. The analysis should then be limited to interpreting only the short-term coefficients, which allows testing whether short-term variations in the SPREAD significantly impact expectations of future rates over a limited horizon.

4. RESULTS

Estimation and statistical validation of the equation

The implementation of the ARDL model estimation procedure, as described above, including the selection of optimal lags and cointegration tests, is presented in the results table below.

Pair (m,n)	ARDL order (p,q)	Bounds Test	Short-Term Coefficient	Long-Term Coefficient	Conclusion R.E. Theory
(1,2)	(1,0)	10,91765		-1,07***	NO
(1,3)	(1,0)	4,863166		-2,53**	NO
(1,4)	(1,0)	9,53		-2,28***	NO
(1,5)	(1,0)	8,34		-2,04***	NO
(1,6)	(1,0)	5,48		-2,72	NO
(2,3)	(3,3)	2,7	-0,20*		NO
(2,4)	(2,0)	4,96		-1,45**	NO
(2,5)	(2,0)	7,63		-1,73***	NO

(2,6)	(2,0)	6,73	-2,15**	NO
(3,4)	(1,0)	4,38	-0,62**	NO
(3,5)	(2,2)	3,64	-0,37*	NO
(3,6)	(1,1)	2,61	-0,95***	NO

Table 3. Forecasting future long-term interest rates based by the SPREAD between Treasury bonds rates

(Source: calculated by the authors.)

Notes: *, ** and *** represent significance at 10%, 5% and 1%.

The empirical results show that, out of the twelve maturity pairs analyzed, nine exhibit an F statistic from the cointegration test above the 5 percent critical upper bound, confirming the existence of a stable long term relationship between the SPREAD of Treasury bonds and the anticipated long term yield variation. Only two pairs, (2,3) and (3,6), fall below the lower bound, indicating the absence of cointegration, while the pair (3,5) lies within the inconclusive zone. However, the presence of cointegration alone is not sufficient to validate the Expectations Theory. For empirical approval, the long term coefficient linking the SPREAD to anticipated long term yield changes should equal 1. The results indicate that, even for maturity pairs with confirmed cointegration, the estimated long term coefficients significantly deviate from this theoretical value. Regarding the short term coefficients, although they are statistically significant, their deviations from the expected theoretical values further suggest the absence of a fully consistent relationship with the rational expectations theory. Diagnostic tests conducted on these models, particularly those for heteroskedasticity and autocorrelation of residuals, confirm the robustness and reliability of the estimates. The absence of major issues ensures that the results are statistically sound, the model specifications are appropriate, and classical regression assumptions are largely satisfied. This strengthens the credibility of the inferences and reinforces the validity of the econometric conclusions. As discussed in the theoretical model section, the Expectations Theory applied to the yield curve relies on two key conditions. The first, already examined, requires that the coefficient linking the yield curve SPREAD to anticipated long term yield changes equals 1. The estimated coefficients significantly deviate from this theoretical value, invalidating the first condition and consequently calling the credibility of the theory into question in the studied context. In this case, testing the second condition, which requires that the regression constant α_1 equals the carry premium $\varphi^{(m,n)}$, becomes unnecessary, as the rejection of the first condition alone is sufficient to refute the rational expectations theory. For the second representation, the analysis focuses on the relationship between the expected average change in future short term rates over an extended period and the yield curve slope. This approach examines how investors anticipate the average evolution of short-term rates over a prolonged horizon.

Pair (m,n)	ARDL order (p,q)	Bounds Test	Short-Term Coefficient	Long-Term Coefficient	Conclusion R.E. Theory
(1,2)	(1,0)	8,23		-0,01	NO
(1,3)	(1,0)	3,3	-0,10		NO
(1,4)	(1,0)	2,13	0,16		NO
(1,5)	(1,0)	1,39	0,13		NO
(1,6)	(1,0)	0,9	0,006		NO
(2,3)	(3,3)	0,22	0,17***		NO
(2,4)	(2,0)	2,65	-0,12		NO
(2,5)	(2,0)	2,78	-0,12		NO
(2,6)	(2,0)	1,66	0,11		NO

(3,4)	(1,0)	0,33	0,13**	NO
(3,5)	(2,2)	0,38	0,12	NO
(3,6)	(1,1)	2,62	-0,01	NO

Table 4. Forecast of future short-term interest rates anticipated by the SPREAD of Treasury bonds rates

(Source: calculated by the authors.)

Notes: *, ** and *** represent significance at 10%, 5% and 1%.

With the exception of the first pair (1,2), none of the F statistics exceed the upper bound of the 5% critical threshold. This result indicates that there is no stable long-term relationship between the yield curve spread and future changes in short-term rates in this specification. Although some short-term relationships appear statistically significant, their effects remain weak in intensity. Furthermore, the long-term coefficient, estimated on an exceptional basis for the first pair of maturities, is close to zero and not very significant. Ultimately, these results show that the SPREAD of Treasury bonds yield curve does not allow for reliable forecasting of the average variation in anticipated short-term rates over an extended horizon. This conclusion is consistent with that obtained in the first representation and calls for caution in interpreting the role of the informational content of the Moroccan yield curve in forecasting future interest rates. It also suggests that structural, institutional, or market factors may limit the effectiveness of the theoretical transmission mechanisms assumed by anticipation theory.

5. DISCUSSIONS

This study examines the informational role of the Treasury yield curve in forecasting future interest rates, in light of the rational expectations theory. The results confirm the limitations highlighted by Shiller (1979) and Campbell and Shiller (1987), related to the exclusion of time-varying term premiums and certain macroeconomic factors. However, as shown by Jondeau and Ricart (1997), some segments of the yield curve may retain predictive power over specific horizons, particularly in the short- and medium-term. Complementarily, Fama (1984) and Campbell and Shiller (1991) argue that the slope of the curve remains a relevant indicator of future rates, provided that risk premiums and cyclical signals, such as yield curve inversions signaling recessions, are properly incorporated. In the Moroccan context, however, the study's results reject the validity of the expectations theory for both representations tested. For the first representation, which links the slope of the yield curve to the expected change in long-term yields, the estimated coefficients are negative and not significant, contradicting the theoretical relationship. This weakness can be attributed to several local factors. Budgetary tensions play a key role: the government's reliance on issuing long-term securities to finance deficits increases supply and pushes long-term yields higher, thereby distorting the monetary policy signal. This situation deteriorates market liquidity conditions and raises borrowing costs, limiting the yield curve's ability to accurately reflect investor expectations. Additional factors include macroeconomic uncertainty and external shocks, notably fluctuations in commodity prices, which further destabilize long-term rates. The risk premium, often elevated during periods of uncertainty and influenced by sovereign risk perception, also distorts the theoretical relationship between the slope and future yields. These elements, absent from classical models, explain why the expectations theory does not fully apply in Morocco. The second representation, which analyzes the relationship between the slope and expected changes in short-term rates, confirms these limitations. The slope only weakly explains short-term rate variations, with coefficients close to zero and rarely significant, questioning its predictive capacity. Similar factors contribute to this weakness: commodity price fluctuations, the partial credibility and limited predictability of monetary policy, and budgetary tensions affecting supply and demand in the short-term securities market.

Overall, these elements render the theoretical relationship between the yield curve slope and future expectations less relevant and more difficult to observe in the Moroccan context. Although some long-term relationships between yields of different maturities are evident, the estimated coefficients deviate significantly from theoretical values. These findings highlight the limitations of the Moroccan Treasury yield curve as a forecasting tool for future interest rates.

6. CONCLUSION

This study evaluated the validity of expectations theory in Morocco over the period 2007 to 2024, focusing on the relationship between the slope of the yield curve and both the expected changes in long-term yields and the expected average changes in future short-term rates. By using the two theoretical representations of the expectations model, the analysis highlighted several important insights regarding the applicability of this theory in the Moroccan context. The empirical results show that the slope of the yield curve, commonly referred to as the SPREAD, is not a reliable predictor of either long-term bond yields or future short-term rate changes. The estimated coefficients are often statistically insignificant and differ from the theoretical values predicted by the model, revealing the limitations of expectations theory in Morocco. These limitations can largely be explained by the absence in the model of certain factors that strongly influence interest rates in the Moroccan market. Fiscal pressures and public financing needs, which lead to significant government bond issuances, can distort the signals conveyed by the yield curve. Macroeconomic uncertainty, external shocks such as fluctuations in commodity prices, and the risk premiums demanded by investors also have a considerable effect on interest rates, yet these elements are not accounted for in the classical theory. Moreover, although Bank Al-Maghrib operates an independent monetary policy, its signals are not always fully predictable, which further reduces the ability of the yield curve to accurately reflect market expectations. Overall, these findings suggest that the limited predictive relevance of the Moroccan T-Bond yield curve is primarily due to the lack of consideration of these structural and macroeconomic factors. The study highlights the need for approaches that incorporate country-specific conditions in order to improve the anticipation of future financial and monetary developments. While expectations theory provides a useful conceptual framework, its empirical application in emerging markets such as Morocco requires adaptation to local economic realities. This would enhance the reliability of interest rate forecasts and support more informed decision-making by policymakers and investors.

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FROM TRUMPETS TO TRUMP FADS: THE LIMITS OF PERSONAL AND CELEBRITY BRANDING IN BRAND EXTENSION BASED ON THE FAILURES OF PRODUCTS NAMED AFTER DONALD TRUMP

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ABSTRACT

This paper explores the limits of personal and celebrity branding in the context of brand extension. Well-known individuals frequently lend their names to products and services, effectively extending their personal or celebrity brands into new markets. While this strategy can create immediate visibility and perceived value, it does not always lead to market success at the level of the product or service, and in some cases, it may even have a negative impact on the personal brand itself. To illustrate these limitations, the paper analyses a set of failed products and services bearing the name of Donald Trump. The focus is not on the performance of the personal brand itself, but on the success or failure of the associated brand extensions and their implications. Based on a qualitative case study approach, seven ventures are examined, including Trump: The Game (a board game), Trump Ice (bottled water), Trump Vodka (a premium alcoholic beverage), Trump Steaks (meat products), Trump Casinos (gambling and hospitality services), the Trump Network (a multi-level marketing system including a urine-based health test, PrivaTest), and Trump University (a private business education program). The findings suggest that brand equity alone is insufficient to ensure market success of the product or service. The analysed cases reveal recurring patterns of failure, including a mismatch between brand identity and product category, lack of authenticity, unrealistic premium pricing, weak distribution strategies, and credibility issues. In some cases, excessive reliance on the personal brand may have contributed to consumer resistance rather than acceptance. The paper contributes to the literature on brand extension, personal branding, and celebrity branding by highlighting the risks of overextension and the limits of symbolic brand value. It demonstrates that even highly recognizable personal or celebrity brands may struggle to generate successful product and service extensions, and that unsuccessful extensions may, in turn, influence perceptions of the personal brand itself.

Keywords: *personal branding; celebrity branding; brand extension; brand failure; brand overextension; Donald Trump; case study*

1. INTRODUCTION

In contemporary marketing, well-known individuals increasingly lend their names to products and services, extending their personal or celebrity brands into new markets. This practice can be interpreted as a specific form of brand extension, where the “parent brand” is not a company but a person. By attaching a recognizable name to a product, marketers aim to leverage existing awareness, perceived expertise, and symbolic value in order to facilitate market entry and consumer acceptance (Keller, 2013; Thomson, 2006; Szántó et al., 2025). In theory, such strategies can reduce perceived risk, increase trust, and allow products to benefit from the positive associations linked to the individual. At the same time, however, the success of these extensions is not guaranteed. Products and services associated with personal or celebrity brands may fail to achieve market success, particularly when there is a lack of fit between the brand and the category, or when expectations created by the name are not met.

Moreover, unsuccessful extensions may not remain isolated at the product level but can also influence perceptions of the personal brand itself (Gorbatov et al., 2018). One of the most prominent examples of large-scale personal brand extension is Donald Trump, an American businessman, media personality, and politician who has served as President of the United States, and who built his public reputation primarily through real estate development, high-profile business ventures, and extensive media exposure, including television. His name has been associated with a wide range of ventures, from real estate and media to consumer goods and education. Over the decades, numerous products and services have carried the Trump name, reflecting an extensive and often aggressive brand extension strategy (Holodny, 2014; TIME Staff, 2011). However, not all of these ventures have been successful. Some have failed rapidly, others disappeared quietly from the market, and several have been widely discussed in media as examples of unsuccessful brand extensions (Tyler, 2018). Some of these failures have even been featured in the Museum of Failure, a travelling exhibition dedicated to unsuccessful products and innovations, where a separate section has been devoted to failed Trump-branded ventures (Papp-Váry et al., 2025). Building on these examples, this paper analyses seven failed products and services bearing the name of Donald Trump. The aim is not to evaluate the performance of the personal brand itself, but to understand the success and failure of brand extensions associated with it, as well as their broader implications. By combining real-world examples with selected theoretical insights, the paper seeks to identify recurring patterns behind these failures and to draw more general conclusions about the limits of brand extension strategies based on personal and celebrity brands. It is important to emphasize that these cases do not represent the failure of a personal brand, but rather the repeated failure of its extensions across fundamentally different product categories.

2. LITERATURE REVIEW

Brand extension is a widely studied topic in marketing, referring to the use of an established brand name to introduce new products in different categories (Aaker, 1990). A strong brand can provide significant advantages, including increased consumer trust, reduced marketing costs, and faster market acceptance (Keller, 2013). However, the success of brand extensions depends heavily on the perceived fit between the original brand and the new product category. Aaker (1990) distinguishes between successful and unsuccessful brand extensions, emphasizing that poor fit, low product quality, or inconsistent brand positioning can damage both the extension and the parent brand. Similarly, Keller (2013) highlights that brand equity is not automatically transferable, and that consumers evaluate extensions based on relevance, credibility, and perceived expertise. As a result, even highly recognizable brands may fail when entering categories that lack logical or symbolic connection to their core identity. Personal branding refers to the process through which an individual develops and manages his or her public image as a brand, based on his or her name, reputation, and symbolic capital. In this sense, the individual becomes the brand itself, shaping how he or she is perceived by different audiences (Gorbatov et al., 2018; Szántó et al., 2025). When brand extension is applied in this context, the personal brand functions as the parent brand, and the individual's name is used to introduce products or services in new categories. In other words, the extension is not based on a corporate brand, but on a personal or celebrity brand that is transferred to different market offerings. This study focuses specifically on such cases, examining brand extensions where a personal or celebrity brand is applied to products and services, rather than analysing the process of personal brand construction itself. According to Thomson (2006), consumers can form strong emotional attachments to human brands, which may enhance trust and loyalty. However, this also increases vulnerability: because the brand is directly tied to a single individual, any inconsistency, overexposure, or mismatch between the brand and its extensions may lead to negative perceptions and reduced credibility.

Closely related to personal branding is the concept of celebrity branding. While personal branding often emphasizes expertise, authenticity, and professional identity, celebrity branding is more strongly linked to visibility, media presence, and symbolic appeal. Celebrities frequently lend their names to products and services as a form of endorsement or brand extension, aiming to transfer their popularity and image to the offering (Erdogan, 1999). However, the effectiveness of such strategies depends on perceived congruence between the celebrity and the product, as well as on the credibility of the association. Recent research has further highlighted the dual nature of personal and celebrity brands. Gorbатов et al. (2018) argue that personal branding involves a process of strategic self-presentation, where individuals actively manage how they are perceived by others. Similarly, Szántó et al. (2025) emphasize that personal brands are built on a combination of functional value, symbolic meaning, and perceived authenticity. When these elements are not aligned with the product or service being promoted, the extension may fail to meet consumer expectations. Kapferer (2012) argues that brand identity must remain coherent across all extensions. When a brand enters too many unrelated categories, it may suffer from dilution, losing its clear positioning in the minds of consumers. This is particularly relevant in cases where a personal or celebrity brand is used across highly diverse industries, increasing the risk of overextension. Another important aspect is the role of authenticity and credibility. Holt (2004) suggests that strong brands often function as cultural symbols, and their success depends on maintaining authenticity. When consumers perceive a brand extension as purely opportunistic or inconsistent with the brand's core values, they are more likely to reject it. In the case of personal and celebrity branding, this issue becomes even more pronounced, as the individual behind the brand is directly associated with the product. In addition, distribution channels and pricing strategies play a crucial role. Even a strong brand may fail if the product is overpriced or sold through inappropriate channels, as these factors directly influence perceived value and accessibility. This is particularly important in premium positioning strategies, where high prices must be supported by clear and credible value propositions (Keller, 2013). Overall, the literature suggests that while strong personal and celebrity brands can facilitate market entry and generate initial attention, they do not guarantee long-term success at the product or service level. Failures may occur when there is a lack of fit, credibility, or strategic alignment, and such failures may also have implications for the perception of the personal brand itself. The case of products and services bearing the name of Donald Trump provides a particularly relevant context to examine these dynamics, as it combines high brand visibility with a wide range of both successful and unsuccessful brand extensions.

3. CASE STUDIES: FAILED PRODUCTS BEARING THE NAME OF DONALD TRUMP

3.1. Trump: The Game (board game)

One of the earliest Trump-branded products was Trump: The Game, a board game launched in 1989 following a proposal by game designer Jeffrey Breslow, who personally presented the concept to Donald Trump at Trump Tower. The idea was quickly accepted, and the game entered the market as a business-themed board game strongly resembling Monopoly, built around real estate acquisition, deal-making, and aggressive competition (BoardGameGeek, n.d.; Papp-Váry et al., 2025). However, the game went beyond a simple Monopoly imitation by embedding Trump's personality and business philosophy directly into its mechanics. The dice replaced the traditional number six with a "T", and players who rolled it could take assets from others. The gameplay also included the possibility of excluding competitors from bidding rounds, through the "You're fired!" card, directly referencing Trump's well-known catchphrase. Even taxation followed an unconventional logic: instead of paying taxes to a central entity, players could collect money from each other using specific cards.

The game world itself mirrored Trump's business empire. Players could acquire hotels, casinos, sports facilities, golf courses, and even an airline, all reflecting Trump's real-life portfolio. The personal branding aspect was further reinforced by the visual design: Trump's face appeared on the in-game currency, making the connection between the individual and the brand explicit (Papp-Váry et al., 2025). The communication of the game also reflected Trump's characteristic tone and worldview. Promotional slogans included statements such as "Live the fantasy! Feel the power! Make the deals!" and "It's not whether you win or lose, it's whether you win!", emphasizing competition, dominance, and success at all costs. In this sense, the product can be interpreted not only as a game, but as a gamified representation of Trump's personal brand. Despite high expectations, the product failed to achieve commercial success. While projections estimated sales of up to 2,000,000 units, only around 800,000 copies were sold. As Trump himself later admitted, the game was overly complex and focused too heavily on deal-making, which limited its entertainment value even for adult audiences (Papp-Váry et al., 2025; TIME Staff, 2023). A relaunch in 2004 attempted to capitalize on renewed media visibility following the success of *The Apprentice*, a reality television show in which contestants competed for a job in Donald Trump's business empire. The new version simplified the rules and reduced the number of property types, and it was even integrated into the show itself, significantly lowering marketing costs. However, despite these adjustments, the product failed again within a short period and disappeared from the market (Forbes, 2004; Papp-Váry et al., 2025). From a branding perspective, this case illustrates a key limitation of personal and celebrity branding: even a product that is highly consistent with the personal brand may fail if it does not deliver a compelling user experience. In this case, the strong alignment with Trump's image was not enough to compensate for the lack of entertainment value, supporting Aaker's (1990) argument that perceived fit alone is not sufficient for successful brand extension.

3.2. Trump Ice (bottled water)

The launch of Trump Ice, a bottled water brand, was closely tied to the rise of Donald Trump's media presence in 2004, particularly the debut of his reality television show *The Apprentice*. The product was introduced directly within the show itself, using the program as a built-in marketing platform and reinforcing the connection between Trump's personal brand and the product (Wastewater Digest, 2004; Papp-Váry et al., 2025). The concept behind the brand was straightforward: if Trump's name represents success and luxury, then even a basic product such as bottled water can be positioned as premium. Accordingly, Trump Ice Natural Spring Water entered the market with a strong premium positioning and a price to match. A standard 16.9-ounce (approximately 0.5-liter) bottle was priced at around \$1.50, which was considered very high at that time. The product was available in multiple sizes, ranging from smaller 12-ounce bottles to large one-gallon (3.8-liter) containers, suggesting ambitions for both everyday and bulk consumption (Papp-Váry et al., 2025). The branding made the personal connection explicit. The bottles featured Trump's face directly on the label, in two versions: one in blue with a more approachable tone, and another in red emphasizing a stronger, more dominant image. The label also suggested that the water was "one of the world's finest", reinforcing the premium narrative. At the same time, the product itself offered relatively limited differentiation: it was low in mineral content and nearly sodium-free, attributes that alone did not justify the high price in an already saturated premium water market (Papp-Váry et al., 2025). Despite significant investment, reportedly around \$500,000 at the time, and attempts to expand both within the United States and internationally, the brand failed to establish a sustainable market position and was eventually withdrawn from the market. By around 2010, Trump Ice had largely disappeared from retail shelves.

Interestingly, the product continued to be available for a longer period within Trump-owned environments such as casinos, hotels, and luxury properties, where it functioned more as an exclusive, symbolic offering than a competitive mass-market product (Tyler, 2018; Holodny, 2014; Papp-Váry et al., 2025). One of the key challenges was that the product category itself did not align well with the logic of personal branding. Bottled water is a low-involvement product, where consumers primarily evaluate price, availability, and basic quality. In this context, the strong emphasis on the personal brand may have worked against the product, as Trump's face appeared directly on the bottle, making even a simple everyday purchase a potentially polarizing choice (Papp-Váry et al., 2025). From a branding perspective, this case illustrates the limits of personal and celebrity branding in functional product categories. Without clear product differentiation or a compelling value proposition, symbolic brand value alone is insufficient to sustain a premium positioning (Keller, 2013).

3.3. Trump Vodka (premium vodka)

Following the unsuccessful launch of his bottled water, Donald Trump turned to what is often referred to in Slavic languages as “little water”, “little voda”: vodka. The idea was inspired by the remarkable success of Grey Goose, a previously unknown French brand that had successfully created and dominated the super-premium vodka segment in the United States. Trump Vodka was launched in 2007 with a clear ambition to compete in this high-end category. The product was manufactured in Europe, first in the Netherlands and later in Germany, using European wheat. It was distilled five times and rested in stainless steel containers before bottling, emphasizing quality, refinement, and craftsmanship, as far as such differentiation is meaningful in the case of vodka (Papp-Váry et al., 2025). The premium positioning was reinforced through design. The bottle was created by renowned graphic designer Milton Glaser, who drew inspiration from Trump's real estate empire and the luxury image associated with his name. According to Glaser, the design aimed to communicate status and even envy, shaping how consumers might relate to both Trump and the product itself. This resulted in a striking bottle with dominant gold elements, a bold “T” on the front, and a form intended to signal exclusivity. The slogan, “Success distilled”, captured this positioning directly (Abelson, 2016; Papp-Váry et al., 2025). The launch campaign followed a similar logic. A high-profile Hollywood event introduced the product, with celebrities in attendance alongside Trump himself. This, however, also revealed one of the central contradictions of the brand: Trump does not drink alcohol, which raised questions about authenticity and weakened the credibility of the association. Beyond the United States, one of the most notable target markets was Israel. The product received kosher certification, allowing it to be consumed by those following kosher dietary rules. This was a relatively unusual move for a premium vodka brand and helped extend the product's presence internationally, even as it struggled in its primary market (Abelson, 2016; Papp-Váry et al., 2025). Despite the strong branding and ambitious positioning, Trump Vodka failed relatively quickly in the United States, although it remained available somewhat longer in certain international markets. Nevertheless, traces of the brand survived in cocktail culture. Drinks such as the Trump and Tonic (vodka with tonic and citrus) or the Trump Tower (vodka with cranberry juice, citrus soda, and lemon garnish) were associated with the brand and reflected its attempt to embed itself in a lifestyle context (Papp-Váry et al., 2025). From a branding perspective, this case highlights the importance of credibility and authenticity in personal and celebrity branding. When there is a disconnect between the individual and the product, the symbolic association may lose its persuasive power. In addition, entering an already crowded premium market without meaningful differentiation further reduced the chances of long-term success (Holt, 2004).

3.4. Trump Steaks (premium meat products)

If one were to ask what Donald Trump's favourite food might be, steak would likely be an unsurprising answer. It is therefore not unexpected that in 2007 he entered the premium meat market with Trump Steaks, attempting to translate his personal brand into the world of high-end food products. From the very beginning, the communication relied heavily on Trump's own persona and characteristic rhetoric. In the launch campaign, he declared: "Believe me: I understand steaks. It's my favorite food. And Trump Steaks are the best." He reinforced this message with wordplay aimed at both consumers and competitors: "When it comes to great steaks, I've just raised the stakes!" (Taylor, 2016; Papp-Váry et al., 2025). The product line included four main steak types, T-bone, New York Strip, Ribeye, and Filet Mignon, as well as burgers and sausages. The supplier was Buckhead Beef, and all products were sold in frozen form. Trump further emphasized quality with bold claims such as: "Trump Steaks are by far the best tasting, most flavorful beef you've ever had. Truly in a league of their own", positioning the brand not just as premium, but as superior to all competitors (Papp-Váry et al., 2025). The pricing followed this logic. The lowest-priced package cost around \$199 and included 12 hamburger patties and four large steaks, while the most expensive offer reached \$999 for 16 pieces of frozen premium beef. Such pricing clearly placed the product in the ultra-premium category, requiring exceptional perceived value to justify the cost. In reality, however, consumer reactions were far less enthusiastic. While a minority of customers responded positively, the majority of online reviews were negative, frequently describing the meat as fatty, tasteless, or dry, and criticizing the poor price-value ratio (Taylor, 2016; Papp-Váry et al., 2025). A second major issue was the distribution strategy. Rather than being sold through traditional food retail or restaurant channels, Trump Steaks was exclusively available via Sharper Image, a retailer primarily associated with electronics and gadgets. Trump imposed two specific conditions: the product had to appear on the cover of the company's catalogue, and it had to be displayed and promoted in all 185 stores. Despite this visibility, the expected breakthrough never materialized (Taylor, 2016; Tyler, 2018; Papp-Váry et al., 2025). Paradoxically, the campaign itself proved effective in one respect. Trump's presence and promotion attracted customers to Sharper Image stores, but instead of buying steaks, many purchased electronic products. In this sense, the communication succeeded in generating traffic, but failed to convert it into demand for the actual product. As a result, despite strong media attention and ambitious positioning, Trump Steaks collapsed within a remarkably short time. Within approximately two months, the product began to be withdrawn from the market. What had been promoted as "the world's greatest steaks" quickly turned into one of the most visible failures among Trump-branded ventures, and it was later even included in the Museum of Failure collection (Papp-Váry et al., 2025; Holodny, 2014; TIME Staff, 2023). From a branding perspective, this case demonstrates that even extremely strong personal branding cannot compensate for fundamental weaknesses in product quality, pricing logic, and distribution strategy. The misalignment between product, positioning, and channel ultimately undermined the entire venture, reinforcing Keller's (2013) argument that premium pricing must be supported by real or at least perceived superiority.

3.5. Trump Casinos (gambling and hospitality)

Unlike the previous cases, Trump's casino ventures do not represent a single failed product, but rather a series of large-scale business setbacks unfolding over decades. In the 1980s and 1990s, Donald Trump invested heavily in Atlantic City, at the time the second most important gambling destination in the United States after Las Vegas. Recognizing the concentration of gambling tourism, he acquired and operated multiple casinos, including the Trump Taj Mahal, positioning himself as a dominant player in the market (Papp-Váry et al., 2025).

Trump himself framed this strategy in a way that reflected his broader business philosophy: “People think I’m a gambler. I’ve never gambled in my life. A gambler is someone who plays slot machines. I prefer to own slot machines.” This statement captured the logic behind the investment: rather than participating in the game, Trump aimed to control the system itself. For a period, the strategy appeared successful. However, this success was highly dependent on external conditions. Atlantic City’s prominence began to decline as gambling was gradually legalized in other U.S. states, leading to a fragmentation of demand. Gambling tourism was no longer concentrated in a single location, and the competitive advantage of Atlantic City weakened significantly (Papp-Váry et al., 2025). The consequences became visible in a series of bankruptcies. The first occurred in 1991, shortly after the opening of the Trump Taj Mahal. This was followed by further financial restructurings in 2004 and again during the 2008–2009 global financial crisis. In 2014, another bankruptcy led to the closure of the Trump Plaza, and in 2016 the Trump Taj Mahal itself also shut down (Russ, 2016; TIME Staff, 2023; Papp-Váry et al., 2025). A particularly revealing comparison illustrates the long-term performance of these ventures. If an investor had placed 100 dollars in a broad market index fund tracking major U.S. companies in 1995, the investment would have grown to approximately 250 dollars within ten years. By contrast, investing the same 100 dollars in Trump Hotels and Casino Resorts stocks would have initially produced rapid gains, reaching a similar value within a single year. However, this was followed by a dramatic decline, and by 2004 the investment had effectively lost almost all of its value (Papp-Váry et al., 2025). The timing is particularly striking. The year 2004, when the stock value collapsed, was also the year when Trump was selected as the central business figure of *The Apprentice*, a television show that presented him as a highly successful and decisive entrepreneur. This contrast highlights a fundamental disconnect between media representation and underlying business performance. Although external factors such as market liberalization and the financial crisis clearly contributed to the outcome, the failures cannot be attributed solely to these conditions. Strategic and managerial decisions also played a significant role in amplifying the negative trajectory (Papp-Váry et al., 2025). From a branding perspective, this case demonstrates that even a highly visible and powerful personal brand cannot compensate for structural market changes and strategic mismanagement. In capital-intensive industries such as gambling and hospitality, long-term success depends not only on brand reputation, but on operational efficiency, financial discipline, and the ability to adapt to a changing competitive environment.

3.6. Trump Network and PrivaTest (MLM health products)

Building on the success of *The Apprentice*, Donald Trump continued to extend his personal brand into increasingly diverse and unconventional categories. One of the most unusual of these ventures was the Trump Network, a multi-level marketing (MLM) business centered around health-related products, most notably the so-called PrivaTest. The core idea of the product was both simple and highly ambitious. Consumers were asked to complete a questionnaire about their health and provide a urine sample, which had to be mailed to a laboratory. Based on this single sample, the system claimed to determine which vitamins, minerals, and phytonutrients the individual needed in order to achieve optimal health. These recommended supplements could then be purchased directly through the network itself (Swetlitz, 2016; Papp-Váry et al., 2025). In practice, however, such claims lacked any solid scientific foundation. The idea that complex nutritional needs could be accurately assessed from a single urine sample was highly questionable. The case bears a clear resemblance, at least in logic, to the later Theranos scandal, where it was claimed that a single drop of blood could provide comprehensive diagnostic results. While the scale and consequences differed significantly, both cases illustrate the risks of overpromising scientific capabilities without sufficient empirical support (Papp-Váry et al., 2025).

Beyond the product itself, the business model added another layer of complexity. The Trump Network operated as an MLM system, encouraging participants not only to purchase products, but also to recruit others into the network. Around 20,000 individuals reportedly joined, investing varying amounts of money and attempting to build their own sales networks. The timing played a crucial role: the venture emerged in the immediate aftermath of the 2008–2009 financial crisis, when many people were actively seeking alternative sources of income and were therefore more receptive to such opportunities (Tyler, 2018; Papp-Váry et al., 2025). However, the system quickly lost credibility and triggered serious concerns. Some of the experts presented as scientific authorities were allegedly involved without their knowledge or consent. In one notable case, a Harvard professor publicly distanced himself from the project, expressing strong objections to the use of his name. Even among participants, including highly educated individuals, skepticism grew rapidly, and many exited the network once the lack of scientific credibility became apparent (Papp-Váry et al., 2025). Interestingly, Trump himself later distanced himself from the venture. Through his legal representation, it was stated that he neither owned nor controlled the company and had not approved the product in question, further complicating the relationship between the personal brand and the business activity (Goldman & Strickler, 2016). From a branding perspective, this case represents a particularly clear example of credibility risk. When a product is based on scientifically questionable claims and distributed through controversial business practices, the association with a personal brand may not only fail to create value, but may actively undermine trust. This reinforces Holt's (2004) argument that authenticity and credibility are essential conditions for sustainable brand extensions.

3.7. Trump University (business education services)

Among Trump's brand extensions, the launch of Trump University in 2005 may have appeared one of the most logical. If there was one area where his personal brand seemed credible, it was business success. The concept was therefore straightforward: offer practical, experience-based business education that promised insights beyond what traditional elite institutions could provide. Trump himself framed the initiative in ambitious terms: "I created Trump University to give motivated businesspeople the skills required to achieve lasting success." The emphasis was clearly on lasting success, even if, ironically, the institution itself proved far less enduring (Papp-Váry et al., 2025). Initially, the educational content was developed and delivered by experienced professionals, and the program combined online courses with later in-person seminars. Pricing reflected a premium positioning, though not unusually so by U.S. education standards. Individual courses were typically priced around \$1,495, while more advanced "elite" programs could cost up to \$35,000, promising to teach participants how to achieve rapid financial success, particularly in real estate (Freifeld & Levine, 2016; Papp-Váry et al., 2025). Over time, however, the nature of the program began to shift. Teaching increasingly gave way to sales-oriented practices. Instructors were reportedly encouraged to act less as educators and more as sales representatives, pushing participants to purchase additional courses and investment opportunities. Students were even advised to increase their credit card limits in order to finance further participation in the program, creating a strong upselling dynamic within the system (Papp-Váry et al., 2025). Although Trump consistently claimed high levels of student satisfaction, a closer look revealed a more complex picture. While numerical ratings in feedback surveys appeared positive, qualitative comments often pointed to discomfort during the sessions, aggressive sales tactics, and dissatisfaction with the overall value. Even physical aspects of the learning environment were criticized, including the conditions of the training facilities. The most fundamental issue, however, was structural. Despite its name, Trump University was not an accredited university. Participants did not receive recognized degrees, credits, or formal qualifications.

This gap between branding and reality became the central source of controversy and led to multiple lawsuits, with former students alleging misleading marketing practices (Helderman, 2016; Papp-Váry et al., 2025). In 2016, the case was settled for \$25 million, covering approximately 6,000 former students (Freifeld & Levine, 2016). During the legal proceedings, Trump argued that respected institutions such as Northwestern, Stanford, and Columbia Business School were associated with the program. However, when contacted by journalists, all three institutions denied any formal connection, further undermining the credibility of the claims (Papp-Váry et al., 2025). From a branding perspective, this case illustrates one of the most severe risks of personal and celebrity brand extension. When the promise created by the brand is not matched by the actual offering, the consequences extend beyond market failure to legal disputes and reputational damage. In this sense, Trump University represents not only a failed brand extension, but also a breakdown of trust, reinforcing the importance of transparency, authenticity, and real value in brand-driven ventures.

4. DISCUSSION

The analysis of the seven Trump-branded ventures reveals several recurring patterns that help explain why strong personal and celebrity branding did not translate into market success at the level of products and services. These patterns are summarized in Table 1. First, the issue of brand-product fit appears repeatedly. While the Trump brand is strongly associated with wealth, success, and real estate, not all product categories aligned with this identity. For example, products such as Trump Ice water or the Trump Network lacked a clear and credible connection to the brand's core meaning. This finding is consistent with Aaker's (1990) argument that perceived fit is a key determinant of successful brand extensions. When consumers cannot easily understand why a brand enters a particular category, acceptance becomes less likely. Second, overreliance on personal and celebrity branding can lead to diminishing returns. In several cases, the branding strategy placed excessive emphasis on Donald Trump himself, including the use of his name, image, and persona in product design and communication. While this increased visibility, it may also have contributed to consumer fatigue or even rejection. This observation is in line with Thomson's (2006) concept of human brands, which highlights both the advantages and risks of strong personal associations. The case of Trump Ice water illustrates that high visibility does not always result in positive consumer response. Third, credibility and authenticity emerged as critical factors. Products such as Trump Vodka or the Trump Network suffered from a perceived lack of authenticity. The fact that Trump does not consume alcohol weakened the credibility of the vodka brand, while the questionable scientific basis of PrivaTest raised trust issues. This aligns with Holt's (2004) view that strong brands must maintain cultural authenticity in order to remain credible. It also supports the argument of Gorbатов et al. (2018) that personal brands rely heavily on consistent and credible self-presentation. Fourth, pricing and value perception played a significant role. Several products were positioned in the premium segment without offering clear added value. Trump Steaks, for example, were priced at a level that required exceptional quality and experience, yet available evidence suggests that consumer perceptions did not support this positioning. This confirms Keller's (2013) assertion that brand equity can support premium pricing only when it is backed by real or perceived product superiority. Fifth, distribution and channel strategy proved to be another critical weakness. The decision to sell Trump Steaks through a non-traditional retail channel demonstrates a clear mismatch between product type and retail environment. Even a strong brand cannot compensate for poor accessibility or inappropriate sales channels, reinforcing the importance of strategic alignment across the entire marketing mix. Finally, external factors and managerial decisions also contributed to failure in more complex ventures such as the casino business.

The case of Trump Casinos illustrates that even strong brand recognition cannot compensate for structural market challenges and strategic mismanagement. This highlights that in capital-intensive industries, brand strength is only one of many success factors, and cannot substitute for sound operational and financial management. When viewed together, the cases reveal a clear pattern of different types of failure. Some products failed because they were too simple and offered no meaningful differentiation, as in the case of bottled water. Others failed due to lack of authenticity, such as vodka, or overly aggressive positioning, as seen with steaks. In contrast, the board game failed because it was too complex and not entertaining enough, while the casino ventures were exposed to excessive financial risk. The Trump Network relied on scientifically questionable claims, and Trump University ultimately failed due to misleading expectations. Several cases reveal a striking irony, where the symbolic strength of the personal brand contrasts sharply with the actual performance of the product or business. The casino ventures collapsed financially while the media image of success was simultaneously strengthened through television. The steak campaign attracted customers, but not for the product itself. The vodka emphasized luxury despite the fact that the brand owner did not consume alcohol. Trump University promised elite education while lacking formal accreditation. These contradictions highlight the gap between symbolic branding and functional value. This pattern also suggests that the limitations of personal brand extension are not tied to a single factor, but emerge in different forms depending on the product category and the quality of strategic execution. Overall, the cases show that personal and celebrity branding can be powerful tools for attracting attention and facilitating market entry, but they are not substitutes for sound marketing strategy. The Trump brand provided initial visibility and recognition, but in many cases, this was not sufficient to ensure long-term success of the associated products and services. As summarized in Table 1, failures were typically linked not to the strength of the personal brand itself, but to weaknesses in strategic execution, lack of fit, or credibility issues at the product level.

Table 1. Key Failure Factors of Products and Services Bearing the Name of Donald Trump

<i>Case</i>	<i>Product/Service Type</i>	<i>Main Problem</i>	<i>Key Failure Factor</i>	<i>Link to Theory</i>
Trump: The Game	Board game	Low entertainment value	Weak product experience despite strong brand fit	Aaker (1990) – fit alone is insufficient
Trump Ice	Bottled water	Limited product differentiation	Overreliance on personal branding	Thomson (2006) – risks of human brands
Trump Vodka	Premium alcoholic beverage	Lack of authenticity	Credibility gap between brand and product	Holt (2004) – authenticity requirement
Trump Steaks	Premium food product	Poor value perception	Price–quality mismatch and weak distribution	Keller (2013) – value must support premium pricing
Trump Casinos	Gambling & hospitality	Financial instability	External factors and strategic mismanagement	Kapferer (2012) – limits of brand extension and strategic coherence
Trump Network / PrivaTest	MLM & health product	Questionable scientific claims	Lack of credibility and trust	Holt (2004) – trust and authenticity
Trump University	Education service	Misleading expectations	Legal and reputational failure	Keller (2013) – importance of delivering brand value and credibility

Source: Own compilation based on case study analysis and secondary sources

Beyond the seven analysed cases, a broader pattern of overextension becomes visible. A large number of additional Trump-branded products and services followed a similar trajectory, achieving initial visibility but failing to sustain long-term success. These included ventures such as Trump Airlines, which operated only for a limited period, and Trump Magazine, which was discontinued after a short run, as well as various consumer products ranging from eyewear and wallets to clothing lines and a modelling agency (Holodny, 2014; Tyler, 2018; Papp-Váry et al., 2025). Several of these extensions attempted to translate the “Trump lifestyle” into everyday consumption. Examples include the Trump Home collection of furniture and decorative items, fragrance lines such as Success and Empire, and even a branded energy drink. In some cases, the logic of extension became particularly symbolic, such as Trump-branded chocolate packaged in gold-bar-like wrapping, directly referencing wealth and luxury (Papp-Váry et al., 2025). While a few of these products achieved temporary visibility or moderate success, the majority failed to establish a lasting market presence. Altogether, nearly 300 different products and services have carried the Trump name over time, illustrating an exceptionally broad and aggressive brand extension strategy (Papp-Váry et al., 2025). This broader context reinforces the findings of the case studies: the issue is not limited to a few unsuccessful ventures, but reflects a systematic pattern of overextension, where the symbolic strength of the personal brand was repeatedly applied across unrelated categories without sufficient alignment, differentiation, or long-term strategic coherence. This pattern of repeated failure is also reflected in the inclusion of several Trump-branded products in the Museum of Failure, reinforcing their symbolic status as examples of unsuccessful brand extensions (Museum of Failure, 2026).

5. CONCLUSION

This paper examined the limits of personal and celebrity branding through the analysis of failed products and services bearing the name of Donald Trump. By analysing a set of real-world cases, the study identified key factors behind the success and failure of brand extensions linked to a highly visible personal brand. The findings indicate that while a strong personal or celebrity brand can facilitate market entry and generate initial attention, it does not guarantee success at the level of individual products and services. Several recurring issues were identified, including poor brand–product fit, lack of authenticity, weak value propositions, inappropriate pricing, and flawed distribution strategies, as summarized in Table 1. In some cases, these challenges were further compounded by external market conditions or managerial decisions. From a practical perspective, the results highlight the importance of strategic coherence in brand extension. Companies and individuals should carefully evaluate whether a new product aligns with the core meaning of the brand and whether it delivers real value to consumers. Overextending a brand into unrelated categories may not only reduce the chances of product success, but may also weaken the clarity and credibility of the brand itself. From a theoretical perspective, the study reinforces existing literature on brand extension, personal branding, and celebrity branding, while providing a set of illustrative, real-world examples. The analysed cases demonstrate that brand equity is a necessary but not sufficient condition for success, and that its effectiveness depends on alignment, credibility, and execution at the product level. In conclusion, the key lesson is not that strong personal brands fail, but that their extensions often do. A recognizable name may open the door, but it cannot substitute for product value, strategic fit, or credibility. As the cases analysed in this study demonstrate, failures typically occur not at the level of the personal brand itself, but at the level of its application. In this sense, brand extension is not only an opportunity, but also a strategic risk that requires careful management.

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ASSESSING FINANCIAL INCLUSION POLICIES IN AFRICA: PERFORMANCE SCORE ANALYSIS

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ABSTRACT

Financial inclusion is a key lever for achieving the Sustainable Development Goals, particularly in Africa, where access to financial services remains limited. In light of this situation, many African countries have adopted National Financial Inclusion Strategies. This article empirically assesses the effectiveness of these strategies in 47 African countries between 2013 and 2021, through the construction of a financial inclusion index encompassing the dimensions of access, availability, and usage of financial services. The results reveal significant disparities between countries, highlighting the impact of persistent structural challenges such as the exclusion of rural populations and the predominance of the informal economy.

Keywords: *Financial inclusion; National strategies; Public policy; Sustainable development.*

1. INTRODUCTION

Expanding access to financial services has emerged as a central priority in public development policies, particularly in least developed and developing countries. Indeed, financial inclusion is now widely viewed as a strategic lever for reducing social inequalities, stimulating economic growth, and promoting the empowerment of vulnerable populations. Given its importance, this strategic orientation has been enshrined in the international agenda of the Sustainable Development Goals (SDGs), where financial inclusion is embedded as a cross-cutting tool for combating poverty and fostering more equitable development. In this context, the genesis of financial inclusion policies seen as an extension of microfinance initiatives can be traced back to the Maya Declaration (2011), issued by the Alliance for Financial Inclusion (AFI). This supranational commitment provided developing countries with a shared framework of principles and guidelines aimed at improving access to various banking and financial services. However, despite these advances, disparities remain significant: more than 1.7 billion adults worldwide do not have a bank account (Demirguc-Kunt et al., 2018), with the majority concentrated mainly in Africa, due to persistent political and institutional barriers that hinder the effective promotion of financial inclusion. Faced with these observations, to what extent have financial inclusion policies implemented in Africa succeeded in improving access to financial services, and through what approach can the effectiveness of these strategic frameworks be assessed? In this regard, the existing literature is abundant, yet the findings often remain heterogeneous and sometimes contradictory. Against this backdrop, the present study aims to provide updated empirical insights into public financial inclusion programs in Africa. It draws on a broad sample of 47 African economies over the period 2013–2021—corresponding to the post-subprime crisis era, marked by renewed attention to financial stability and economic resilience.

Accordingly, the analysis relies on quantitative techniques of statistical exploration and scoring to assess the impact of financial inclusion policies, identify obstacles to their implementation, and produce an overall diagnostic of inclusive financial systems in Africa. This article is structured into four sections. The first presents a concise review of the conceptual and empirical literature related to the design and evaluation of financial inclusion strategies. The second section focuses on evaluation tools and methods for constructing financial inclusion indices. Finally, the last two sections present and analyze the results derived from performance scores, highlighting the observed dynamics.

2. DEVELOPMENT OF FINANCIAL INCLUSION STRATEGIES: LITERATURE REVIEW

As a global imperative, numerous governments have adopted financial inclusion strategies, in partnership with international donors and multilateral institutions, through public actions aimed at modernizing their financial sectors. These public policies seek to broaden access to essential financial services (credit, savings, insurance, payment mechanisms) for populations excluded from the traditional banking system. Thanks to this momentum, new financing models have emerged, combining conventional and alternative solutions (participatory finance, crowdfunding, digitalization of services, mobile banking) to strengthen economic and social inclusion. However, the level of financial inclusion varies considerably across regions. Some countries in the Global North and South have achieved near-universal access to banking and financial services, with account ownership in high-income countries exceeding approximately 95%.

2.1 Strategic Model of Financial Inclusion: Conceptual and Contextual Framework

As a genuine channel for democratizing financial access, the National Financial Inclusion Strategy (NFIS) reflects a long-term vision, supported by sectoral priorities, and formalized in an official reference document prepared by a public authority in the form of a roadmap (World Bank, 2012). This strategic framework outlines the main orientations regarding targeting, governance, and implementation, specifying the necessary measures and key milestones. The adoption of such a reference document facilitates the progressive integration and dissemination of an inclusive finance culture at all levels (AFI, 2020). Like any strategy, the NFIS determines the resources to be allocated, identifies the stakeholders involved, and sets a timeframe for achieving the objectives, together with periodic monitoring indicators. Moreover, the common design framework for NFIS follows an iterative logic—a four-stage cycle ranging from the initial diagnostic to ex-post evaluation.

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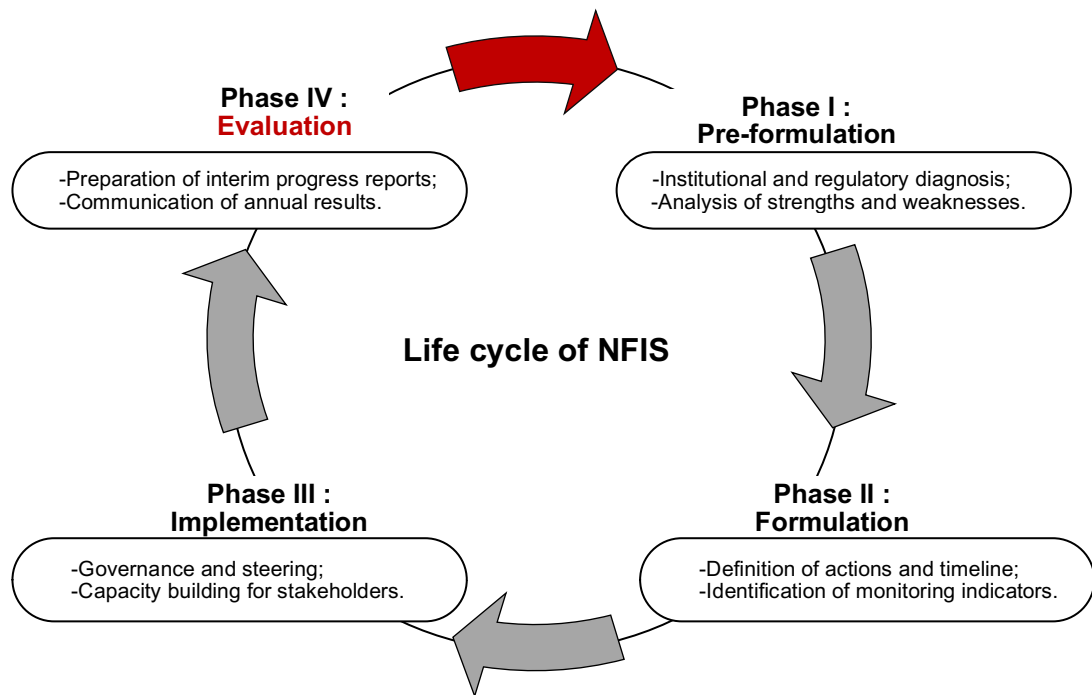


Figure 1. Life Cycle of a Financial Inclusion Strategy
(Source: Developed by the authors based on the AFI (2020) reference framework).

According to the AFI, a financial inclusion model begins, in its initial phase, with a thorough assessment of the existing situation, including the organizational and institutional environment, the financial architecture, and the legal framework governing banking activities. The objective is to identify constraints and map the initiatives and opportunities available in the sector. This is followed by the formulation phase, which aims to prioritize actions and define clear SMART objectives (Specific, Measurable, Achievable, Realistic, and Time-bound), together with indicators used to monitor the achievement of results and assess observed gaps. Once stakeholders have been identified, governance and steering bodies ensure the operational implementation of actions and projects, deploying a training and capacity-building plan to support stakeholders progressively in managing change and promoting an optimal appropriation of the financial inclusion culture. This phase concludes with an evaluation of expected results, formalized in an institutional report that outlines progress and shortcomings and, where necessary, proposes recommendations or corrective measures to improve the strategic framework. Building on this shared reference framework, more than 55 countries have adopted financial inclusion commitments, and over 60 countries have officially implemented a NFIS (UNCCD, 2023), with strategic models tailored to their specific contexts. Given the NFIS life cycle, measuring financial inclusion is essential for identifying opportunities and addressing challenges, in order to continuously improve the implementation of these national strategies (Demirgüç-Kunt, A. et al., 2015). It is from this perspective that our study seeks to identify the various evaluation tools, in particular financial inclusion indicators.

2.1 Measuring and Evaluating Financial Inclusion: Main Empirical Works

The evaluation of financial inclusion, as a multidimensional framework, is part of a broader analytical perspective combining several sub-dimensions, and generally follows two main ex-post approaches.

A quantitative approach aims to assess the overall impact of a financial inclusion policy, from both the supply and demand sides, in order to determine whether banked individuals or those with access to services use them regularly and benefit from financial offerings. A qualitative approach, on the other hand, seeks to gather user feedback on their experience with formal financial institutions, particularly regarding satisfaction with the quality of banking services. To achieve this, various institutional initiatives have been launched to collect data on access, availability, usage, and quality through surveys such as the Global Findex, the Financial Access Survey (FAS), and the World Bank Enterprise Surveys. These databases constitute the raw material used to develop individual, synthetic, and composite indicators. The existing empirical literature shows a methodological convergence based on the work of Demirgüç-Kunt and Martínez Peria (2007). Typically, a composite Financial Inclusion Index (FII) is constructed using three inclusion dimensions (access, availability, and usage), based on data from the IMF's FAS1 survey. Despite the informational gaps that persist in evaluating NFIS, empirical studies frequently refer, in building these indices, to the following variables (Sarma, 2008):

- Number of bank accounts;
- Number of access points to financial services;
- Volume of domestic deposits;
- Volume of domestic credit.

Using a scoring method, Sarma (2008) constructed two synthetic indices establishing an international classification by financial inclusion level. The first index is based on three dimensions (access / availability / usage) covering 55 countries, while the second is calculated using two dimensions (availability / usage) for 100 countries. The results of the first index show that Spain recorded the highest FII value in 2004, whereas Madagascar ranked last with a score not exceeding 0.01. For the second group, nine OECD countries display the highest FII, while Cambodia ranks last. Building on this work, Sarma (2012) expanded the sample to 94 countries by incorporating a temporal dimension covering 2004–2010. The Sarma method is distinguished by its simplicity, consisting of constructing a sub-index for each dimension and then aggregating them using the normalized inverse Euclidean distance relative to a reference point (Park et al., 2021). The exploratory approach based on dimension reduction or the Principal Component Analysis (PCA) method also makes it possible to obtain financial inclusion scores. Amidžić, Massara and Mialou (2014) constructed a new FII database through a composite index built from FAS data. The application of factor analysis for the period 2009–2012 generated significant results with a stable ranking over time. Along similar lines, Park and Mercado (2021) developed a new composite index for 151 economies, assigning weights using PCA to aggregate nine indicators related to access, availability, and usage. E. Ezzahid and Z. El Ouairi (2021) analyzed the impact of financial inclusion on investment and economic growth. They designed an index-based scoring function of inclusion in Africa (AFIndex), applied to 33 countries, using a PCA-based methodological approach for the period 2009–2019. However, the application of factor analysis may limit optimal data exploitation due to the weighting coefficients assigned, which may disproportionately reflect the importance of certain variables or dimensions (Park & Mercado, 2021). Using an econometric approach, R. Yorulmaz (2016) focused on the euro area by constructing an index that compares the degree of access to the financial sector across EU member states and candidate countries, through a fixed-effects panel data model. A review of the scientific output on this topic shows that virtually all studies focus exclusively on applying the Sarma index or developing new indices by incorporating additional variables.

¹ This is a survey conducted on a triennial basis, with the first round dating back to 2014.

2.3 Technical Foundations of the Financial Inclusion Index

The composite index proposed by M. Sarma (2008) provides a global comparison of performance scores achieved by each country in implementing their NFIS, by simultaneously integrating the different dimensions. The simplified aggregation used to compute the multidimensional financial inclusion index follows the mathematical form:

$$\sum (IIF_t) = f(D_1^a; D_2^d; D_3^u) \quad (1)$$

The three dimensions set out in Sarma's (2012) initial framework are illustrated in the figure below, where each dimension is defined, axis by axis, within a three-dimensional space.

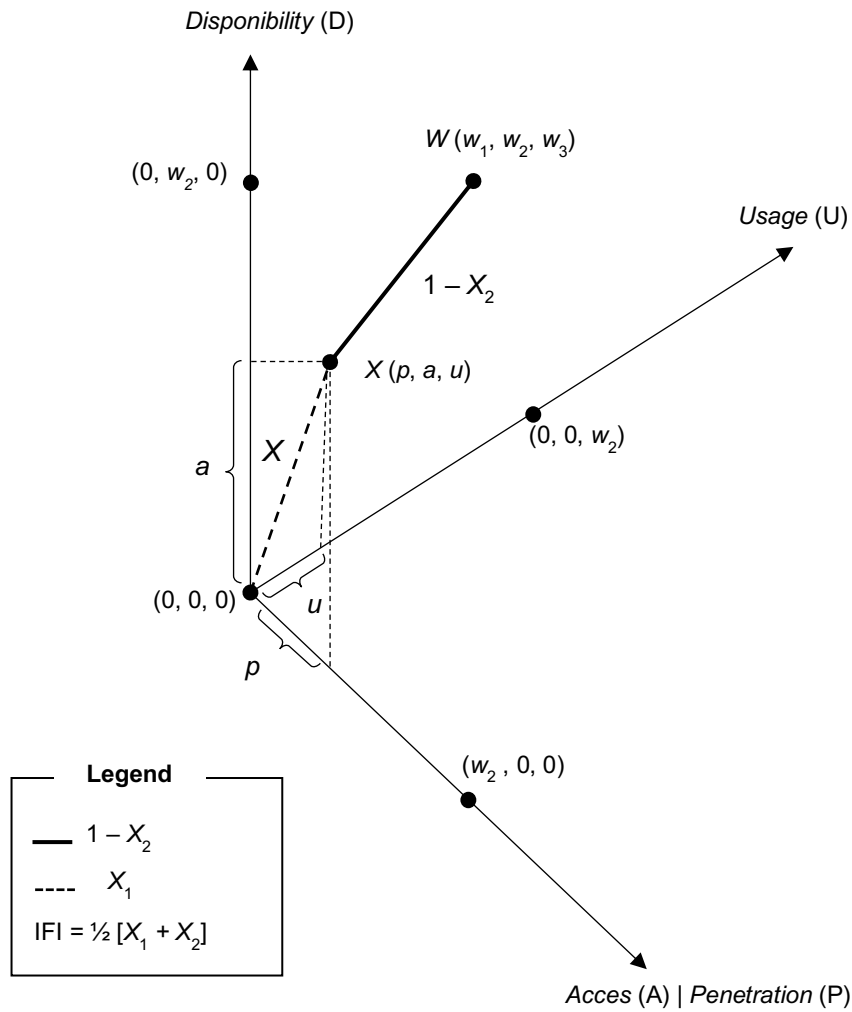


Figure 2. Financial inclusion in a three-dimensional space
(Source: Graphical representation of Sarma, M. (2012).)

The point $[W = (w_1; w_2; w_3)]$ represents the optimal zone in which a country can achieve notable performance in terms of financial inclusion. Thus, before proceeding with statistical compilation, the creator of this indicator recommends verifying a number of technical criteria, namely that it should be “exhaustive” in terms of information coverage, “simple” in its design and compilation, and “comparable” through scores that allow for territorial or interstate rankings.

Building on this foundation, we propose a methodological approach based on a normalization technique to evaluate the effectiveness of National Financial Inclusion Strategies (NFIS) through score analysis and an assessment of the determinants and explanatory factors affecting their operational implementation. Drawing on the insights from the normalization or “scoring” method, the index-based calculation of scores for each inclusion dimension relies on identifying the extreme values of the multidimensional criteria. Thus, before proceeding with statistical compilation, the designer of this indicator recommends verifying several technical criteria, namely that it should be “exhaustive” in its information coverage, “simple” in its design and compilation, and “comparable” through scores that allow for territorial or interstate rankings. On this basis, we propose a methodological approach grounded in a normalization procedure to assess the effectiveness of National Financial Inclusion Strategies (NFIS) through score analysis and an examination of the determinants and explanatory factors that influence their operational implementation. Building on the insights of the normalization or “scoring” method, the index-based calculation of scores for each inclusion dimension relies on identifying the extreme values of the multidimensional criteria.

$$d_i = \frac{VA_i - \min_i}{\max_i - \min_i} \quad (2)$$

Where VA_i is the current or observed value of the financial inclusion dimension (i), and $\min_i$ and $\max_i$ represent the minimum and maximum values in the database for the variable under study. Technically, the results obtained from compiling the statistical data must fall within the interval $0 \leq d_i \leq 1$, and may reflect three different scenarios. The overall index is then calculated as follows:

$$IIF_i = 1 - \frac{\sqrt{(1 - d_1)^2 + (1 - d_2)^2 + \dots + (1 - d_n)^2}}{\sqrt{n}} \quad (3)$$

Where the level of financial inclusion is considered high when $0,5 \leq IIF_i \leq 1$, moderate for the interval $0,3 \leq IIF_i < 0,5$, and low when the values fall within $0 \leq IIF_i < 0,3$.

3. METHODOLOGICAL FRAMEWORK FOR THE EVALUATION: DEFINITION OF THE SAMPLE AND THE STUDY PERIOD

According to the systematic review conducted by Samputra (2023), more than 20 indicators and variables are frequently used in empirical analyses of financial inclusion. The examination of the references shows that 10 contributions focus on the penetration dimension, often measured by the number of bank accounts per 1,000 adults, as well as by the number of internet and mobile phone subscribers. Availability appears in 14 empirical assessments, where the most frequently used variables include the number of ATMs per 100,000 adults or per 1,000 km², and/or the number of bank employees per customer. As for accessibility, this dimension is present in 17 studies, where access is examined, among other indicators, through the number of bank branches per 100,000 adults, the percentage of account holders (aged 15+) in a formal financial institution, or the percentage of debit/credit card holders. Conversely, usage appears in 11 articles and is represented by variables such as the volume of credit and deposits, the number of loans per 1,000 people, or the number of borrowers per 1,000 adults (Samputra, 2023). For our case study, we retained three variables for each dimension, in line with the existing literature and in accordance with the methodological specifications of the empirical works of Sarma (2008), Arora (2010), and Samputra (2023).

Dimension	Variables	Definition

Access/ Penetration	Number of commercial bank branches per 100,000 adults	Presence of commercial bank branches serving the population aged 15 and above.
Availability	Number of Automated Teller Machines (ATMs) per 1,000 km ²	Geographic coverage of automated cash dispensers within each territorial area.
Usage	Domestic credit to the private sector (% of GDP)	Use of financial resources provided by the banking sector to the benefit of the private sector, expressed as a percentage of GDP.

*Table 1. Synoptic Presentation of Financial Inclusion Variables
(Source: Authors' elaboration)*

To assess this dynamic, the calculation of the Financial Inclusion Index (FII) will cover all countries on the African continent, ensuring the reliability and consistency of the data used for the dimensions mentioned above. To avoid any biased interpretation of the results, the construction of the database adheres to international quality standards, which require compliance with certain fundamental criteria and statistical rules. These include “availability”, referring to the existence of country-level aggregated data. This criterion is followed by “continuity” of the series to prevent statistical breaks or truncated data. Additionally, “homogeneity” of data units and statistical measures is essential to build a coherent database. Finally, the “reliability” of institutional sources is a key criterion for scientific rigor, ensuring that the data can be verified and audited. Following this normative verification, the sample delimitation can be organized according to a regional distribution, encompassing a total of 47 territories², representing approximately 87% geostatistical coverage of the continent, over the study period from 2013 to 2021.

North Africa	West Africa	East Africa	Central Africa	Southern Africa
Algeria	Benin	Burundi	Angola	South Africa
Egypt	Burkina Faso	Comoros Islands	Cameroon	Botswana
Libya	Cabo Verde	Djibouti	Equatorial Guinea	Eswatini
Morocco	Côte d'Ivoire	Kenya	D. R. of the Congo	Lesotho
Tunisia	Gambia	Madagascar	Congo	Malawi
	Ghana	Mauritius	São Tomé and Príncipe	Mozambique
	Guinea	Uganda	Chad	Namibia
	Guinea-Bissau	Rwanda		Zambia
	Liberia	Seychelles		Zimbabwe
	Mali	South Sudan		
	Mauritania	Tanzania		
	Niger			
	Nigeria			
	Senegal			
	Togo			

*Table 2. Summary of the Country Sample
(Source: Prepared by the authors)*

Due to the periodicity of the surveys, the construction of this African continental analysis database relied on the exploration of complementary sources in addition to UN platforms, notably African central banks, to address gaps caused by discontinuities or censored data, thus resulting in a panel comprising 1,269 observations³.

² The continent comprises 54 independent economies. The countries not included in the database are: Eritrea; Ethiopia; Gabon; Central African Republic; Sierra Leone; Somalia; Sudan.

³ Some observations, representing less than 0.15% of the total (i.e., 2 out of 1,269 observations), were estimated using conventional smoothing methods, notably the **Compound Annual Growth Rate (CAGR)**.

4. ASSESSMENT OF FINANCIAL INCLUSION POLICIES IN AFRICA: STRATEGIC AND MONOGRAPHIC ANALYSIS

Nearly 2.5 billion adults worldwide remain unbanked, according to GSMA surveys. Nevertheless, supranational initiatives in financial development have helped reduce banking exclusion and facilitate access to financial services. To evaluate the effectiveness of inclusive finance, a comprehensive and rigorous assessment of the implementation of National Financial Inclusion Strategies (NFIS) in Africa is essential, highlighting the pitfalls and obstacles that hinder the successful execution of international initiatives.

4.1 Statistical Analysis of Banking Data

Before providing explanations regarding the implementation status of NFIS, statistical processing is an essential step to gain a general understanding of the structure, characteristics, and The components of the collected database show the following statistics. The average number of commercial bank branches per 100,000 adults is 13.52 in North Africa, 6.5 in West Africa, 13.87 in East Africa, 6.48 in Central Africa, and 6.76 in Southern Africa. The average number of Automated Teller Machines (ATMs) per 100,000 adults is 8.94 in North Africa, 6.75 in West Africa, 43.17 in East Africa, 5.50 in Central Africa, and 7.43 in Southern Africa. Regarding the average level of domestic credit provided by the banking sector (% of GDP), it is 38.05% in North Africa, 20.06% in West Africa, 27.57% in East Africa, 14.19% in Central Africa, and 32.05% in Southern Africa.

	Number of branches per 100,000 adults	Number of ATMs per 1,000 km ²	Credit to the private sector (% of GDP)
Descriptive Statistics			
<i>North Africa</i>	Mean (μ)	13.52	8.94
	Max	25.05	19.34
	Min	4.33	0.1
	Standard Deviation (σ)	7.86	7.31
<i>West Africa</i>	Mean (μ)	6.50	6.75
	Max	32.09	51.61
	Min	1.56	0.09
	Standard Deviation (σ)	6.86	11.56
<i>East Africa</i>	Mean (μ)	13.87	43.17
	Max	163.92	228.57
	Min	1.35	0.05
	Standard Deviation (σ)	22.56	73.96
<i>Central Africa</i>	Mean (μ)	6.48	5.5
	Max	31.27	42.71
	Min	0.42	0.04
	Standard Deviation (σ)	7.88	10.65
<i>Southern Africa</i>	Mean (μ)	6.76	7.43
	Max	15.53	22.62
	Min	2.00	0.69
	Standard Deviation (σ)	3.36	7.33
Inferential Statistics			
Skewness (γ_1)	6.37	4.66	1.88
Kurtosis (γ_2)	71.43	25.13	6.68

*Table 3. Statistical Processing of the Data
(Source: Authors' calculation).*

Given the heterogeneity of the territorial zones evaluated in Africa, the statistical distribution of the database appears relatively stable, despite certain outliers, as suggested by the central

tendency and dispersion indicators. However, the skewness and kurtosis coefficients are positive, confirming a right-skewed distribution with heavier tails and peaks, i.e., a leptokurtic statistical profile, which is very common in finance. The proposed index calculation provides a fairly comprehensive view of the financial inclusion situation for the sample studied.

4.2 Results of the Financial Inclusion Index: Score Ranking

After a recession caused by the Covid-19 pandemic, African economies have adapted to these significant challenges, with real GDP growth reaching 4.3% in 2021 compared to an average of 3.2% between 2015 and 2019. Within this context, several actions and strategies have been implemented in Africa to promote financial inclusion as part of economic recovery and social progress, while reducing access inequalities.

According to the statistical compilation of the IIFt index, the top five economies on the continent are: Mauritius, which occupies the 1st rank almost throughout the analyzed period with an average inclusion index of 0.62; Seychelles in 2nd place, achieving notable performance with an average inclusion score of 0.51; followed by Cape Verde in 3rd place (0.43), Morocco in 4th place (0.34), and Tunisia in 5th place (0.32).

Country	Average Score	Rank	Country	Average Score	Rank
Mauritius	0,62	1	Ghana	0,09	25
Seychelles	0,51	2	Lesotho	0,09	26
Cape Verde	0,43	3	Nigeria	0,09	27
Morocco	0,34	4	Côte d'Ivoire	0,09	28
Tunisia	0,32	5	Comoros	0,08	29
São Tomé and Príncipe	0,27	6	Gambia	0,08	30
South Africa	0,27	7	Zimbabwe	0,08	31
Namibia	0,23	8	Benin	0,07	32
Burundi	0,17	9	Equatorial Guinea	0,07	33
Botswana	0,16	10	Zambia	0,06	34
Kenya	0,14	11	Uganda	0,06	35
Egypt	0,13	12	Liberia	0,06	36
Eswatini	0,13	13	Guinea-Bissau	0,06	37
Mauritania	0,13	14	Tanzania	0,05	38
Libya	0,12	15	Cameroon	0,05	39
Togo	0,12	16	Madagascar	0,05	40
Senegal	0,12	17	DR Congo	0,04	41
Rwanda	0,12	18	Malawi	0,04	42
Djibouti	0,11	19	Guinea	0,04	43
Angola	0,11	20	Niger	0,04	44
Mali	0,11	21	Chad	0,03	45
Mozambique	0,11	22	Republic of Congo	0,03	46
Algeria	0,10	23			
Burkina Faso	0,10	24	South Sudan	0,01	47

*Table 4. Financial Inclusion Index Results between 2013 and 2021
(Source: Authors' calculation).*

At the 47th rank, the economy of South Sudan occupies the last position, with average inclusion scores close to zero (0.01). These results can be explained, on the one hand, by the successive political and economic crises experienced by the country, and on the other hand, by institutional instability. Indeed, the overall scores obtained are broadly consistent with those of Ngono (2020), who applied Sarma's method to 11 Sub-Saharan African countries, and with Tram, T. X. H., et al. (2023), whose approach relies on Principal Component Analysis (PCA) for 41 developed countries.

The observed rankings can be explained not only by aspects related to the financial and banking systems but also by the macroeconomic, demographic, and geographic context. The

performances can be presented in a spatio-temporal distribution across the African continent (see Appendix 1). The map below visualizes the ranking obtained using the method proposed by M. Sarma (2008), applied to the 47 countries studied.

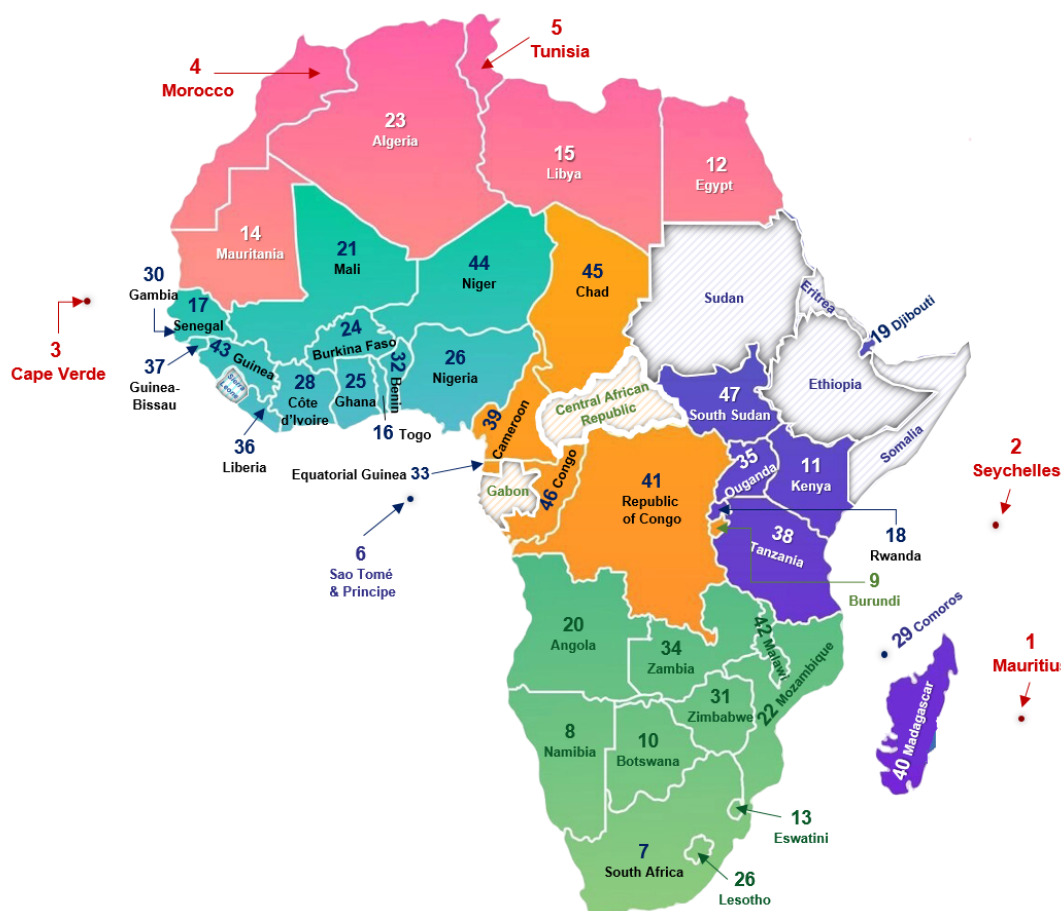


Figure 3. Geographic Ranking of Financial Inclusion
(Source: Map design by the authors)

Financial inclusion in Africa has certainly progressed over the study period, yet significant efforts remain necessary to increase the participation of disadvantaged groups in the financial system. Today, there is a real shift in commercial transactions thanks to Mobile Banking. However, with the rise of the digital economy, governments have had to revise their tax systems by introducing new taxes on digital payments, as post-Covid financial statistics showed that over 70% of international transactions in Africa are now conducted via mobile money. In this context, taxing digital operations may hinder access to financial services. Some regions of the continent continue to experience geopolitical crises and armed conflicts⁴ (South Sudan, DR Congo, Mali, Mozambique, Burkina Faso, and Cameroon), which reduce livelihoods, exacerbate precarity and poverty, and intensify food insecurity among vulnerable populations. Despite the consequences of global crises (subprime, Covid-19, water stress, etc.) that have shaken world stability, these exogenous shocks have provided an opportunity to consider potential risks threatening Africa's real and financial sectors. Consequently, new regulations governing the operation of financial sectors have emerged to protect against economic and financial uncertainty. Basel prudential rules have been

⁴ There are currently 15 armed conflicts in Africa.

implemented alongside IAS/IFRS accounting standards, and Financial Action Task Force (FATF) standards have been applied to combat all forms of illicit financing, including terrorism and money laundering (AML/CFT). Although considerable efforts have been made in Africa to modernize financial and banking infrastructures, the continent still faces structural challenges. Access to services remains highly unequal across regions, and the predominance of the informal sector exacerbates the gap between formal banking and effective financial inclusion.

5. ANALYSIS AND INTERPRETATION OF INDEX RESULTS

African economies have undergone several structural reforms aimed primarily at joining the ranks of emerging countries and pursuing a trajectory of sustainable and prosperous development. Based on the results of the Financial Inclusion Index, we propose below an examination of the economic and financial landscape of the five leading and pioneering financial inclusion models in Africa, to better understand the role of National Financial Inclusion Strategies (NFIS) in these countries and ultimately identify the keys to their success.

5.1. Mauritian Financial Inclusion Model

For the Mauritian economy (ranked 1st), the continent's leader, the achievements in financial inclusion are primarily attributable to the country's geographic and demographic characteristics. Mauritius is an island nation with an area of 2,040 km² and a population of 1.26 million, with females representing 50.57% and males 49.43%, a population density of approximately 621 inhabitants/km², and a rural population of 749,824 (urbanization level: 40.7% versus 59.3% rural). Additionally, Mauritius ranks 62nd globally in human development, with one of the highest education levels on the continent. These territorial and socio-demographic characteristics constitute advantages that facilitate access to and use of financial services, both in terms of branch coverage and ATMs. At the macroeconomic level, thanks to sectoral diversification⁵ efforts and institutional measures to stimulate demand, the country has strengthened its resilience to external shocks and reduced the unemployment rate to 8.6%, while enhancing women's economic empowerment. This has encouraged the use of financial services for investment and savings, with 39% of adults taking out loans and 55% saving their capital. Mauritius has one of the highest banking penetration rates in Africa (95%), with 91% of adults in 2021 using formal or informal financial services, either through a bank account (4% inactive) or mobile money. The banking sector is advanced compared to other sub-Saharan countries, comprising 18 banks, 17 leasing and insurance companies, a microfinance institution, and nine housing finance institutions. Banking and financial services activity is mainly credit-driven, with domestic credit to the private sector reaching 86.41% of GDP. As one of the key economic sectors, the assets held by the banking sector, mostly foreign-owned, amounted to 394% of GDP in 2020. The UNCTAD recognizes Mauritius as a continental financial hub and a gateway between Africa and Asia, supported by a regulatory framework integrating fintech innovations, which have seen a demand growth of 25% in recent years. Despite the sector's competitiveness, SME financing remains more difficult than for individuals.

5.2. Seychellois Financial Inclusion Model

Regarding the Seychelles (ranked 2nd), the country experienced a strong economic rebound following the 2008 crisis. It is among the African economies with the highest real GDP growth rates, ranging between 5% and 6.7%. Inflation is manageable at around 2.5%. The Seychelles enjoys high per capita income relative to the region, about USD 26,214 in PPP terms, and ranks

⁵ Before the implementation of structural adjustment programs, the former Mauritian economy was based solely on monoculture activities, namely sugar production.

high in human development indices. According to the Doing Business ranking, it is among the most competitive and attractive African economies (96th). The banking sector consists of six banks, 48 financial service providers, and two insurance companies, with total banking assets representing roughly 99% of GDP. More than 90% of adults hold a bank account, with only 2.8% excluded from formal financial services. Like Mauritius, Seychelles benefits from its small size and insular geography, which support financial inclusion. Financial literacy is nearly universal, reducing financial illiteracy significantly. However, financing opportunities for SMEs remain limited due to high costs and administrative burdens. Since 2011, the country has implemented a legislative framework promoting new financial products. In line with ongoing financial system reforms, Seychelles aims to establish innovative financing mechanisms that integrate ecological considerations, balancing economic development goals with climate change mitigation.

5.3. Cape Verdean Financial Inclusion Model

Part of the Greater Sahel region, Cape Verde (ranked 3rd) has experienced rapid growth in its banking market over the past decade. It is no longer considered a Least Developed Country (LDC), with a per capita GDP exceeding USD 3,600 and a low inflation rate of 1.8%. Demographically, Cape Verde had 593,149 inhabitants in 2022, with an unemployment rate of 13.6%. The financial sector consists of seven conventional banks, two insurance groups, mobile payment operators, microfinance institutions, and a stock exchange. Thanks to the rapid development of digital financial services, subscription rates have reached around 70%, supported by mobile phone penetration. The sector's assets represent over 130% of GDP. Domestic credit to the private sector exceeds 40% of GDP, above the lower-middle-income country average. Cape Verde does not yet have a formal, explicit national financial inclusion strategy, aside from initiatives led by the Banco de Cabo Verde, which integrates the promotion of the financial ecosystem into sectoral plans. These plans aim to improve both cognitive and behavioral aspects (knowledge and attitudes) of the adult population, including migrants and residents, in the financial domain.

Strategic Plan	Horizon	Targeted Dimensions	Strategic Axes and Implemented Measures
Sustainable Development Strategic Plan (PEDS)	2017 – 2021	Usage	- Improve remittance mobilization - Enhance investment opportunities
		Access	- Provide benefits and fiscal incentives for financial savings
		Availability	- Strengthen the availability of financial products
National Financial Education Plan (PNEF)	2021 – 2024	Access	- Improve financial planning to encourage savings - Awareness of available financial products - Promote a culture of responsible credit use
		Usage / Quality	- Optimal use of digital channels
		Well-being	- Consumer protection
National Strategy on Migration and Development (ENED)	2014	Usage	- Facilitate remittance transfers (cash or bank account)
		Access	- Enhance capital attractiveness

Table 5. Role of Financial Inclusion in Cape Verdean Strategic Plans

(Source: Prepared and consolidated by the authors)

Among the targets of these various plans are the automation of systems and the anchoring of digitalization, the implementation of new payment mechanisms, the strengthening of awareness

through financial education campaigns, the integration of electronic payments into the informal sector, and the adaptation of the regulatory framework to the requirements of digital finance. Based on these strategic documents, Cape Verde has 157 physical access points for 382,000 adults, i.e., 41 points per 100,000 adults, indicating that 83% of the Cape Verdean population is banked and financially included. The deployment of these plans has also allowed an annual increase of 10% in the use of electronic payment systems, with the issuance of 271,854 payment cards, including 15,000 active international cards, 70% of which were used for commercial transactions and 30% for ATM withdrawals. Despite a banking penetration of 83%, project holders still face obstacles in accessing credit to meet their financing needs due to risk aversion (International Fund for Agricultural Development, 2022).

5.4. Moroccan Financial Inclusion Model

Regarding the Moroccan economy (ranked 4th), the country has undergone several reforms in the financial sector to strengthen banking competitiveness and invigorate the financial hub. The reinforcement of the Central Bank’s independence reflects a long process of institutionalizing the rule of law and consolidating governance and transparency principles. Over the past two decades, reforms in the sector aimed to create a robust and efficient financial system with resilient financial markets, agile and forward-looking monetary policies, and more flexible exchange rate policies. The pursuit of efficiency and attractiveness in the financial sector remains a key concern for public authorities to ensure the transition and modernization of the financial system, notably through the alignment of national regulations with European Union (EU) standards and Basel rules, which require the implementation of macroprudential supervision and risk prevention mechanisms⁶. Indeed, mobilizing savings and allocating resources, Being key components of the productive system, they have been strengthened through the expansion and diversification of financial mechanisms and instruments, notably the issuance of Sukuks and the initiation of Real Estate Collective Investment Schemes (OPCI) to meet financing needs. In the same vein, this legal framework has promoted the broadening of the scope of financial activities to ensure optimal financial inclusion through a new range of savings products and banking services, supporting efforts to improve access to credit for disadvantaged social groups. From the outset, the reforms aimed to deepen the financial system (institutions and markets) to develop the national economic potential and reaffirm the country’s strategic position as a regional financial hub. Regarding financial markets, the transformation and modernization of the Moroccan financial center, through the creation of “Casablanca Finance City,” aligned with the vision of strengthening local economic competitiveness and enhancing the business climate to attract foreign capital (Ministry of Economy and Finance, 2016). It was only from 2018 that the SNIF emerged, injecting a new dynamic that mobilized actors within the financial ecosystem to tackle socioeconomic obstacles and offer a broad range of financial products and services tailored to different population segments. This led to the creation of the Financial Education Foundation, the institutionalization of a working group responsible for coordinating the SNIF, led by the Central Bank and the Ministry of Economy and Finance, and, finally, the establishment of an SME Observatory.

Levers	Actions and Measures

⁶ Under banking legislation, Law No. 103-12 on credit institutions and similar organizations enshrines the implementation of financial control instruments under the authority of an institutional committee composed of the Central Bank, the Moroccan Capital Market Authority (AMMC), and the Insurance and Social Welfare Supervisory Authority (ACAPS). This committee ensures coordination and is responsible for monitoring systemic risks, including macroeconomic, real estate, liquidity, credit and contagion risks.

Mobile Payment	- Securing technological choices to ensure maximum accessibility and availability; - Implementing communication campaigns.
Microfinance	- Diversifying the sector's offerings; - Setting a ceiling amount for microcredit; - Establishing fiscal and non-fiscal incentives to accelerate microfinance penetration in target segments.
Inclusive Insurance	- Implementing a coverage and compensation system under the micro-insurance label for hospitalization, temporary death, borrower death, personal accident, property damage, assistance, and micro-savings.
Banking Offers	- Developing products tailored to target populations; - Implementing measures to expand the banking network in rural areas; - Strengthening collaboration with civil society to better identify population constraints and needs; - Ensuring both physical and digital measures for People with Disabilities (PWD) or reduced mobility.
Financing Tools	- Setting up Credit Information Bureaus (BIC); - Creating the National Electronic Registry of Movable Securities (RNESM); - Establishing additional financing mechanisms for very small enterprises (VSEs); - Providing incentives for startup financing.
Financial Education	- Developing adapted educational resources; - Strengthening capacities by gender, socio-professional category, and geographic area.

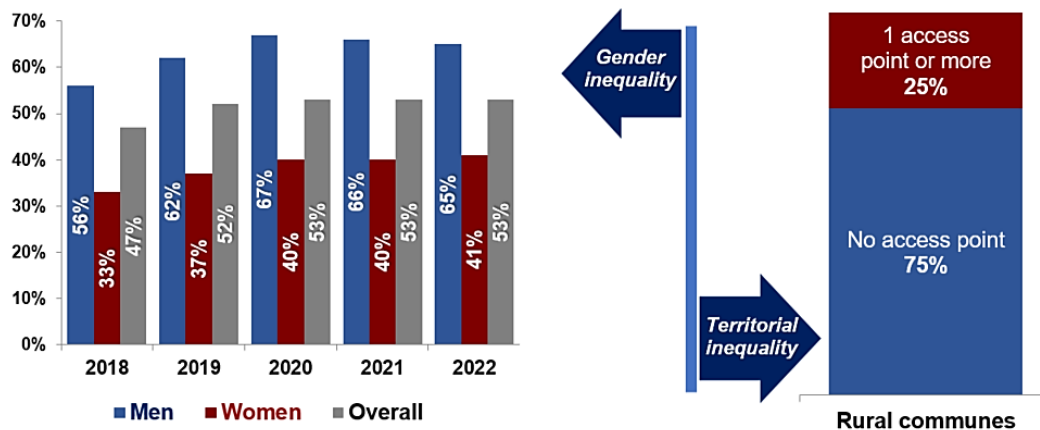
Table 6. Main Strategic Levers of the National Financial Inclusion Strategy (SNIF) in Morocco

(Source: Consolidated by the authors from Bank Al-Maghrib reports)

From an operational standpoint, the implementation of the SNIF has had a notable impact on access to the financial sector, particularly in terms of gender parity. In 2022, the proportion of account holders was approximately 41% female and 65% male, representing a significant increase compared to 2018, which recorded about 33% for women and 56% for men (cf. Graph 1). In the same year, the majority of bank accounts were held by the population segment around 60 years of age, with 81% of men and 53% of women in this age group holding accounts. This demographic distribution appears consistent with banking data, as individuals aged 60 and above generally maintain accounts for receiving pensions, retirement benefits, or accessing mutualized coverage provided by credit institutions. In contrast, the resident adult population accounts for only 53% of the total, equivalent to 14.2 million people, of whom 645,000 were newly⁷ banked in 2022.

Graph following on the next Page

⁷ First-time banked individuals correspond to those who had the opportunity to open a bank account for the first time.



Graph 1. Bank Account Ownership Rates by Gender and Area
(Source : Ayachi, C., & Mossadak, A. (2024))

Despite these figures reflecting the penetration dimension as defined by Sarma (2008), approximately 49% of individuals hold only one bank account, while 28.1% hold up to two accounts and 22.2% possess three or more accounts. According to the Findex survey, the main barriers to financial inclusion are insufficient funds, reported by 50% of adults. Access costs and geographic distance were cited by relatively few respondents. Regarding religious reasons, only 3% of adults consider holding a bank account prohibited according to their beliefs.

5.5. Tunisian Financial Inclusion Model

Concerning the Tunisian economy (ranked 5th), the country has implemented for more than three decades a comprehensive set of support instruments to financially assist private sector operators, with the aim of enhancing sectoral productivity and promoting employment and self-employment. Economically, Tunisia experienced a relatively low growth rate of 2.5% in 2021, accompanied by an inflation rate of 8.3%. The Tunisian financial landscape consists of 37 resident institutions (banks, leasing companies, factoring companies, and investment banks) and 8 non-resident institutions. Indeed, the sector only underwent significant modernization starting in 2015, as banks had largely suffered from an imbalance between commercial credits and deposits. However, Tunisia has established a strategic framework for implementing financial inclusion, aiming to increase the use of digital financial services among disadvantaged social groups, particularly in rural and peri-urban areas, and to encourage the use of formal transactional channels. Based on an average financial inclusion rate of 27% in 2014, the Tunisian model drew inspiration from Western experiences and international best practices in microfinance. Moreover, the SNIF planned over the 2018–2022 period by the Central Bank of Tunisia defines five strategic components, namely:

Domain	Strategic Axis
Digital Finance	- Strengthening access to and use of electronic accounts;
Microinsurance	- Protection of low-income individuals and very small enterprises (VSEs) against hazards and risks;
Refinancing	- Expanding citizens' access to services at lower costs;
Social and Solidarity Economy	- Integrating civil society actors, such as associations and cooperatives, into the financial system;
Financial Education	- Improving individuals' decision-making capacities to effectively manage their own financial needs.

Table 7. Core Strategic Axes of SNIF in Tunisia
(Source: Prepared by the author).

Thanks to this strategy, the proportion of the adult population holding a formal account in a financial institution is approximately 27.3%. The network of bank branches is distributed across 1,701 establishments, representing one access point for every 6,558 inhabitants across all governorates of the country. In contrast, 8% of the adult population has obtained credit from a formal banking institution. Overall, the implementation of SNIF reflects an increasing commitment by African states to strengthen economic resilience and lay the foundations for inclusive growth, capable of fostering prosperity and full employment. Given the structural challenges, the effectiveness of public action in financial inclusion requires improved governance and policy convergence, as well as the adaptation of strategic frameworks to local realities to ensure sustainability and socio-economic impact.

6. CONCLUSION

Beyond its cultural and ethnic diversity and natural wealth, the African continent is experiencing a growing attraction of capital flows in the financial sector, characterized by a strong trend in the localization of banking firms, which accounted for nearly 40% of total investments in Africa in 2022 (EIB, 2023). Despite the attractiveness of this sector, the use of inclusive financial services by the African population remains unequal and highly differentiated across the regions studied. In this context, National Financial Inclusion Strategies (SNIF) represent an important lever of public policy to improve access to financing and fully exploit the opportunities offered by the banking sector. However, the assessment of SNIF's effectiveness shows that, despite the progress made, African authorities should continue and intensify efforts to further embed a culture of financial and banking inclusion, particularly among the most disadvantaged social groups. The results of the Financial Inclusion Index indicate that island states demonstrate remarkable performance in terms of economic and financial inclusion. Mauritius ranks first with an average inclusion index of 0.62, followed by Seychelles in second place with an average inclusion score of 0.51. Cape Verde occupies the third position with an index of 0.43, Morocco is in fourth place (0.34), and Tunisia in fifth (0.32). For other countries on the continent, the underperformance observed can mainly be explained by a mismatch between the economic-institutional framework and the financial system, where financial and banking activity remains dominated by monopolistic positions, limiting sector development and calling for liberalization reforms to diversify banking services and strengthen inclusion.

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APPENDIX

Countries	2013		2014		2015		2016		2017		2018		2019		2020		2021	
	Index	Rank	Index	Rank	Index	Rank	Index	Rank	Index	Rank	Index	Rank	Index	Rank	Index	Rank	Index	Rank
NORTH AFRICA																		
Algeria	0,080	27	0,085	24	0,091	22	0,095	21	0,102	22	0,134	20	0,133	20	0,128	19	0,095	20
Egypt	0,111	15	0,111	16	0,111	17	0,139	11	0,123	14	0,145	17	0,151	14	0,148	12	0,135	10
Libya	0,119	14	0,141	11	0,142	10	0,131	12	0,113	18	0,135	19	0,138	19	0,147	13	0,051	34
Morocco	0,335	4	0,336	4	0,325	4	0,338	4	0,334	4	0,399	4	0,391	4	0,373	4	0,252	6
Tunisia	0,288	6	0,298	6	0,299	6	0,318	5	0,329	5	0,389	5	0,377	5	0,364	5	0,258	5
WEST AFRICA																		
Benin	0,068	32	0,069	32	0,066	32	0,067	31	0,067	32	0,088	32	0,094	31	0,072	33	0,059	29
Burkina Faso	0,072	29	0,084	25	0,086	25	0,089	24	0,096	24	0,120	24	0,124	21	0,108	22	0,102	18
Cabo Verde	0,423	3	0,420	3	0,408	3	0,415	3	0,408	3	0,489	3	0,477	3	0,474	3	0,341	3
Côte d'Ivoire	0,070	30	0,072	30	0,076	28	0,079	26	0,090	25	0,115	25	0,111	26	0,101	24	0,083	24
Gambia	0,088	24	0,079	28	0,076	29	0,063	33	0,067	33	0,091	31	0,090	32	0,084	31	0,055	32
Ghana	0,086	25	0,084	26	0,088	23	0,085	25	0,089	27	0,125	22	0,120	23	0,090	29	0,074	27
Guinea	0,028	43	0,038	42	0,042	41	0,035	41	0,036	43	0,050	41	0,051	40	0,044	41	0,030	43
Guinea-Bissau	0,051	37	0,055	35	0,036	43	0,027	45	0,052	38	0,073	34	0,079	33	0,074	32	0,057	31
Liberia	0,054	35	0,051	37	0,048	37	0,045	39	0,063	34	0,085	33	0,072	34	0,061	36	0,046	37
Mali	0,090	23	0,096	22	0,103	20	0,109	20	0,104	21	0,131	21	0,123	22	0,110	21	0,100	19
Mauritania	0,098	20	0,101	20	0,104	19	0,109	19	0,116	17	0,172	11	0,171	11	0,153	11	0,103	17
Niger	0,036	42	0,036	43	0,034	44	0,031	43	0,037	42	0,043	43	0,047	41	0,042	42	0,042	40
Nigeria	0,090	22	0,096	23	0,088	24	0,091	23	0,089	26	0,097	30	0,101	30	0,093	28	0,077	26
Togo	0,109	16	0,107	19	0,117	14	0,126	13	0,124	12	0,148	15	0,146	17	0,129	18	0,105	16
Senegal	0,106	17	0,111	17	0,109	18	0,112	18	0,123	13	0,155	14	0,148	15	0,131	16	0,112	13
EAST AFRICA																		
Burundi	0,078	28	0,077	29	0,064	33	0,065	32	0,129	11	0,248	9	0,272	7	0,281	6	0,329	4
Comoros Is.	0,070	31	0,072	31	0,074	30	0,076	29	0,083	29	0,100	29	0,103	29	0,095	27	0,083	23
Djibouti	0,093	21	0,097	21	0,096	21	0,091	22	0,107	20	0,143	18	0,152	13	0,126	20	0,084	22
Kenya	0,120	13	0,140	12	0,142	11	0,141	10	0,134	10	0,160	12	0,152	12	0,138	15	0,115	12

Madagascar	0,038	41	0,041	41	0,040	42	0,036	40	0,046	40	0,062	39	0,066	37	0,066	34	0,062	28
Mauritius	0,679	1	0,657	1	0,647	1	0,636	1	0,619	1	0,652	1	0,633	1	0,603	2	0,474	1
Uganda	0,057	34	0,057	34	0,055	35	0,050	35	0,054	36	0,069	37	0,069	35	0,061	35	0,052	33
Rwanda	0,104	18	0,108	18	0,116	15	0,116	15	0,121	15	0,147	16	0,140	18	0,129	17	0,109	14
Seychelles	0,435	2	0,460	2	0,458	2	0,482	2	0,519	2	0,583	2	0,624	2	0,645	1	0,427	2
South Sudan	0,005	47	0,006	47	0,004	47	0,005	47	0,005	47	0,006	47	0,007	47	0,008	47	0,002	47
Tanzania	0,051	36	0,053	36	0,054	36	0,049	36	0,053	37	0,065	38	0,064	39	0,055	39	0,047	36
CENTRAL AFRICA																		
Angola	0,126	11	0,120	14	0,130	12	0,116	17	0,107	19	0,123	23	0,119	24	0,095	26	0,045	38
Cameroon	0,047	39	0,049	38	0,048	38	0,045	38	0,049	39	0,069	36	0,065	38	0,058	37	0,058	30
Eq. Guinea	0,042	40	0,047	39	0,062	34	0,068	30	0,075	31	0,104	28	0,105	28	0,087	30	0,048	35
RDC	0,024	44	0,032	44	0,043	40	0,048	37	0,046	41	0,049	42	0,045	42	0,048	40	0,043	39
Congo	0,023	45	0,025	45	0,025	45	0,025	46	0,028	46	0,039	46	0,038	45	0,039	44	0,024	46
São Tomé & P	0,318	5	0,304	5	0,302	5	0,275	6	0,278	6	0,294	7	0,269	8	0,231	9	0,153	9
Chad	0,017	46	0,022	46	0,020	46	0,030	44	0,035	45	0,042	45	0,036	46	0,031	46	0,036	41
SOUTHERN AFRICA																		
South Africa	0,253	7	0,264	7	0,259	7	0,264	7	0,262	7	0,305	6	0,295	6	0,270	7	0,216	7
Botswana	0,149	9	0,148	9	0,148	9	0,144	9	0,144	9	0,192	10	0,191	10	0,178	10	0,125	11
Eswatini	0,121	12	0,124	13	0,124	13	0,122	14	0,120	16	0,156	13	0,147	16	0,138	14	0,107	15
Lesotho	0,085	26	0,083	27	0,078	27	0,077	28	0,087	28	0,111	27	0,113	25	0,101	25	0,090	21
Malawi	0,049	38	0,044	40	0,045	39	0,034	42	0,035	44	0,042	44	0,043	43	0,039	43	0,031	42
Mozambique	0,099	19	0,113	15	0,115	16	0,116	16	0,097	23	0,115	26	0,107	27	0,102	23	0,082	25
Namibia	0,221	8	0,226	8	0,227	8	0,246	8	0,208	8	0,263	8	0,262	9	0,242	8	0,184	8
Zambia	0,060	33	0,065	33	0,069	31	0,054	34	0,057	35	0,070	35	0,067	36	0,057	38	0,029	45
Zimbabwe	0,141	10	0,143	10	0,084	26	0,078	27	0,081	30	0,056	40	0,039	44	0,038	45	0,030	44

*Table 1. Results of the Financial Inclusion Index
(Source: Authors' calculations)*

	2013	2014	2015	2016	2017	2018	2019	2020	2021	Average Inclusion Index	Average Ranking
Mauritius	0,68	0,66	0,65	0,64	0,62	0,65	0,63	0,60	0,47	0,62	1
Seychelles	0,43	0,46	0,46	0,48	0,52	0,58	0,62	0,65	0,43	0,51	2
Cabo Verde	0,42	0,42	0,41	0,41	0,41	0,49	0,48	0,47	0,34	0,43	3
Morocco	0,33	0,34	0,32	0,34	0,33	0,40	0,39	0,37	0,25	0,34	4
Tunisia	0,29	0,30	0,30	0,32	0,33	0,39	0,38	0,36	0,26	0,32	5
São Tomé and Príncipe	0,32	0,30	0,30	0,27	0,28	0,29	0,27	0,23	0,15	0,27	6
South Africa	0,25	0,26	0,26	0,26	0,26	0,31	0,29	0,27	0,22	0,27	7
Namibia	0,22	0,23	0,23	0,25	0,21	0,26	0,26	0,24	0,18	0,23	8
Burundi	0,08	0,08	0,06	0,06	0,13	0,25	0,27	0,28	0,33	0,17	9
Botswana	0,15	0,15	0,15	0,14	0,14	0,19	0,19	0,18	0,12	0,16	10
Kenya	0,12	0,14	0,14	0,14	0,13	0,16	0,15	0,14	0,11	0,14	11
Egypt	0,11	0,11	0,11	0,14	0,12	0,15	0,15	0,15	0,13	0,13	12
Eswatini	0,12	0,12	0,12	0,12	0,12	0,16	0,15	0,14	0,11	0,13	13
Mauritania	0,10	0,10	0,10	0,11	0,12	0,17	0,17	0,15	0,10	0,13	14
Libya	0,12	0,14	0,14	0,13	0,11	0,14	0,14	0,15	0,05	0,12	15
Togo	0,11	0,11	0,12	0,13	0,12	0,15	0,15	0,13	0,10	0,12	16
Senegal	0,11	0,11	0,11	0,11	0,12	0,16	0,15	0,13	0,11	0,12	17
Rwanda	0,10	0,11	0,12	0,12	0,12	0,15	0,14	0,13	0,11	0,12	18
Djibouti	0,09	0,10	0,10	0,09	0,11	0,14	0,15	0,13	0,08	0,11	19
Angola	0,13	0,12	0,13	0,12	0,11	0,12	0,12	0,10	0,04	0,11	20
Mali	0,09	0,10	0,10	0,11	0,10	0,13	0,12	0,11	0,10	0,11	21
Mozambique	0,10	0,11	0,12	0,12	0,10	0,12	0,11	0,10	0,08	0,11	22
Algeria	0,08	0,08	0,09	0,09	0,10	0,13	0,13	0,13	0,10	0,10	23
Burkina Faso	0,07	0,08	0,09	0,09	0,10	0,12	0,12	0,11	0,10	0,10	24
Ghana	0,09	0,08	0,09	0,08	0,09	0,12	0,12	0,09	0,07	0,09	25
Lesotho	0,08	0,08	0,08	0,08	0,09	0,11	0,11	0,10	0,09	0,09	26
Nigeria	0,09	0,10	0,09	0,09	0,09	0,10	0,10	0,09	0,08	0,09	27
Côte d'Ivoire	0,07	0,07	0,08	0,08	0,09	0,12	0,11	0,10	0,08	0,09	28
Comoros	0,07	0,07	0,07	0,08	0,08	0,10	0,10	0,09	0,08	0,08	29
Gambia	0,09	0,08	0,08	0,06	0,07	0,09	0,09	0,08	0,06	0,08	30
Zimbabwe	0,14	0,14	0,08	0,08	0,08	0,06	0,04	0,04	0,03	0,08	31
Benin	0,07	0,07	0,07	0,07	0,07	0,09	0,09	0,07	0,06	0,07	32
Equatorial Guinea	0,04	0,05	0,06	0,07	0,07	0,10	0,11	0,09	0,05	0,07	33
Zambia	0,06	0,07	0,07	0,05	0,06	0,07	0,07	0,06	0,03	0,06	34
Uganda	0,06	0,06	0,06	0,05	0,05	0,07	0,07	0,06	0,05	0,06	35
Liberia	0,05	0,05	0,05	0,04	0,06	0,08	0,07	0,06	0,05	0,06	36
Guinea-Bissau	0,05	0,05	0,04	0,03	0,05	0,07	0,08	0,07	0,06	0,06	37

Tanzania	0,05	0,05	0,05	0,05	0,05	0,07	0,06	0,05	0,05	0,05	38
Cameroon	0,05	0,05	0,05	0,05	0,05	0,07	0,06	0,06	0,06	0,05	39
Madagascar	0,04	0,04	0,04	0,04	0,05	0,06	0,07	0,07	0,06	0,05	40
RDC	0,02	0,03	0,04	0,05	0,05	0,05	0,05	0,05	0,04	0,04	41
Malawi	0,05	0,04	0,05	0,03	0,04	0,04	0,04	0,04	0,03	0,04	42
Guinea	0,03	0,04	0,04	0,03	0,04	0,05	0,05	0,04	0,03	0,04	43
Niger	0,04	0,04	0,03	0,03	0,04	0,04	0,05	0,04	0,04	0,04	44
Chad	0,02	0,02	0,02	0,03	0,04	0,04	0,04	0,03	0,04	0,03	45
Congo	0,02	0,03	0,02	0,03	0,03	0,04	0,04	0,04	0,02	0,03	46
South Sudan	0,00	0,01	0,00	0,01	0,00	0,01	0,01	0,01	0,00	0,01	47

*Table 2. Average Ranking of Financial Inclusion Performance
(Source: Authors' calculations)*

STRATEGIC MAINTENANCE MANAGEMENT IN MANUFACTURING: A PFMEA AND WORKFORCE OPTIMIZATION APPROACH

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ABSTRACT

Effective maintenance management has become an important factor in improving manufacturing reliability, operational efficiency and organizational resilience. This paper analyses the application of Process Failure Mode and Effects Analysis (PFMEA), key performance indicators (KPIs) and workforce optimization methods in manufacturing maintenance systems. The research focuses on identifying critical maintenance risks, improving maintenance performance and optimizing human resource allocation through FTE analysis. The findings indicate that the integration of PFMEA and KPI-based monitoring contributes to improved maintenance planning, reduced operational disruptions and better resource utilization. The paper highlights the importance of strategic maintenance management in achieving sustainable and resilient manufacturing processes.

Keywords: *Management, PFMEA analysis, preventive maintenance, production systems, KPI indicators*

1. INTRODUCTION

Modern manufacturing systems operate in increasingly turbulent and technologically demanding environments characterized by high production intensity, complex machinery and strong pressure toward operational efficiency, cost reduction and process reliability. Under such conditions, maintenance management is no longer perceived solely as a technical support function but increasingly as a strategic organizational activity directly influencing productivity, competitiveness and business continuity (Wireman, 2004). Modern industrial environments are additionally shaped by rapid technological development and continuous market changes that increasingly influence all areas of organizational activity. Technological progress has significantly transformed manufacturing systems, operational processes and organizational management practices. Although modern information technologies and digital tools provide organizations with opportunities to improve operational performance, competitiveness and long-term sustainability, numerous companies continue to experience serious difficulties in adapting to increasingly dynamic market conditions. Investments in technology alone therefore do not guarantee organizational success, particularly when strategic management, operational efficiency and organizational adaptability remain insufficiently developed (Miloloža et al., 2021, p. 9). The growing complexity of manufacturing systems additionally increases the importance of preventive and predictive maintenance approaches aimed at minimizing production interruptions and reducing operational risks. Failures within production systems may generate significant direct and indirect costs through machine downtime, product quality deviations, delayed deliveries and reduced customer satisfaction (Mobley, 2002).

Consequently, organizations increasingly implement systematic maintenance management approaches focused on risk identification, performance measurement and resource optimization. One of the most frequently applied tools for risk identification within maintenance and production systems is Process Failure Mode and Effects Analysis (PFMEA). PFMEA enables organizations to systematically identify potential process failures, assess their severity and prioritize corrective actions according to calculated risk levels (Stamatis, 2003). The method is particularly important within manufacturing systems because it contributes to reducing operational disruptions and improving process reliability through structured preventive activities. At the same time, maintenance effectiveness increasingly depends on the ability of organizations to monitor operational performance through key performance indicators (KPIs). Maintenance KPIs provide measurable information regarding machine availability, maintenance efficiency, downtime duration and workforce productivity, thereby enabling data-driven decision-making processes within maintenance management systems (Parida & Kumar, 2006). In addition to technical and operational aspects, strategic maintenance management also involves workforce planning and optimization. Human resource allocation significantly influences maintenance responsiveness, operational continuity and overall maintenance effectiveness. Workforce optimization methods, including Full-Time Equivalent (FTE) analysis, therefore become important instruments for balancing labour capacities and operational maintenance requirements within manufacturing organizations (Muchiri et al., 2011). The aim of this paper is to analyse the application of PFMEA, KPI-based monitoring and workforce optimization approaches within strategic maintenance management systems in manufacturing organizations. The paper focuses on the interrelationship between risk management, maintenance performance indicators and workforce allocation as integrated dimensions of organizational resilience and operational efficiency.

2. STRATEGIC MAINTENANCE MANAGEMENT IN MANUFACTURING

Maintenance management has evolved significantly during recent decades from reactive repair activities toward integrated strategic systems aimed at improving organizational performance and long-term operational sustainability (Nakajima, 1988). Within modern manufacturing environments, maintenance activities directly influence machine reliability, production continuity, product quality and organizational competitiveness. Traditional reactive maintenance approaches often resulted in increased operational costs and unexpected production interruptions due to unplanned machine failures. Consequently, manufacturing organizations increasingly introduced preventive and predictive maintenance strategies focused on reducing downtime and improving equipment effectiveness (Mobley, 2002). Preventive maintenance refers to scheduled maintenance activities conducted before equipment failure occurs, while predictive maintenance relies on condition monitoring and performance analysis in order to anticipate potential failures before operational disruptions emerge (Wireman, 2004). Such approaches contribute to improved operational reliability and lower maintenance costs over longer periods of time. Strategic maintenance management additionally requires integration between technical maintenance processes and organizational planning mechanisms. According to Muchiri et al. (2011), maintenance systems should be aligned with broader organizational objectives such as productivity growth, cost optimization and operational resilience. The growing importance of resilience within manufacturing organizations additionally intensified the strategic role of maintenance management. Organizational resilience refers to the capability of organizations to resist, adapt and recover from operational disruptions while maintaining core business functions (Hollnagel et al., 2006). Within manufacturing systems, maintenance activities therefore contribute directly to business continuity and operational stability.

Area	Contribution
Operational efficiency	Reduced downtime
Cost management	Lower maintenance costs
Workforce management	Better staff allocation
Organizational resilience	Faster recovery from disruptions
Industry 4.0 integration	Predictive maintenance support

*Table 1: Advantages of Strategic Maintenance Management
(Source: Authors' compilation based on Wireman, 2004; Muchiri et al., 2011)*

3. PFMEA AS A RISK MANAGEMENT TOOL IN MANUFACTURING

Process Failure Mode and Effects Analysis (PFMEA) represents one of the most important tools for identifying and reducing operational risks within manufacturing systems. PFMEA originated from Failure Mode and Effects Analysis (FMEA), a methodology initially developed within aerospace and military industries and later widely adopted across industrial manufacturing sectors (Stamatis, 2003).

PFMEA systematically identifies potential process failures, evaluates their possible effects and determines corrective priorities based on risk assessment criteria. The methodology is based on three principal risk valuation dimensions:

- Severity (S)
- Occurrence (O)
- Detection (D)

The Risk Priority Number (RPN) is calculated using the following formula:

$$RPN = S \times O \times D$$

where:

- S = severity of failure consequences
- O = probability of occurrence
- D = probability of detection

Higher RPN values indicate higher operational risks requiring priority corrective actions (Stamatis, 2003).

Failure mode	Severity (S)	Occurrence (O)	Detection (D)	RPN
Bearing overheating	8	6	4	192
Conveyor stoppage	7	5	3	105
Sensor malfunction	6	4	5	120

*Table 2: Example of PFMEA Calculation
(Source: Authors' calculations based on Stamatis, 2003)*

Table 2 demonstrates that bearing overheating represents the most critical identified risk due to the highest calculated RPN value.

PFMEA contributes to the reduction of operational failures, improvement of preventive maintenance planning, reduction of downtime costs, improvement of process reliability and better allocation of maintenance resources.

Within manufacturing organizations, PFMEA additionally supports strategic decision-making by enabling organizations to identify critical operational weaknesses before severe production disruptions occur (Carlson, 2012).

3.1. Main Steps of PFMEA Analysis

PFMEA implementation within manufacturing systems generally includes several interconnected phases aimed at systematic risk identification and process improvement. According to Stamatis (2003), the main PFMEA steps include:

1. Process identification and mapping
2. Identification of potential failure modes
3. Analysis of possible failure effects
4. Determination of potential causes of failures
5. Evaluation of Severity (S), Occurrence (O) and Detection (D) ratings
6. Calculation of the Risk Priority Number (RPN)
7. Prioritization of corrective actions
8. Implementation of preventive and corrective measures
9. Continuous monitoring and revision of PFMEA documentation

Through such a structured approach, organizations are able to systematically reduce operational risks and improve manufacturing reliability.

4. KPI-BASED MAINTENANCE PERFORMANCE MEASUREMENT

The effectiveness of maintenance systems increasingly depends on the ability of organizations to measure and evaluate maintenance performance through quantitative indicators. Key Performance Indicators (KPIs) therefore represent an important component of strategic maintenance management systems (Parida & Kumar, 2006).

Maintenance KPIs enable organizations to monitor operational efficiency, machine availability, maintenance responsiveness and workforce productivity.

Among the most commonly used maintenance indicators are:

- Mean Time Between Failures (MTBF)
- Mean Time To Repair (MTTR)
- Overall Equipment Effectiveness (OEE)
- Downtime percentage
- Maintenance cost per unit

4.1. MTBF Calculation

$$MTBF = \frac{\text{Operating Time}}{\text{Number of Failures}}$$

Example:

- Operating time = 720 hours
- Number of failures = 6

$$MTBF = \frac{720}{6} = 120 \text{ hours}$$

This indicates that failures occur every 120 operational hours on average.

4.2. MTTR Calculation

$$MTTR = \frac{\text{Total Repair Time}}{\text{Number of Repairs}}$$

Example:

- Total repair time = 18 hours
- Number of repairs = 6

$$MTTR = \frac{18}{6} = 3 \text{ hours}$$

Lower MTTR values indicate more efficient maintenance responsiveness and shorter operational interruptions.

4.3. OEE Calculation

Overall Equipment Effectiveness (OEE) is one of the most widely used manufacturing performance indicators.

$$OEE = \text{Availability} \times \text{Performance} \times \text{Quality}$$

Example:

- Availability = 90%
- Performance = 92%
- Quality = 96%

$$OEE = 0.90 \times 0.92 \times 0.96$$

$$OEE = 0.7949 = 79.49\%$$

The calculated OEE value indicates moderate operational effectiveness with potential improvement opportunities. According to Parida and Kumar (2006), KPI systems contribute not only to operational monitoring but also to strategic decision-making and continuous improvement processes within maintenance management systems.

5. WORKFORCE OPTIMIZATION AND FTE ANALYSIS

Human resource allocation represents one of the key organizational dimensions of maintenance management systems. Insufficient staffing levels may reduce maintenance responsiveness and increase downtime duration, while excessive workforce capacities may generate unnecessary operational costs.

Full-Time Equivalent (FTE) analysis is frequently applied in workforce planning processes in order to estimate the required number of employees for maintenance operations (Muchiri et al., 2011).

5.1. FTE Formula

$$FTE = \frac{\text{Total Working Hours Required}}{\text{Annual Working Hours per Employee}}$$

Example:

- Total maintenance hours required annually = 9,600
- Annual working hours per employee = 1,920

$$FTE = \frac{9600}{1920} = 5$$

The organization therefore requires approximately five full-time maintenance employees.

FTE analysis contributes to:

- workforce optimization,
- labour cost planning,
- maintenance scheduling,
- operational continuity,
- productivity improvement.

Within strategic maintenance management systems, workforce optimization additionally supports organizational resilience by ensuring adequate maintenance responsiveness during operational disruptions and increased production demands.

6. DISCUSSION

The findings presented in this paper indicate that strategic maintenance management increasingly requires integrated approaches combining technical risk management, performance measurement and workforce planning. Modern manufacturing organizations operate in technologically intensive and highly competitive environments where operational disruptions may generate significant financial losses, production instability and reduced organizational competitiveness. The conducted PFMEA analysis demonstrated the importance of systematic identification and prioritization of operational risks within manufacturing systems. Preventive identification of critical failure points enables organizations to reduce downtime duration, improve operational reliability and optimize maintenance interventions before serious production disruptions occur. These findings are consistent with previous research emphasizing that proactive maintenance strategies contribute significantly to operational stability and long-term organizational sustainability (Stamatis, 2003). The KPI analysis additionally confirmed the importance of continuous maintenance performance monitoring. Indicators such as MTBF, MTTR and OEE provide valuable information regarding equipment reliability, maintenance responsiveness and production efficiency. However, KPI systems should not be observed exclusively as reporting instruments, but rather as strategic tools supporting managerial decision-making and continuous process improvement (Parida & Kumar, 2006). The research additionally highlights the growing importance of workforce optimization within maintenance systems. In practice, many manufacturing organizations face shortages of qualified maintenance personnel, increasing workload pressure and difficulties related to knowledge transfer between experienced and newly employed workers. Under such conditions, FTE analysis becomes an important instrument for balancing operational demands and available workforce capacities. At the same time, organizations continue to face important challenges related to maintenance implementation costs, employee resistance to organizational changes and integration of digital technologies into existing production systems. Smaller manufacturing organizations may additionally experience difficulties related to financial limitations, insufficient technological capacities and lack of specialized personnel required for digital transformation processes (Bokrantz et al., 2020; Sony & Naik, 2020). Future maintenance systems will therefore increasingly depend on predictive analytics, Industry 4.0 technologies and real-time operational monitoring systems (Lee et al., 2015). Consequently, strategic maintenance management should be understood not only as a technical support function, but also as a multidimensional organizational capability directly connected with operational resilience, business continuity and long-term manufacturing competitiveness. The future development of maintenance systems will increasingly rely on artificial intelligence, machine learning algorithms and predictive analytics capable of identifying operational anomalies in real time.

Such technologies may significantly reduce unplanned downtime and improve maintenance decision-making processes within Industry 4.0 environments (Lee, Bagheri & Kao, 2015; Bokrantz et al., 2020). Predictive maintenance models based on big data analytics and cyber-physical systems additionally enable more accurate failure forecasting, optimized maintenance scheduling and improved production efficiency within smart manufacturing environments (Carvalho et al., 2019).

7. CONCLUSION

Strategic maintenance management has become an essential component of modern manufacturing systems due to its direct influence on operational reliability, productivity and organizational resilience. The paper demonstrated that the integration of PFMEA methodology, KPI-based performance measurement and workforce optimization approaches contributes significantly to improving maintenance effectiveness and reducing operational risks. PFMEA enables systematic identification and prioritization of process risks, while KPI systems provide measurable insights into maintenance efficiency and machine performance. Simultaneously, workforce optimization through FTE analysis contributes to more balanced human resource allocation and improved operational continuity. The findings additionally indicate that maintenance management should no longer be observed exclusively as a technical support function, but rather as a strategic organizational activity directly connected with business continuity and long-term operational sustainability. Future research should place stronger emphasis on predictive maintenance systems, artificial intelligence applications and digital maintenance analytics within Industry 4.0 manufacturing environments (Lee et al., 2015; Carvalho et al., 2019).

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KNOWLEDGE MANAGEMENT AND CONSUMER BEHAVIOUR AS INTERRELATED DETERMINANTS OF VALUE CREATION IN COMPANIES

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ABSTRACT

This paper examines the relationship between knowledge management and consumer behaviour as interrelated determinants of value creation in companies. The analysis starts from the distinction between data, information and knowledge and places that distinction within the broader transition from an industrial economy to a knowledge-based economy. In such an environment, companies no longer compete solely through the value of tangible assets and economies of scale, but increasingly through their ability to create, interpret, share and apply knowledge about markets, customers and organisational processes. The paper argues that consumer behaviour should not be viewed only as an external influence; it should also be understood as an important source of strategic knowledge that shapes managerial decisions, innovation and long-term competitiveness. By applying a qualitative conceptual approach grounded in relevant academic and institutional literature, the study develops an expanded theoretical framework linking customer knowledge, organisational learning, digital environments, trust and intangible assets. The analysis shows that effective knowledge management improves a company's ability to understand consumer needs, personalise its value proposition, coordinate internal learning and strengthen customer relationships. At the same time, consumer behaviour operates as a corrective mechanism that confirms, challenges or refines organisational assumptions. In conclusion, the interaction between knowledge management and consumer behaviour is strategically important for companies because it contributes to higher-quality decision-making, a more adaptive market response and more sustainable competitive advantage.

Keywords: *Consumers, Intangible Assets, Knowledge Management, Companies, Consumer Behaviour*

1. INTRODUCTION

In the contemporary economy, companies compete not only through price, scale and distribution, but increasingly through their ability to create, structure, share and apply knowledge. The transition towards a knowledge-based economy has increased the importance of intangible resources, organisational learning and data-informed decision-making, while digitalisation has expanded both the volume of available information and the speed at which markets respond to managerial decisions (Grant, 1996; OECD, 2024a; WIPO and Luiss Business School, 2025). In this context, knowledge should be understood as more than accumulated information. It is an organisational resource oriented towards action because it enables interpretation, judgement and effective response. Knowledge management therefore refers to the managerial practices through which organisations create, acquire, codify, disseminate and apply knowledge in order to improve performance, coordination and innovation (North, 2008; Nonaka and Takeuchi, 1995; Cristache, Croitoru and Florea, 2025). The purpose of this paper is to explain how knowledge management and consumer behaviour are connected in companies and why that relationship is strategically important for competitiveness, adaptation and value creation.

The paper starts from the assumption that consumers are not merely end users of what the market offers; they are active carriers of information, preferences, evaluations and signals that can enrich the company's knowledge base and improve managerial judgement (Kotler, Kartajaya and Setiawan, 2017; Stremersch et al., 2025).

2. KNOWLEDGE, KNOWLEDGE MANAGEMENT AND THE KNOWLEDGE-BASED ECONOMY

The distinction between data, information and knowledge remains a useful analytical starting point for understanding knowledge management. Data consist of raw observations; information emerges when those observations are organised and interpreted; knowledge develops when information is connected with experience, judgement and contextual understanding. In management literature, knowledge is therefore treated as a productive organisational resource rather than a static stock of facts (Nonaka and Takeuchi, 1995; Grant, 1996; North, 2008). Knowledge management can accordingly be defined as a coordinated set of managerial practices directed towards the creation, integration, storage, sharing and application of knowledge in ways that enhance organisational effectiveness. In knowledge-intensive environments, these practices support innovation, problem-solving, faster adaptation and stronger strategic alignment. Recent empirical research confirms that knowledge creation, integration, implementation and sharing are positively associated with innovation and organisational performance (Cristache, Croitoru and Florea, 2025). For companies, this means that knowledge management is not a mere administrative support activity. It is a strategic mechanism through which the company learns about consumers, market shifts, operational bottlenecks and emerging opportunities. A firm's competitive position increasingly depends on its ability to transform dispersed information into coordinated organisational action and customer-relevant value (Grant, 1996; North, 2008). Consumer behaviour refers to the processes through which individuals search for, evaluate, purchase, use and assess products and services. In competitive markets, these processes are no longer linear or limited to the purchase act itself. Digital platforms, reviews, peer-to-peer communication, search engines and mobile interfaces have made the customer journey more fragmented, interactive and transparent both for firms and for consumers (Kotler, Kartajaya and Setiawan, 2017; European Commission, 2025). The shift described by Kotler, Kartajaya and Setiawan (2017), from a linear purchasing model towards the connected 5A logic of awareness, appeal, ask, act and advocacy, is particularly useful for explaining contemporary consumer behaviour. Consumers are influenced not only by company-generated communication but also by communities, digital traces and post-purchase experiences that can reinforce or weaken loyalty. Consumer behaviour is therefore both a market response and an informational process. From the perspective of knowledge management, consumer behaviour should not be treated exclusively as an object of managerial influence. It should also be understood as a set of signals through which organisations learn. Reviews, complaints, repeated purchases, churn, search patterns, service interactions and loyalty data all contain valuable clues about satisfaction, expectations and latent needs. When these signals are systematically interpreted and shared across the company, they become customer knowledge with strategic value (Ji et al., 2024; Wang et al., 2024).

2.1. Explicit and tacit customer knowledge

A broader theoretical view of knowledge management shows that companies do not manage only codified reports, databases and dashboards. They also manage routines of interpretation, frontline employee experience, managerial judgement and informal insights accumulated through interaction with customers.

The classic distinction between explicit and tacit knowledge therefore remains important because organisations must connect documented customer data with experiential understanding derived from observation and contact (Nonaka and Takeuchi, 1995; North, 2008). This distinction matters because consumer behaviour rarely communicates its meaning directly. A decline in repeat purchases, for example, may indicate dissatisfaction, a change in purchasing power, stronger competition or a poor post-purchase experience. Data may show that something has changed, but tacit knowledge helps explain why. Companies therefore require organisational arrangements in which analytics and human interpretation complement one another rather than operate in isolation.

2.2. Core knowledge management processes in companies

From a process perspective, knowledge management in companies can be explained through several interrelated activities: knowledge acquisition, knowledge creation, storage, sharing and application. In customer-oriented environments, knowledge acquisition includes market research, transaction records, service interactions, CRM systems, digital analytics and social-media monitoring. Knowledge creation arises when these heterogeneous inputs are interpreted and translated into meaningful insights on which management can act (North, 2008; Cristache, Croitoru and Florea, 2025). Knowledge sharing is equally important because customer-related insights often remain trapped in the minds of individuals or within departmental silos. Marketing may understand campaign responses, sales may observe resistance at the point of purchase, and customer service may recognise recurring dissatisfaction patterns. If those observations do not circulate across the organisation, the company loses learning capacity and responds too slowly to market change. Knowledge application, finally, is the stage at which insight becomes product refinement, service redesign, segmentation, communication adjustment or strategic repositioning. Further theoretical considerations concern intangible assets and the foundations of knowledge-based competitive advantage. In contemporary firms, value is increasingly tied to assets that are not fully captured by traditional accounting categories: organisational routines, software, data resources, analytical capabilities, brand relationships and accumulated market knowledge. Recent international evidence shows that investment in intangible assets continues to grow in strategic importance, with software, data and other knowledge-based assets expanding faster than tangible investment in many economies (WIPO and Luiss Business School, 2025). For companies, customer-related knowledge is one of the most operationally important intangible assets because it simultaneously affects innovation, retention, positioning and risk reduction. However, a company can benefit from this asset only if it possesses sufficient absorptive capacity - that is, the ability to recognise valuable external knowledge, adapt it and apply it effectively. Recent research shows that customer knowledge obtained through social media contributes more strongly to innovation when firms possess higher realised absorptive capacity and stronger R&D intensity (Ji et al., 2024).

2.3. Consumer behaviour in digital and omnichannel environments

Another branch of the theoretical framework concerns the changing nature of consumer behaviour in digital and omnichannel settings. Consumers now move through hybrid environments in which searching, comparing, recommending, purchasing and resolving complaints take place across interconnected channels. The distinction between online and offline behaviour has therefore become less analytically useful than the broader idea of a connected customer journey shaped by repeated interactions and feedback loops (Kotler, Kartajaya and Setiawan, 2017; OECD, 2024a).

Institutional findings further support this view. OECD analysis shows that digital transformation has expanded the scale and speed of platform-mediated interaction, while the European Commission's latest review of consumer conditions points to both growing confidence in digital transactions and continued exposure to online risks such as misleading practices, fake reviews and fraud (OECD, 2024a; European Commission, 2025). These conditions increase the managerial value of reliable customer knowledge and further highlight the importance of responsible data use. Another important extension of the theoretical framework is the idea that consumers are not passive objects of analysis, but active participants in value creation. Contemporary literature on customer insights and value co-creation shows that firms increasingly depend on user feedback, customer participation and contextual understanding when developing products, services and communication strategies (Stremersch et al., 2025; Wang et al., 2024). For companies, this has two implications. First, customer knowledge should be regarded as relational knowledge generated through ongoing interaction between the company and the consumer rather than as a one-off informational input. Second, effective knowledge management requires mechanisms through which companies can capture, interpret and reuse that relational knowledge without reducing consumers to mere data points. The quality of that interpretive process influences innovation, service quality and long-term loyalty. A final theoretical point concerns the conditions under which customer knowledge can be used both effectively and legitimately. Growing reliance on behavioural data, predictive analytics and personalised communication means that knowledge management is now closely intertwined with issues of trust, privacy and governance. Recent findings from the European Commission's consumer conditions review confirm that digital trust remains fragile where manipulation, opacity or misleading practices are perceived (European Commission, 2025). The implication is that effective knowledge management has both a cognitive and an ethical dimension. It must help the company know more about the consumer, but it must also regulate how that knowledge is collected, interpreted and applied. Personalisation that increases relevance may strengthen the customer relationship; personalisation that feels intrusive may produce resistance, distrust and behavioural withdrawal. In that sense, governance is not external to value creation but one of its internal conditions. A related stream of recent research further points to the growing importance of social CRM and digitally mediated relationship infrastructures. Social customer relationship management expands traditional CRM by integrating social platforms, dialogue-based interaction and customer communities into the firm's knowledge architecture. This matters for the present topic because consumer behaviour is increasingly observable, discussable and influenceable in networked environments, while the strategic value of those signals depends on how effectively they are interpreted and governed (Rostamzadeh et al., 2024; Reinartz, 2025). The same conclusion is reinforced by recent systematic evidence on knowledge management systems. Studies reviewing the performance effects of KMS show that technology alone is insufficient; implementation succeeds when organisational culture, leadership support, user competence, process integration and governance mechanisms are aligned. For companies, this implies that customer knowledge becomes economically useful only when it is embedded in a wider managerial system rather than treated as an isolated database or software function (Alam et al., 2025). The expanded theoretical framework also requires attention to organisational learning. Knowledge management does not end with the storage or dissemination of information; it depends on feedback loops through which customer responses are translated into revised assumptions, improved routines and better decision criteria. Consumer behaviour is especially important in this process because it confronts the company with evidence that may confirm or disprove earlier managerial beliefs. The link with knowledge management is therefore strong because feedback creates value only when the organisation can absorb it without fragmentation.

If one function learns from the market while another continues to operate on outdated assumptions, the company accumulates information without building usable knowledge. Organisational learning therefore requires integration across marketing, sales, service, digital operations and management. Customer-related knowledge also affects managerial decision quality through analytics and segmentation. Whereas segmentation in traditional business logic often relied on relatively stable demographic categories, digital environments allow companies to identify behavioural patterns, experience profiles and situational triggers with far greater precision. Analytics, however, do not remove the need for interpretation; they intensify it. Meaningful segmentation depends on theoretically informed judgement about which patterns matter and why (OECD, 2024b; Stremersch et al., 2025). Customer knowledge management should therefore not be reduced to software for collecting data. Its strategic purpose is to improve managerial interpretation and coordinated action. When analytics are detached from organisational context, firms may optimise the wrong indicators. When analytics are embedded in knowledge-sharing routines and connected with customer value, they can enhance responsiveness, service relevance and strategic coherence. Taken as a whole, the expanded theoretical framework suggests that the relationship between knowledge management and consumer behaviour operates through several mutually connected levels. On the conceptual level, knowledge management transforms market signals into organisational understanding. On the behavioural level, consumers continually generate information through their choices, evaluations and interactions. On the strategic level, firms that can convert that information into coordinated learning are better positioned to innovate, build trust and sustain competitive advantage (Grant, 1996; Ji et al., 2024; WIPO and Luiss Business School, 2025). Based on the theoretical framework, the central research question is the following: how does knowledge management contribute to understanding and shaping consumer behaviour, and why is the consumer a key subject for the long-term competitiveness of every company?

3. METHODOLOGY, ANALYSIS AND RESULTS

This paper applies a qualitative conceptual methodology based on secondary sources. The analysis connects foundational literature on knowledge management and consumer behaviour with recent academic and institutional sources that address digital transformation, customer knowledge, intangible assets and market trust. The aim is not to empirically test a single causal model, but to develop a theoretically coherent explanation of the interaction between knowledge management and consumer behaviour in the business practice of companies.

3.1. Analysis

Traditional management models often treated consumers primarily as recipients of finished goods and services. In a knowledge-based economy, such a view is insufficient. Consumers generate strategic signals before, during and after the purchase act, and those signals may reveal unmet expectations, loyalty dynamics, service failures and emerging demand patterns. A company that treats consumers as sources of knowledge rather than merely as targets of persuasion gains a richer basis for decision-making. This transformation is not possible without an internal architecture capable of linking explicit and tacit knowledge. Digital analytics can identify what consumers do, but frontline employees, service staff and managers often understand the contextual reasons behind those actions. A company that integrates both forms of knowledge can respond more accurately to shifting demand and avoid superficial interpretations of customer data (Nonaka and Takeuchi, 1995; North, 2008). This broader perspective also aligns with recent work in CRM research and related management studies. Reinartz (2025) shows that CRM has evolved from a largely tactical marketing instrument into a strategic capability centred on experience, engagement, loyalty, profitability and community.

Likewise, Nicolescu and Rîpa (2024) demonstrate that CRM-related knowledge processes are strengthened when innovation becomes an organisational rather than merely individual capability. Together, these findings suggest that customer-related knowledge generates the greatest value when it is institutionally supported across the whole company. The strategic value of knowledge management becomes visible when customer insight is translated into relevant action. Companies that use customer knowledge well can personalise communication, simplify purchase processes, redesign service encounters, segment markets more precisely and adapt their product portfolios more effectively. In that sense, knowledge management contributes to customer value not indirectly but through the operational quality of market response. Recent research and institutional reports further support this interpretation. The growth of investment in intangible assets indicates that competitive advantage is increasingly built through software, data, organisational capabilities and other non-physical resources, while recent empirical studies show that knowledge management, customer knowledge and CRM-related capabilities are associated with innovation, profitability, satisfaction and loyalty (Cristache, Croitoru and Florea, 2025; Gazi et al., 2024; WIPO and Luiss Business School, 2025). Consumer behaviour also performs an important corrective function in companies. Firms may rely on internal assumptions about what the market values, yet actual consumer behaviour can quickly disprove those assumptions. Reduced engagement, abandoned baskets, negative reviews, weaker advocacy or lower repeat-purchase rates suggest that organisational knowledge may be incomplete, outdated or poorly applied. Consumer behaviour therefore operates as an external test of managerial relevance. In this sense, the consumer functions as an evaluator of the quality of organisational knowledge. A company may possess numerous reports and sophisticated dashboards, but if it cannot convert those resources into experiences that consumers perceive as useful, fair and trustworthy, knowledge has not yet become value. The practical challenge is not the abundance of information, but disciplined interpretation and implementation. For limited liability companies and joint-stock companies alike, the implications are both strategic and operational:

1. customer-related knowledge should be treated as an asset-generating capability rather than as a by-product of sales activity
2. knowledge-sharing routines should connect marketing, sales, service, analytics and management so that customer insight is not lost in organisational silos
3. investments in CRM systems, digital analytics and employee learning should be aligned with decision processes rather than managed as isolated technology projects
4. companies should strengthen the governance of intangible assets.

Data quality, privacy compliance, interpretation standards, employee training and feedback routines should be understood as parts of a unified knowledge infrastructure. Without such integration, companies risk collecting more customer data while learning less from it. With such integration, they improve their ability to respond to consumers in ways that are timely, credible and commercially effective. A useful way of synthesising the analysis is to view the company as an actor operating through a circular knowledge architecture (Figure 1). In the first phase, the company captures signals from the market through transactions, service contacts, digital behaviour, direct feedback, social-media monitoring and formal research. In the second phase, those signals are interpreted through organisational routines, analytical tools and managerial judgement. In the third phase, the resulting knowledge is translated into action through pricing decisions, assortment planning, service design, communication, complaint handling, retention measures and innovation initiatives. In the fourth phase, consumer behaviour responds to those interventions and generates a new round of information that either confirms or challenges the quality of prior decisions.

The company therefore does not move from knowledge to action in a single direction; it learns through a recurring loop in which consumers continuously shape the next cycle of organisational interpretation. This transformation is not possible without an internal architecture capable of linking explicit and tacit knowledge. Digital analytics can identify what consumers do, but frontline employees, service staff and managers often understand the contextual reasons behind those actions. A company that integrates both forms of knowledge can respond more accurately to changing demand and avoid superficial interpretations of customer data (Nonaka and Takeuchi, 1995; North, 2008).

3.2. From knowledge management to consumer value

This conceptualisation matters because it positions the consumer inside the company's learning system without erasing the distinction between internal managerial processes and external market behaviour. It also clarifies why investment in CRM systems, data platforms or reporting dashboards is not sufficient in itself. If these tools are not embedded in routines of interpretation, accountability and cross-functional communication, they increase informational volume without necessarily improving organisational knowledge.

The practical meaning of these results can be summarised in the conceptual graphic presented in Figure 1, which illustrates the knowledge-value loop linking market signals, interpretation, organisational learning, managerial action and subsequent consumer responses.

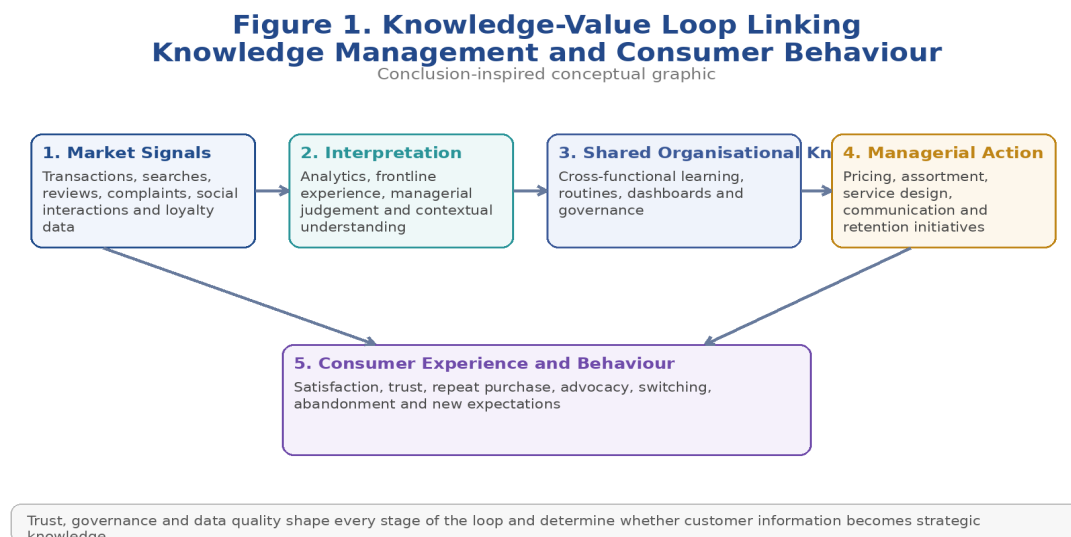


*Figure 1: Knowledge-value loop linking knowledge management and consumer behaviour
(Source: Author's elaboration)*

This framework also helps explain why some companies accumulate large amounts of customer data and still struggle to improve loyalty, satisfaction or innovation outcomes. The difficulty often lies not in data scarcity, but in weak mechanisms for converting information into knowledge. Such weaknesses may appear in fragmented ownership of customer insight, low trust in data quality, poor interdepartmental collaboration, inadequate employee training or the absence of clear rules for acting on behavioural evidence. In practice, companies need a balanced knowledge architecture composed of at least five elements: reliable data capture, interpretive competence, internal sharing mechanisms, governance rules that protect legitimacy and trust, and managerial commitment to learning from consumer reactions. When one of these elements is missing, the company's market intelligence remains partial or inconsistently applied. When they are aligned, customer-related knowledge becomes a durable strategic capability that supports both operational efficiency and market responsiveness.

For that reason, knowledge management should be understood not only as a technological or informational issue, but also as a governance issue shaping how the company recognises consumers as relevant subjects of business processes and strategic development.

3.3. Results

The analysis leads to four main results. First, knowledge management and consumer behaviour are structurally interdependent: companies learn from consumers, and consumers respond to the quality of organisational learning embodied in products, services and communication. Second, customer-related knowledge should be regarded as a strategic intangible asset whose value depends on the company's ability to absorb and apply it. Third, digital environments simultaneously amplify the opportunities and the risks of managing customer knowledge because they expand behavioural visibility while making trust more fragile. Fourth, the consumer should be understood as an active subject in the company's learning process rather than as a passive endpoint of market exchange.

4. CONCLUSION

Knowledge management and consumer behaviour should not be analysed as separate domains. In companies, they form a connected system of value creation, adaptation and competitive positioning. The company learns from the market, but the quality of its own learning is revealed through the experiences it delivers to consumers. Consumer behaviour is therefore not only a consequence of managerial action; it is also one of the most important sources of organisational knowledge. The analysis has shown that the strategic relevance of knowledge management lies in its ability to convert dispersed market signals into coordinated organisational understanding. When companies integrate customer data, employee experience, analytics and cross-functional learning, they are better able to recognise changes in consumer expectations and respond in ways that strengthen value creation. When they fail to do so, even extensive information resources may remain unused or misinterpreted. A further practical implication concerns managerial discipline in the use of customer knowledge. Companies should not equate more data with better understanding. They need repeatable procedures through which behavioural signals are verified, interpreted, discussed and translated into operational or strategic adjustment. This requires clear ownership of customer insight, regular cross-functional reviews, a balance between automated analytics and expert judgement, and explicit attention to consumer trust. Companies that build such routines are more likely to detect weak signals early, reduce noise in decision-making and align innovation with real consumer expectations. In that sense, the relationship between knowledge management and consumer behaviour is not only a theoretical issue, but also a practical criterion of managerial quality in contemporary companies. For companies organised as capital companies, the central managerial implication is clear: customer-related knowledge should be systematically developed, governed and applied as a strategic resource. Future research could deepen this conceptual model through empirical investigation in sectors such as retail, banking, telecommunications and platform business, with particular attention to how trust, governance and digital feedback mechanisms shape the conversion of customer knowledge into business outcomes. Further research could compare how this knowledge–consumer value loop operates across industries with different levels of digital maturity and regulatory intensity. Empirical studies based on case analyses, survey data or mixed-method designs could also identify which organisational mechanisms most effectively transform customer knowledge into measurable outcomes such as loyalty, innovation performance and long-term firm value.

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THE ROLE OF CENTRAL BANK COMMUNICATION IN SHAPING EXPECTATIONS AND MONETARY POLICY: INSIGHTS FROM THE ECB AND IMPLICATIONS FOR THE CROATIAN NATIONAL BANK

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ABSTRACT

This paper analyzes the effectiveness of the ECB's communication channels, primarily the speeches of the Executive Board members, in shaping expectations about inflation developments. The aim is to determine the extent to which communication asymmetries affect the credibility of monetary policy in the entire euro area and its member Croatia. The empirical analysis focuses on three correlated channels: the ECB's communication channel (number and structure of announcements), the interest rate channel (changes in key rates), and the inflation outcome channel (Eurozone HICP and Croatian CPI). The analysis was conducted using descriptive statistics with an emphasis on the time dynamics and asymmetries between the euro area and Croatia. The empirical results showed that at the level of the quarterly ECB speech cycles and the Eurozone HICP, communication becomes a reactive shield - the higher the inflation, the more the ECB attacks with rhetoric, neglecting the topic of economic growth. At the level of the Eurozone interest rate cycles, the effectiveness of the impact of interest rates on inflation (HICP) is noticeable, so the need for aggressive rhetoric decreases as interest rates reach their peak. However, on the edge of the eurozone, Croatia lacks communication cohesion, so the influence of ECB communication and interest rates on inflation expectations is absent. Instead of being an active creator of the narrative, the CNB has become a helpless statistical chronicler of the Croatian inflation structure under the institutional shelter of the ECB.

Keywords: communication channels, key interest rates, inflation expectations, correlations, ECB and CNB

1. INTRODUCTION

In modern monetary systems, the communication of central banks has evolved from a supporting element into an independent instrument of monetary policy. Since the crisis of 2008, and especially in conditions of low interest rates, banks have been using forward guidance and strategic narratives to anchor the expectations of economic entities and ensure market stability. The European Central Bank (ECB) is leading this trend through intensive channel diversification. Data for the period 2020-2025 show a strong growth in activity - a total of 1,510 communication units were published. There is a noticeable move away from formal forms towards more flexible channels, such as blogs and speeches, which seek to manage inflationary expectations in conditions of high macroeconomic uncertainty and the fastest cycle of monetary policy tightening in the history of the ECB. However, uniform communication does not necessarily produce homogeneous effects in the heterogeneous eurozone. This was a special challenge for Croatia, which joined the euro area in 2023 in the midst of high inflation. Upon joining the Eurosystem, the Croatian National Bank (CNB) lost its monetary independence, but retained responsibility for communication with the domestic public. In doing so, a key research problem arises - asymmetry in message transmission. While the ECB aims at the eurozone average, Croatian inflation dynamics often deviate from that average, which often reduces the CNB's communication to a defensive explanation of structural factors.

This paper analyzes the effectiveness of the ECB's communication at the national level and investigates whether there is a "loss in translation" in the specific context of Croatia. The empirical analysis focuses on three correlated channels: (i) Communication channel of the ECB (number and structure of announcements), (ii) Interest rate channel (changes in key rates) and (iii) Channel of inflationary outcomes (comparison of HICP - Harmonized index of consumer prices of the eurozone and Croatian CPI - Consumer price index). The goal is to determine to what extent communication asymmetries affect the credibility of monetary policy and the formation of expectations in Croatia. The analysis was carried out using descriptive statistics, with an emphasis on temporal dynamics and asymmetries between the eurozone and Croatia itself. Starting from the theoretical framework on the role of central bank communication and empirical differences in inflation trends between the Eurozone and Croatia, the paper answers the following research questions (RQ): RQ1: What is the direction and strength of the relationship between the intensity of the ECB executive board members' speeches on dominant topics and inflation trends?; RQ2: Is there a temporal and statistical connection between the change in key ECB interest rates, speeches on inflation and inflation in the Eurozone?; RQ3: Is there a visible connection between the ECB's communication and inflation trends in Croatia, or is there a weakening of the transmission of messages at the national level?

The following hypotheses (H) are formulated on the basis of the theoretical overview, research questions and preliminary descriptive statistics: H1: The increased intensity of the ECB's communication on inflation results in a fall in inflation at the level of the Eurozone. (Justification: the ECB uses communication as an instrument for managing inflationary expectations, which in the conditions of developed financial markets is reflected in the stabilization of the HICP.); H2: Changes in key interest rates of the ECB correlate with inflation levels in the entire eurozone, in contrast to member Croatia, where the correlation is absent. (Justification: Due to the structural characteristics of the Croatian economy - small open economy, high import inflation, seasonality - the interest rate channel of monetary policy is limited); H3: Can the differences between the intensity of communication, the effect of the interest rate channel and the trend of inflation in the Eurozone (HICP) and in Croatia (CPI) be interpreted as an indicator of asymmetric transmission of monetary policy and communication between the ECB and the CNB? (Justification: ECB communication primarily acts through financial markets and expectations in the central countries of the eurozone, while on the periphery in Croatia there is a "loss in translation" with heterogeneous inflationary outcomes and underdeveloped national communication channels. The work is divided into six chapters. After the introductory part, the second chapter provides an overview of the literature, the third chapter explains and systematizes data on the ECB's communication channels as well as data on interest rates and inflation in the eurozone, i.e. Croatia. The fourth chapter refers to methodology and research results in accordance with the set research questions and hypotheses. The fifth chapter provides a brief discussion of the research, while the sixth chapter ends with findings, scientific contribution, limitations and recommendations for future research.

2. LITERATURE REVIEW

The communication of central banks has evolved from a supporting element into an integral instrument of monetary policy, crucial for shaping market expectations (Woodford, 2005; Assenmacher et al., 2021). Clear and consistent communication makes it possible to manage inflationary expectations without the necessary aggressive use of interest rates, but its effectiveness depends on the style, clarity and relevance of messages (Lagarde, 2023). Data from the ECB repository (ECB, 2020-2025) show that the institution uses a multi-channel approach (speeches, press releases, interviews and blogs) that balances technical precision with accessibility to the general public (Angeloni, Faia & Lo Duca, 2021).

The effectiveness of monetary communication is primarily limited by the "rational inattention" of the public; stakeholders cannot follow all information (Sims, 2010), and households react primarily to simple messages related to everyday experience (Binder, 2017; Bholata et al., 2019). Therefore, communication that includes information about instruments and ways of acting helps align expectations with goals (Brouwer & de Haan, 2021). Research confirms that simpler language significantly increases public understanding and trust (Bholata et al., 2019; Ehrmann & Wabitsch, 2021). The strategic role of communication is especially emphasized in periods of unconventional monetary policy, such as quantitative easing and forward guidance, where clear messages about the motives and duration of measures improve policy effectiveness (Coenen et al., 2017). During the COVID-19 pandemic and subsequent inflationary shocks, the combination of channels enabled the ECB to signal steps precisely (Borio, 2021; ECB, 2020-2025; Gardt et al., 2021). Speeches serve as the main formal channel and tool for forward guidance (Dahlhaus, Eisenbach & Faust, 2019), announcements ensure institutional transparency (BIS, 2017), while interviews offer a more flexible, contextual approach in crises (Ehrmann & Talmi, 2020). Analyses show that members of the Executive Board, such as Lagarde, Schnabel and Lane, prefer different channels for targeted communication (Dovern, Fritsche & Slacalek, 2021). Blogs have emerged as a newer channel for the detailed explanation of complex policies such as the digital euro or climate initiatives (Lagarde, 2023; Bindseil, 2022). Greater clarity in these texts has been proven to increase the engagement of the media and the general public (Angino & Ferrara, 2021).

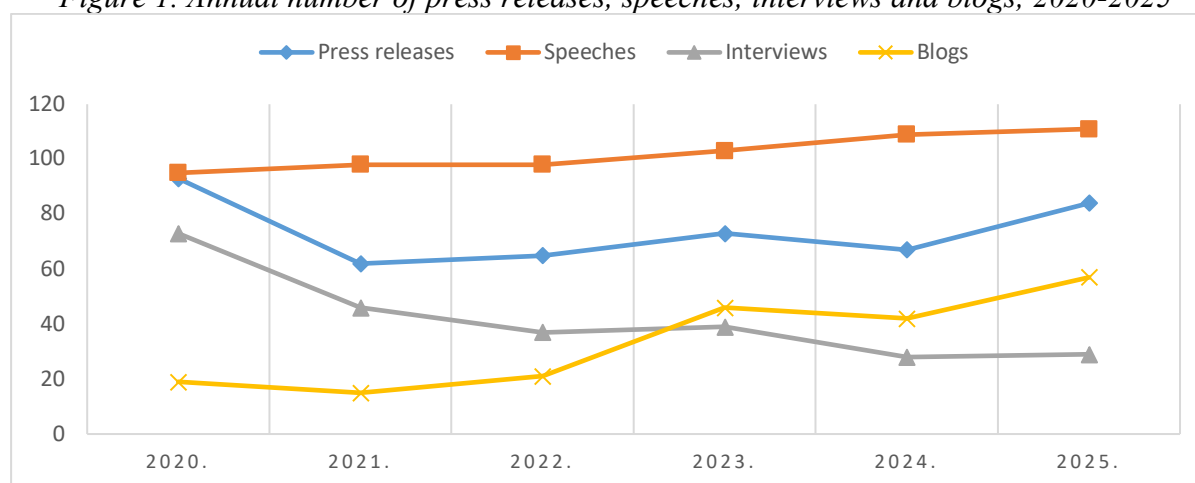
Furthermore, the tone of communication (hawkish vs. dovish) significantly affects financial markets and inflation perception, often even before the change in interest rates (Gürkaynak, Sack & Swanson, 2005; Campbell et al., 2012; Lagarde, 2023). Consistent and predictable communication reduces volatility in markets (Stroebel & Taylor, 2012), while unexpected communication shocks can directly shape macroeconomic trends (Gebauer, McGregor & Schumacher, 2024). The ECB's strategy is not static, the bank actively expands the scope of messages beyond the strictly monetary domain in order to preserve legitimacy in response to political pressures or negative public opinion (Moschella, Pinto & Martocchia Diodati, 2020). Although inflationary expectations influence the behavior of companies, they sometimes remain insensitive to messages in low inflation conditions (Coibion et al., 2020), which highlights the importance of an engaged communication style. Direct educational and interactive communication with non-experts is essential for anchoring expectations (Jung, Mongelli & Scherf, 2025). After all, the style, clarity and relevance of messages is not a mere formality, but a key transmission channel (Sims, 2010; Binder, 2017; Angino & Ferrara, 2021; Ehrmann & Wabitsch, 2021; Gebauer, McGregor & Schumacher, 2024; Jung, Mongelli & Scherf, 2025). Considering the linguistic diversity of the Eurozone and the heterogeneity of financial literacy, these findings have important implications for the CNB. Effective communication contributes to a better perception of monetary policy and public trust, which is a prerequisite for successfully shaping expectations in the national context.

3. DATA DESCRIPTION

Based on the publicly announced ECB communication channels in the period 2020-2025, four main channels have been identified: speeches, press releases, interviews and blogs. The data show that speeches are the main channel of policy signaling (614 speeches in total), especially during inflationary and crisis periods (Dahlhaus et al., 2019). This channel enables detailed reasoning of decisions, forward guidance and coordination among the members of the Executive Board. The press releases (444 in total) have an institutional character and serve to formally communicate decisions and explanations of monetary policy.

BIS (2017) and Angeloni et al. (2021) suggest that such documents increase the predictability of decisions and reduce market volatility, which is especially important in periods of uncertainty, such as the onset of the COVID-19 pandemic. Interviews (252 in total) serve for flexible communication and explanation of policies in real time, often directed towards the media and analysts. Data show that members like Luis de Guindos and Isabel Schnabel are most active in this channel, reflecting their focus on direct communication with markets (Ehrmann & Talmi, 2020; Dovern et al., 2021). Interviews are most numerous in crisis years (2020: 74 interviews), and decrease in more stable periods, which confirms their role in crisis communication. Blogs (200 in total) represent a newer channel that allows for detailed explanations of complex instruments, including the digital euro, climate initiatives and non-standard purchase programs (PEPP, APP). Bindseil (2022) and ECB (2021) emphasize that blogs serve as an additional educational tool and increase the ECB's transparency towards the general public. Growth trend of blogs in 2023-2025. indicates the increased importance of digital channels for the communication of technically complex topics. ECB's multi-channel communication strategy enables simultaneous targeting of market expectations, formal reporting and public education, with each channel having a specific function and target audience. This integration of data on speeches, interviews, press releases and blogs (Appendix 1, Figure 1) provides a powerful framework for analyzing the dynamics of ECB communication, including the individual contribution of Executive Board members, thematic priorities and tone changes in different macroeconomic and crisis situations

Figure 1. Annual number of press releases, speeches, interviews and blogs, 2020-2025



Source: Author's edit; <https://www.ecb.europa.eu/home/html/index.en.html>

3.1. Thematic analysis of ECB speeches

For research purposes, 614 speeches by members of the ECB's Executive Board in the period 2020-2025 were analyzed. (ECB, 2020-2025). The speeches were classified into ten thematic groups: (i) macroeconomic variables, (ii) exogenous variables, (iii) economic policy, (iv) ECB management, (v) banking, (vi) the euro and the eurozone, (vii) market interest rates, (viii) monetary policy instruments, (ix) non-standard instruments and (x) financial stability (Appendix 2). One speech can cover several topics. Analysis of the dynamics reveals three key trends. First, the absolute dominance of the topics of monetary policy (283), eurozone (241) and inflation (168), which confirms the focus on price stability. Second, there is a noticeable shift from crisis to structural topics - while topics like COVID-19 (drop from 50 in 2020 to zero in 2025) and PEPP (Pandemic Emergency Purchase Programme) are disappearing, the importance of the digital euro and climate change is growing.

Third, technically narrower topics (microprudential policy, Basel III) keep a low frequency, while the communication is personalized by members of the Executive Board Lagarde, Lane and Schnabel as bearers of key macroeconomic messages. This categorization proves that the ECB is actively adapting the narrative to macroeconomic shocks, transforming the thematic focus from a "reactive shield" during the pandemic to a platform for digital and regulatory innovation, which forms a robust framework for further analysis of tone (hawkish/dovish) and correlation with interest cycles. The five dominant themes in the speeches from Q1/2020 to Q4/2025 can be found in Table 1 together with HICP trends in the euro area.

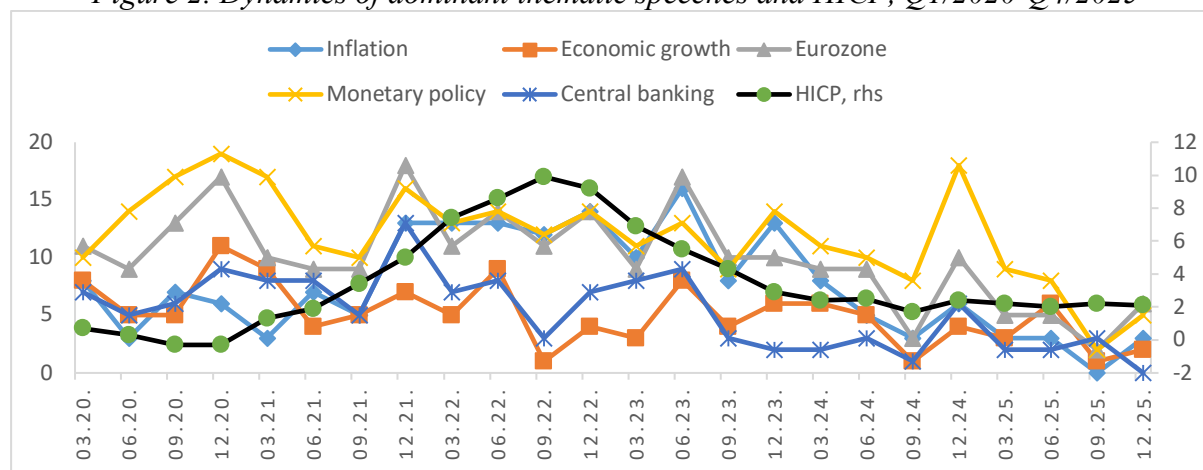
Table 1. Dominant thematic speeches and HICP, Q1/2020-Q4/2025

Quarters	Thematic speeches					HICP
	Inflation	Economic growth	Eurozone	Monetary policy	Central banking	
03.20.	8	8	11	10	7	0,7
06.20.	3	5	9	14	5	0,3
09.20.	7	5	13	17	6	-0,3
12.20.	6	11	17	19	9	-0,3
03.21.	3	9	10	17	8	1,3
06.21.	7	4	9	11	8	1,9
09.21.	5	5	9	10	5	3,4
12.21.	13	7	18	16	13	5,0
03.22.	13	5	11	13	7	7,4
06.22.	13	9	14	14	8	8,6
09.22.	12	1	11	12	3	9,9
12.22.	14	4	14	14	7	9,2
03.23.	10	3	9	11	8	6,9
06.23.	16	8	17	13	9	5,5
09.23.	8	4	10	9	3	4,3
12.23.	13	6	10	14	2	2,9
03.24.	8	6	9	11	2	2,4
06.24.	5	5	9	10	3	2,5
09.24.	3	1	3	8	1	1,7
12.24.	6	4	10	18	6	2,4
03.25.	3	3	5	9	2	2,2
06.25.	3	6	5	8	2	2,0
09.25.	0	1	2	2	3	2,2
12.25.	3	2	6	5	0	2,1
Total	182	122	241	285	127	-

Source: Author's calculation; https://www.ecb.europa.eu/press/pubbydate/html/index.en.html?name_of_publication=Speech; https://www.ecb.europa.eu/stats/macroeconomic_and_sectoral/hicp/html/index.en.html

The dynamics of dominant speech and HICP at the level of the eurozone can best be seen in Figure 2, which will serve in the later analysis of the correlation between speech dynamics and inflation.

Figure 2. Dynamics of dominant thematic speeches and HICP, Q1/2020-Q4/2025

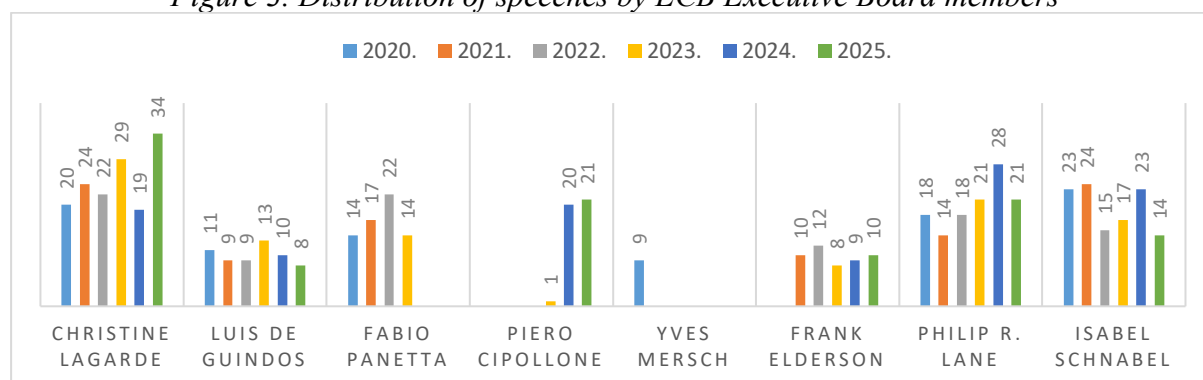


Source: Author's calculation

3.2. Distribution of speeches by ECB Executive Board members

Distribution of speeches by ECB Executive Board members in the period 2020-2025 clearly shows that communication is a systematically and intensively used instrument of monetary policy, and not a secondary activity. The total number of 614 public speeches, with a stable annual volume of around 95-110 speeches, points to a high frequency and continuity of communication, even after the acute phase of the pandemic crisis subsided (Appendix 3, Figure 3).

Figure 3. Distribution of speeches by ECB Executive Board members



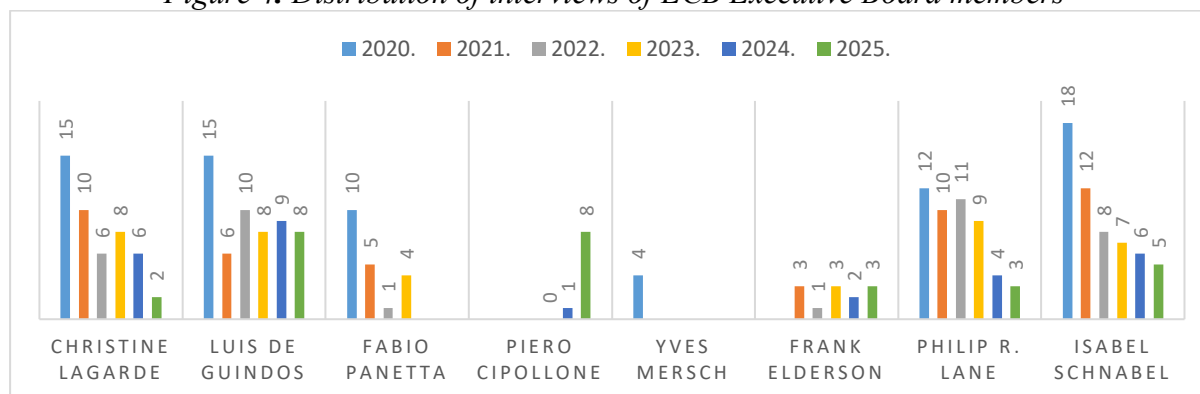
Source: Author's calculation

The role of ECB President Christine Lagarde is particularly noteworthy, as she herself participates in almost a quarter of all speeches (148), thus ensuring the centralization of the message and a strong personal anchoring of monetary policy communication. At the same time, a significant number of speeches by other members of the Executive Board - especially Philip R. Lane and Isabel Schnabel - indicate a functional division of communication roles, where technical, analytical, and normative messages are distributed through multiple voices, but within a coherent communication framework. The growth of the total number of speeches after 2022, in a period of high inflation and monetary tightening, further confirms that the ECB uses communication as an active channel of managing expectations, and not only as an ex-post explanation of decisions. In this context, the intensity and structure of the ECB's communication is in strong contrast with the communication practice of the national central banks in the euro area, including the CNB, where inflation is less often set as a central and continuous topic of public statements.

3.3. Distribution of interviews of ECB Executive Board members

In the period 2020-2025 the ECB, along with formal speeches, systematically uses interviews as a selective and targeted communication instrument (Annex 4, Figure 4). Unlike speeches, which have an institutional and often pre-structured character, interviews enable a more flexible articulation of messages, adaptation to the current context, and direct addressing of the concerns of the market and the wider public.

Figure 4. Distribution of interviews of ECB Executive Board members



Source: Author's calculation

The total number of interviews shows a significant downward trend after 2020, which is most evident in the speeches of President Christine Lagarde, whose intensity dropped from 15 interviews in 2020 to only two in 2025. This dynamic suggests that interviews in the initial phase of the crisis - encompassing the pandemic and the initial inflationary shock - served as the primary crisis tool for stabilizing expectations, while in the later phases, communication shifted toward more formal channels such as speeches and official announcements. Within the Executive Board, a clear differentiation of roles is visible - while President Lagarde and Vice President de Guindos dominate the early crisis period, board members Philip R. Lane and Isabel Schnabel retain the role of "bridge" between technical monetary analysis and the public throughout the tightening cycle. At the same time, data from new members, such as Fabio Panetta and Piero Cipollone, indicate that the ECB uses interviews as an instrument for building public recognition and credibility at the beginning of the mandate. Although numerically rarer than speeches, interviews have a disproportionately large impact on monetary transmission because they reach a non-expert audience through the mass media, providing a flexible and personalized framework for explaining complex monetary policy decisions.

3.4. Distribution of blogs of ECB Executive Board members

The blogs of ECB Executive Board members represent the most selective communication channel (a total of 80 posts in the period 2020-2025), whose primary role is not frequency, but depth of analysis and strategic positioning of messages (Appendix 5). This format is used as an instrument of policy leadership, enabling the articulation of complex narratives that go beyond daily communication dynamics. The authorship structure, in which President Lagarde and Vice-President de Guindos often participate in collaborative formats with European Commission officials (such as von der Leyen or Dombrovskis), signals a strong institutional consensus and inter-institutional coordination. At the same time, members with a pronounced analytical role, such as Philip R. Lane and Isabel Schnabel, use blogs to elaborate theoretical and empirical arguments about inflation and monetary policy transmission. New members, such as Piero Cipollone, quickly integrate their views into the ECB's communication strategy through blogs, thus ensuring the continuity of the narrative.

From the point of view of managing expectations, blogs structure the interpretive framework within which markets and the professional public analyze subsequent decisions. However, this systematic approach to blogs as a strategic tool is hardly seen at national central banks such as the CNB. This deficiency deepens the communication gap between the level at which monetary policy is formed (ECB) and the national levels at which inflation expectations are formed, thus reducing the effectiveness of the local transmission of the common policy.

3.5. Key ECB interest rates, inflation and inflation speeches

Analysis of the interest rate channel and inflation outcomes from 2019 to mid-2025 reveals the most intense cycle of monetary tightening in the history of the eurozone, marked by a record cumulative magnitude of changes. After a multi-year period of negative rates (−0.5%), the ECB in July 2022 begins a decisive turnaround - the rate on overnight deposits increased by 450 basis points in just fourteen months, reaching a peak of 4.0% in September 2023. With regard to the dynamics of interest rates, the trend of inflation and the frequency of rhetorical statements (Table 2), this period is articulated through four different phases: passivity, reaction, reversal and easing.

Table 2. Key interest rates, inflation and inflation speeches

Years	ECB interest rate change dates	Key ECB interest rates			Number of speeches on inflation	Number of days between interest rate change dates	Eurozone HICP	CPI in Croatia
		Deposit facility	Main refinancing operations	Marginal lending facility				
2019.	18 Sep.	-0,5	0	0,25	-	-	-	0,8
2022.	27 Jul.	0	0,5	0,75	78	1.043	0,8	12,3
2022.	14 Sep.	0,75	1,25	1,5	5	49	8,9	12,8
2022.	2 Nov.	1,5	2	2,25	6	49	9,9	13,5
2022.	21 Dec.	2	2,5	2,75	12	49	10,1	13,1
2023.	8 Feb.	2,5	3	3,25	2	49	9,2	12
2023.	22 Mar.	3	3,5	3,75	7	42	8,5	10,7
2023.	10 May	3,25	3,75	4	9	49	6,9	7,9
2023.	21 Jun.	3,5	4	4,25	7	42	6,1	7,6
2023.	2 Aug.	3,75	4,25	4,5	2	42	5,5	7,8
2023.	20 Sep.	4	4,5	4,75	5	49	5,2	6,7
2024.	12 Jun.	3,75	4,25	4,5	28	266	4,3	2,4
2024.	18 Sep.	3,5	3,65	3,9	3	98	2,5	1,6
2024.	23 Oct.	3,25	3,4	3,65	1	35	1,7	2,2
2024.	18 Dec.	3	3,15	3,4	5	56	2	3,4
2025.	5 Feb.	2,75	2,9	3,15	1	49	2,4	3,7
2025.	12 Mar.	2,5	2,65	2,9	1	35	2,3	3,2
2025.	23 Apr.	2,25	2,4	2,65	2	42	2,2	3,2
2025.	11 Jun.	2	2,15	2,4	1	49	2,2	3,7

Source: ECB and author's calculation; https://www.ecb.europa.eu/stats/policy_and_exchange_rates/key_ecb_interest_rates/html/index.en.html; <https://podaci.dzs.hr/en/statistics-in-line/>

1. Passive phase: September 2019 - July 2022. For 1,043 days (equivalent to 21 decision cycles of 49 days on average), the ECB kept the interest rate on deposits frozen at −0.50%, despite a drastic jump in inflation (HICP) from 0.8% to 8.9%.

This period of monetary immobility created a critical time gap between inflationary impulse and reaction, which later forced an aggressive and mechanical tightening cycle.

2. Reaction phase: July 2022 - September 2023. Characterized by rapid and mechanical tightening, this phase brings the interest rate jump from 0.00% to 4.00% through ten consecutive increases in just 14 months. With inflation peaking at 10.1% (November 2022), the ECB is applying a "late reaction + high inflation = rigid rhythm" pattern. Strong intensity is accompanied by extreme communication activity (e.g. 12 speeches in December 2022), which establishes a direct correlation between price growth, frequency of speeches and short decision cycles.

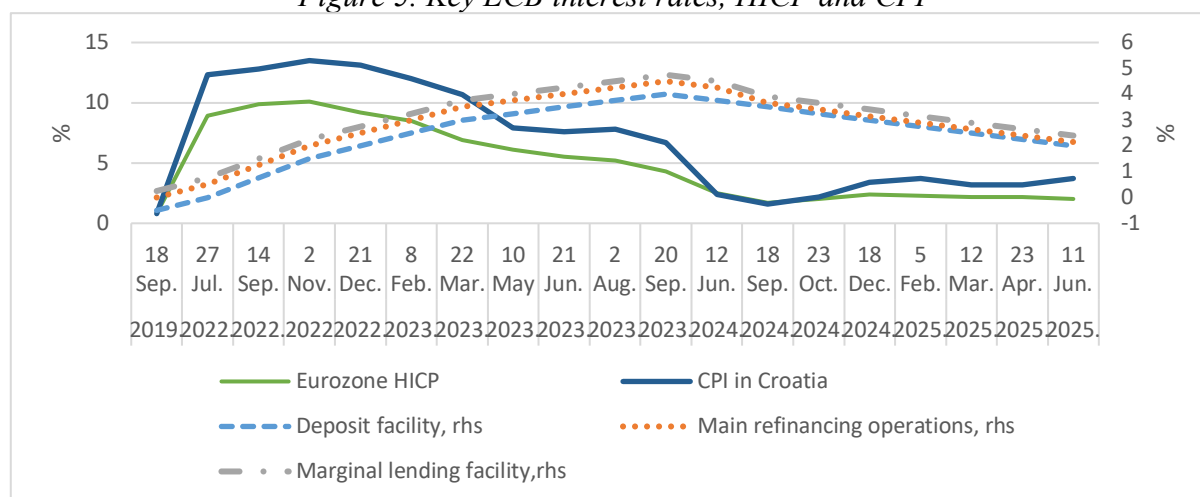
3. Reversal phase: September 2023 - June 2024. This period marks a key structural break. During 266 days without interest rate changes, the HICP falls from 4.3% to 2.5%. Although rates are frozen to test restrictiveness, rhetoric is peaking with a record 28 speeches on inflation. There is a regime change in which communication replaces interest rates as the main instrument of monetary policy, maintaining active pressure on expectations despite the absence of mechanical changes.

4. Easing phase: September 2024 - June 2025. The period of monetary normalization is characterized by a gradual reduction of interest rates in uneven intervals (35-56 days). With the stabilization of inflation (HICP: 2-2.4%), the communication intensity drops sharply (1-5 speeches), which signals the return of inflation to the target range. The focus shifts from active combat to stable maintenance, which eliminates the need for intensive signaling to the market.

3.6. Croatia and the Croatian National Bank

Croatia entered the eurozone on January 1, 2023. with the highest CPI rate and practically found itself in the 2nd phase - ECB reactions (July 2022 - September 2023) and continued a parallel monetary life between the ECB's policy of tightening and the independent powerlessness to influence the CPI rates, which are continuously above the HICP of the eurozone (Figure 5).

Figure 5. Key ECB interest rates, HICP and CPI



Source: ECB and Author's calculation

The loss of monetary independence transformed the CNB from an active policy maker into a "statistical chronicler" whose communication mechanism in the period 2023-2025 remained reactive and defensive.

While the ECB uses communication as a proactive tool for managing future expectations (forward guidance), the CNB's announcement is reduced to retrospectively explaining experienced shocks through sterile formats. Archive analysis 2023-2025 (CNB 2025) reveals a strictly structured but predictable activity: (i) 36 regular monthly commentaries on inflation (CNB, 2025), (ii) 12 quarterly macroeconomic projections (CNB, 2025), (iii) a dozen specialized HNBlogs (CNB, 2025), and (iv) 15-20 annual announcements on the speeches of governors and members of the Council, often abbreviated to abstracts from conferences (CNB, 2025). This "loss in translation" is accentuated by the fact that the messages from Frankfurt are calibrated according to the core of the Eurozone, which makes them difficult to apply to the specific and shallow Croatian financial market. The CNB found itself in the paradox of a translator without the right to free interpretation, despite domestic inflation well above the target of 2%. The institution has retreated into the role of an observer hiding behind general statements about structural factors. The CNB tries to fill the resulting communication vacuum with unconventional educational projects in the money museum, but this fails to anchor citizens' inflationary expectations, which remain adaptive, based on the daily experience of rising food and service prices. The perception of the CNB as an institution without real power opens up space for populist narratives, while real inflationary pressures remain beyond the reach of the official, sterile narrative, which weakens the long-term credibility of the entire Eurosystem in Croatia.

4. RESEARCH METHODOLOGY AND RESULTS

The research is based on descriptive statistics, with the aim of identifying the relationship and temporal dynamics between ECB communication, monetary policy and inflationary trends. Due to the limited number of observations and the institutional specificity of the observed period, complex causal econometric models are not applied, but emphasis is placed on the interpretation of empirical patterns in the context of the theoretical framework. This approach is suitable for researching the communication effects of central banks, which are often analyzed in the literature through a combination of descriptive statistics and correlations. The analysis is divided in time into two cycles that include: a) quarterly speech cycles from 2020 to 2025, i.e. 24 quarters, and b) interest cycles of the ECB in accordance with effective changes in the level of interest rates, i.e. 18 interest rate changes from July 27, 2022 until June 11, 2025 year. The paper uses two research approaches:

1. The first approach - includes quarterly cycles of speeches from 2020 to 2025, and the units of analysis are: *inf* - number of speeches on inflation; *gdp* - number of speeches on economic growth; *euro* - number of speeches about the eurozone; *mpol* - number of speeches on monetary policy; *centb* – number of speeches on central banking; *hicp* – HICP rates.

2. Second approach - includes interest cycles from July 27, 2022 until June 11, 2025, and the units of analysis are; *dep* – ECB interest rate on overnight deposits (Deposit facility); *inf* - number of speeches about inflation; *hicp* - HICP rates in the eurozone; *cpi* - CPI rates in Croatia. In the first approach, the direction and strength of the links between the distribution of five dominant thematic discourses and the trend of the HICP are investigated. The obtained results are presented with three types of correlation coefficients with p-values, namely:

a) Pearson's coefficient

$$r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

x_i, y_i : individual values

$\bar{x}, \bar{y}$: arithmetic means of sets

b) Spearman's coefficient

$$r_s = 1 - \frac{6\sum d_i^2}{n(n^2 - 1)}$$

d_i : the difference between the ranks of the same respondent in two variables ($rg(x_i) - rg(y_i)$)

n : number of data pairs

c) Kendall tau

$$\tau = \frac{C - D}{\frac{1}{2} n (n - 1)}$$

C : number of concordant pairs (pairs that maintain the same rank direction)

D : number of discordant pairs (pairs that change the direction of the rank)

n : total number of observed units

The use and calculation of all three coefficients (according to data from Tables 1 and 2) provides a more complete picture of the relationship between couples because they combine the precision of a linear trend (Pearson) with robustness to extreme values and nonlinear but monotonic relationships (Spearman and Kendall).

Table 3. Correlation results and p-values – quarterly speech cycles

Correlations for all pairs of data series with p-values			
Pairs	Pearson r	Spearman ρ	Kendall τ
inf,gdp	0.2823	0.3051	0.228
<i>p-value</i>	(0.1814)	(0.1472)	(0.1475)
inf,euro	0.7361	0.7685	0.6426
<i>p-value</i>	(0)	(0)	(0)
inf,mpol	0.4271	0.4342	0.3773
<i>p-value</i>	(0.0374)	(0.034)	(0.0152)
inf,centb	0.4946	0.4895	0.3832
<i>p-value</i>	(0.014)	(0.0152)	(0.0148)
inf,hicp	0.7169	0.6803	0.4909
<i>p-value</i>	(1e-04)	(3e-04)	(0.0013)

Izvor: Author's calculation

The results confirm that the ECB Executive Board's rhetoric is not random, but strictly dictated by price trends. The high Pearson coefficient for the pair *inf;hicp* (0.7169) with a significant p-value proves a strong positive correlation - in order to anchor inflation expectations, the ECB used "verbal intervention" as a direct response to HICP growth above 2%. Somewhat lower coefficients in pairs with Spearman (0.68) and Kendall (0.49) indicate the non-linearity of the relationship, which suggests the existence of a time deviation (lag) or an extreme rhetorical reaction in specific quarters of the crisis. The strongest established connection is manifested in the *inf;euro* pair (0.7361), which surpasses even the connection with HICP.

This suggests that price growth was rarely discussed in isolation, and the narrative was focused on the stability and preservation of the integrity of the entire euro area, especially during the 2022-2024 crisis. A moderate but statistically significant correlation ($p < 0.05$) in the pairs *inf;mpol* and *inf;centb* (0.43-0.49) indicates the following: a) *inf;mpol* - the growth of talk about inflation naturally follows monetary policy, but the correlation is not perfect because policy is also discussed through the topics of financial stability or the digital euro; b) *inf;centb* - the significance of this pair confirms that in times of crisis, the ECB, in addition to explaining inflation, had to actively defend its mandate and institutional independence. The weakest link in this correlation of pairs is inflation and economic growth (*inf;gdp*). The pair *inf;gdp* is the only one with p-values higher than 0.05 (0.18 for Pearson). This correlation is not statistically significant. This is an important finding that suggests that the topics of inflation and economic growth in ECB speeches have been "uncoupled". Even as growth slowed, the focus of inflation talk remained independent. This reflects the true mandate of the ECB where price stability is primary, while economic growth is secondary. Overall, it can be said that the ECB reacts much faster by increasing the number of speeches when inflation rises, than it does by reducing the number of speeches when it starts to fall - there is clearly a fear of premature celebration. Also, it is evident that the number of speeches about the Eurozone follows the rate of inflation. When inflation is high, speakers often use the word "eurozone" to emphasize unity and the common currency as a shield. The data confirms that headline inflation (HICP) has forced bankers to change the subject. The rhetoric followed the statistics with a lag of about one quarter. Ultimately, if the "aggressiveness index of communication" is calculated based on the quarterly data (ratio of the number of speeches given about inflation to the number of speeches given about economic growth or $AIC = inf/gdp$), we get indicators (Table 4) of how many times the fight against prices was more important to central bankers compared to worrying about recession or economic growth. The higher the index, the more pronounced the "hawkish" policy.

Table 4. Aggressiveness index of communication (AIC)

Quarter	Inflation (<i>inf</i>)	Growth (<i>gdp</i>)	AIC	HICP (%)	Comments
03.20.	8	8	1.0	0.7	Equilibrium (beginning of the pandemic)
12.20.	6	11	0.5	-0.3	Focus on growth (deflation)
12.21.	13	7	1.8	5.0	A reversal towards inflation
09.22.	12	1	12.0	9.9	Peak of aggressiveness (panic)
06.23.	16	8	2.0	5.5	Controlled combat
09.24.	3	1	3.0	1.7	Low activity with caution
09.25.	0	1	0.0	2.2	Completely ignoring inflation

Source: Author's calculation

The following conclusions can be drawn from the table:

- (i) During 2020-2021 the index was low, showing that the ECB "slept through" early signs of inflation, keeping its focus on supporting the economy growth.
- (ii) The extreme level (09/22) shows an index as high as 12.0, which means that for every mention of economic growth there were an incredible 12 mentions of inflation. It was a moment of unconditional commitment to price suppression, regardless of the consequences in the form of a recession.
- (iii) In 2025, there is a return to normal, we can see a dramatic drop in the index to 0.0 in 09/25 which suggests that the anti-inflation communication cycle is officially over. The ECB stopped "scare" the markets with inflation as it stabilized around the target of 2%.

- (iv) It can be seen that the index moves almost in sync with the HICP as an anchor, but with a slight overreaction. When inflation increases 10 times (from 1% to 10%), the aggressiveness of speech increases over 20 times.

In the second research approach (interest cycles), the correlation was calculated between the actual dynamics of changes in the ECB's overnight deposit interest rate, the number of speeches on inflation, the trend of the HICP at the level of the eurozone and the trend of the CPI in Croatia after joining the eurozone on January 1, 2023. Shifting the analysis from fixed quarterly speeches to interest rate decision intervals provides insight into how the ECB actually reacts from meeting to meeting. The results from Table 5 are counterintuitive at first glance, but they actually reveal the deep logic of central banking.

Table 5: Eurozone - interest rate cycles, talks about inflation and HICP

Correlations for all pairs of data series with p-values			
Pairs	Pearson r	Spearman ρ	Kendall τ
dep;inf	-0.5109	-0.0173	0
<i>p-value</i>	<i>(0.0303)</i>	<i>(0.9458)</i>	<i>(1)</i>
dep;hicp	-0.5742	-0.4026	-0.2752
<i>p-value</i>	<i>(0.0127)</i>	<i>(0.0976)</i>	<i>(0.1183)</i>
inf;hicp	0.3233	0.637	0.4608
<i>p-value</i>	<i>(0.1907)</i>	<i>(0.0045)</i>	<i>(0.0101)</i>

Source: Author's calculation

The negative correlation with the pair *dep;inf* ($r = -0.5109$; $p = 0.03$) indicates a successful transmission of the policy because with the increase in interest rates, the intensity of talk about inflation decreases. While the beginning of the cycle (2022) was marked by a low interest rate with maximum communication pressure (panic), the aggressive increase towards 4% gradually calmed the inflationary narrative. The closer the interest rates were to their peak, the lower the need for verbal intervention - actions, i.e. interest rates, spoke louder than words. The negative and significant correlation in the pair *dep;hicp* ($r = -0.5742$; $p = 0.01$) provides empirical evidence of the classical mechanism of restrictive monetary policy. This result confirms that higher interest rates successfully "broke" the inflation rate downwards. If the correlation were positive, it would suggest that the ECB only passively follows the inflationary trend, while a negative correlation, on the contrary, proves the active and effective impact of interest rate hikes on suppressing price growth in the observed period. In the analysis of the *inf;hicp* pair, a significant difference is observed - while Pearson's coefficient ($r = 0.32$) is insignificant, Spearman's ($\rho = 0.63$) and Kendall's ($\tau = 0.46$) are high and statistically significant ($p < 0.01$). This result suggests that the relationship between inflation and speech is not mathematically linear, but monotonic. Speakers do not react in a fixed proportion (e.g. +1% inflation = +2 speeches), but consistently follow the direction of price trends. Spearman's coefficient of 0.63 gives the right picture here as it confirms the strong connection of the trends, while the low Pearson is probably the result of extreme outliers (high number of speeches despite a slight drop in HICP at certain intervals).

While the quarterly analysis (in the first approach) shows the general trend, this analysis by interest intervals shows the operational logic. It is evident that the ECB used the speeches as a prelude to interest rate changes. The results obtained for Croatia show that the correlations are not significant, which illustrates the difference between the one who makes decisions (ECB) and the one who implements and communicates these decisions at the local level (CNB).

Table 6. Croatia – interest rate cycles, talks about inflation and CPI

Correlations for all pairs of data series with p-values			
Pairs	Pearson r	Spearman rho	Kendall tau
dep;inf <i>p-value</i>	0.4568 (0.1006)	0.5636 (0.0358)	0.422 (0.0486)
dep;cpi <i>p-value</i>	0.0539 (0.8548)	-0.0432 (0.8834)	-0.0686 (0.74)
inf;cpi <i>p-value</i>	-0.0714 (0.8083)	0.2523 (0.3842)	0.2015 (0.3401)

Source: Author's calculation

Analysis of *dep;cpi* and *inf;cpi* pairs shows high p-values (0.80-0.88) and coefficients close to zero, confirming that domestic inflation (CPI) is statistically isolated from ECB rhetoric and rates. In this period, Croatia is primarily the "recipient" of the policy, while the local CPI was driven by specific factors (tourism, convergence) on which ECB interest rates did not have a targeted effect. A significant deviation is observed in the pair *dep;inf*, where Spearman's coefficient (0.56; $p = 0.035$) shows a positive relationship. In contrast to Frankfurt, where the number of speeches decreases as interest rates rise (successful transmission), in Croatia the number of Frankfurt speeches on inflation statistically increases in parallel with interest rates, so that later the number of speeches would be insignificant for the CPI itself. The governor of the CNB uses rhetoric as a tool for education and explanation of restrictive policies in a country that has just entered the eurozone. Increased communication served to explain the rise in interest rates that was previously unexpected.

5. DISCUSSION

By entering the euro area on January 1, 2023, the CNB lost its formal autonomy, but its communication function became a key channel for interpreting and legitimizing ECB policy in the national context. In the regime of limited discretion, the CNB no longer signals independent decisions, but acts as an interpreter of the common monetary stance, coordinated with the communication line of the Eurosystem. The specificity of the ECB, unlike the FED or BoE, is manifested in consensus decision-making, which avoids the perception of national conflicts (e.g. north versus south) and emphasizes the interest of the entire eurozone. Although individual votes are not published, the minutes (Account of the Monetary Policy Meeting) offer compromise transparency by presenting the arguments without naming names. Such institutional cover allows the CNB to communicate policy as a common European necessity, despite the challenges of applying a single interest rate to economically heterogeneous members.

The empirical findings of this paper confirm that the ECB's communication at the Eurozone level acted as a reactive shield - with the growth of inflation, the rhetoric intensified while neglecting economic growth, while reaching the peak of the interest cycle reduced the need for aggressive interventions. On the periphery of the eurozone, in Croatia, the CNB assumes the role of interpreter of the missing transmission. Instead of an independent battle against the domestic CPI, the CNB is synchronizing the narrative with the moves from Frankfurt. The preference of the HICP over the national price index in official speeches indicates a strategic choice to interpret harmonized European trends instead of specific domestic inflationary pressures

6. CONCLUSION

The empirical presentation of the intensity and structure of the communication channels of the ECB Executive Board and the trend of the ECB's key interest rates clearly shows that in modern monetary policy, communication has ceased to be an auxiliary tool, and has become the central instrument for the transmission of monetary impulses. In the face of an exceptionally fast and strong monetary tightening cycle after 2022, the ECB has consciously underpinned interest rate decisions with a multi-layered and coordinated communication strategy to manage inflation expectations and ensure policy credibility. On the contrary, with Croatia's entry into the euro area, the CNB found itself in a paradoxical position. Although the ECB's interest rate decisions had immediate and strong effects on domestic financial conditions, national communication remained predominantly technical, fragmented and defensive. This missed the opportunity to translate monetary impulses into the domestic context and use them to anchor the expectations of households and businesses. Unlike the ECB, which systematically uses communication through speeches, interviews and blogs to anchor inflation expectations, the CNB uses tools of anticipatory communication to a lesser extent. Public addresses of the governor and members of the CNB Council rarely contain explicit signals about the future direction of monetary policy, but mostly focus on retrospective analyzes and explanations of decisions already made. Such a communication pattern, although institutionally understandable, limits the CNB's ability to actively participate in shaping the expectations of domestic economic subjects. This gap between the intensity of monetary policy and the weakness of national communication points to the key conclusion of the paper that in the monetary union, communication is not a substitute for monetary sovereignty, but its functional substitute, and its neglect is not a neutral choice, but an active loss of the effectiveness of monetary transmission. Three hypotheses were set up in the research, and the results obtained using descriptive statistics showed that Hypothesis 1 - Increased intensity of the ECB's communication on inflation results in a fall in inflation at the Eurozone level, was confirmed. Hypothesis 2 was also confirmed - Changes in the ECB's key interest rates correlate with inflation levels in the entire eurozone, in contrast to member Croatia, where the correlation is absent. In the end, Hypothesis 3 - The differences between the intensity of communication, the effect of the interest rate channel and the trend of inflation in the Eurozone (HICP) and in Croatia (CPI) can be interpreted as an indicator of asymmetric transmission of monetary policy and communication between the ECB and the CNB, in nature for the synthesis of the first and second hypotheses, which as such is also confirmed. The results of this research are in line with the results of empirical studies and recent blogs of the ECB, which clearly show that the communication of central banks is not only a formal addition to monetary policy, but a key channel of its transmission. The works of Bholat et al. (2019), Assenmacher et al. (2021) and Ferrara and Angino (2021) emphasize that clear, simple and engaging language increases understanding and media coverage of policies, while ECB experiments (Jung, Mongelli and Scherf, 2025) show that direct education and tailored communication with non-experts improves the anchoring of inflation expectations.

The scientific contribution of the research is based on the fact that the results of the research indicate that, although changes in ECB interest rates successfully stabilize inflation at the euro area level, their effectiveness and perception in individual member states, such as Croatia, deviate significantly. This gap is further deepened by the mismatch between the communication strategies of the ECB and the national central banks, whereby the central messages of monetary policy are lost in the translation to the national context. The limitations of the research include the relatively small number of observations, the immeasurable impacts of fiscal policy and structural shocks, the CNB's communication is difficult to quantify due to its mismatched dynamics of announcements and the structure of communication channels with the ECB's public announcements methodology. Future research can link the interest rate cycles of the ECB not only with inflation but also with other macroeconomic variables such as economic growth and employment in the eurozone or individual members. Finally, future research can deal with the non-use of macroprudential measures available to the CNB in the fight against national inflation, independent of the ECB's centralized interest rate policy and communication strategy.

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APPENDICES

Appendix 1. Communication channels of the ECB

Communication channels	2020	2021	2022	2023	2024	2025	Total
Press releases	93	62	65	73	67	84	444
Speeches	95	98	98	103	109	111	614
Interviews	73	46	37	39	28	29	252
Blogs	19	15	21	46	42	57	200
Total	280	221	221	261	246	281	1.510

Source: ECB repository; <https://www.ecb.europa.eu/press/pubbydate/html/index.en.html?>

Appendix 2. Speeches by ECB Executive Board members

Groups	Speech topics	2020	2021	2022	2023	2024	2025	Total
Macroeconomic variables	Inflation	24	28	52	47	22	9	182
	Price stability	6	7	11	14	3	2	33
	Economic growth	29	25	19	21	16	12	122
	Labor market	9	2	8	9	2	1	31
Exogenous variables and events	The coronavirus	50	42	21	2	1	0	116
	Climate change	8	30	17	13	11	4	83
	International relations	6	5	19	8	2	4	44
	Russia's war against Ukraine	0	0	27	9	3	1	42
	Digitization	19	18	10	9	10	4	71
Economic policy	Monetary policy	60	54	53	47	47	24	285
	Fiscal policy	14	20	17	6	2	0	68
ECB governance	Communication	3	1	1	1	0	0	6
	ECB governance	5	4	4	3	1	4	21
Banking	Banking sector	20	20	10	12	7	2	69
	Banking regulation	3	1	0	5	0	0	4
	Banking supervision	9	13	5	9	6	3	45
	Basel III	0	0	0	1	0	0	1
	Central banking	27	34	25	22	12	7	127
EURO and Eurozone	CBDC	8	8	13	8	5	4	46
	Digital euro	7	8	10	9	10	14	64
	Euro	8	3	1	2	2	5	21
	Exchange rate	1	0	1	0	0	1	2
	Euro zone	50	46	50	46	31	18	241

Market interest rates	EONIA/ ESTR	2	0	0	0	0	0	2
	Interest rates	5	2	3	3	1	1	15
Instruments of monetary policy	Key ECB interest rates	4	0	14	9	6	1	34
	Required reserve	0	0	0	0	0	0	0
	Repo	0	1	1	0	0	0	2
Non-standard instruments of mon. policy	APP	10	5	8	5	4	0	32
	PEPP	32	10	9	2	0	0	53
	PELTRO	4	0	0	0	0	0	4
Financial stability	Financial stability	10	16	9	14	10	14	73
	Macroprudential policy	2	6	2	3	1	0	14
	Microprudential policy	0	0	0	0	0	0	0
	Risks	10	11	5	5	2	1	34

Source: ECB repository; <https://www.ecb.europa.eu/press/pubbydate/html/index.en.html?>

Appendix 3. Number of speeches by ECB Executive Board members

Executive Board Members	2020	2021	2022	2023	2024	2025	Total
Christine Lagarde, The President of the European Central Bank (1.11.2019-31.10.2027)	20	24	22	29	19	34	148
Luis de Guindos, Vice-President of the European Central Bank (1.6.2018-31.5.2026)	11	9	9	13	10	9	61
Fabio Panetta, Member of the ECB's Executive Bord (1.1.2020-31.10.2023)	14	17	22	14	-	-	67
Piero Cipollone, Member of the ECB's Executive Bord (1.11.2023-31.10.2031)	-	-	-	1	20	22	43
Yves Mersch, Member of the ECB's Executive Bord (15.12.2012.-14.12.2020)	9	-	-	-	-	-	9
Frank Elderson, Member of the ECB's Executive Bord (15.12.2020-14.12.2028)	-	10	12	8	9	10	49
Philip R. Lane, Member of the ECB's Executive Bord (1.6.2019-31.5.2027)	18	14	18	21	28	22	121
Isabel Schnabel, Member of the ECB's Executive Bord (1.1.2020-31.12.2027)	23	24	15	17	23	14	116
Total	95	98	98	103	109	111	614

Source: ECB repository; <https://www.ecb.europa.eu/press/pubbydate/html/index.en.html?>

Appendix 4. Interviews of ECB Executive Board members

Executive Board Members	2020	2021	2022	2023	2024	2025	Total
Christine Lagarde, The President of the European Central Bank (1.11.2019-31.10.2027)	15	10	6	8	6	2	47
Luis de Guindos, Vice-President of the European Central Bank (1.6.2018-31.5.2026)	15	6	10	8	9	8	56
Fabio Panetta, Member of the ECB's Executive Bord (1.1.2020-31.10.2023)	10	5	1	4	-	-	20
Piero Cipollone, Member of the ECB's Executive Bord (1.11.2023-31.10.2031)	-	-	-	0	1	8	9
Yves Mersch, Member of the ECB's Executive Bord (15.12.2012.-14.12.2020)	4	-	-	-	-	-	4
Frank Elderson, Member of the ECB's Executive Bord (15.12.2020-14.12.2028)	-	3	1	3	2	3	12
Philip R. Lane, Member of the ECB's Executive Bord (1.6.2019-31.5.2027)	12	10	11	9	4	3	49
Isabel Schnabel, Member of the ECB's Executive Bord (1.1.2020-31.12.2027)	18	12	8	7	6	5	56
Total	74	46	37	39	28	29	253

Source: ECB repository; <https://www.ecb.europa.eu/press/pubbydate/html/index.en.html>

Appendix 5. ECB Executive Board members' blogs

Executive Board Members	2020	2021	2022	2023	2024	2025	Total
Christine Lagarde, The President of the ECB (1.11.2019-31.10.2027)	3	4	3	3 (2 in cooperation)	2	2 (1 with U. von der Leyen, President of the EC)	17
Luis de Guindos, Vice-President of the ECB (1.6.2018-31.5.2026)	3 in cooperation	1	2 in cooperation	2	1	2 (1 with F. Elderson)	11
Fabio Panetta, Member of the ECB's Executive Bord (1.1.2020-31.10.2023)	5 (in cooperation)	3	-	4	-	-	12

Piero Cipollone, Member of the ECB's Executive Bord (1.11.2023- 31.10.2031)					5 (1 with U. Bindseil, P. Cipollone and J. Schaaf, 1 with P. Cipollone, P. Lane and I. Schnabel)	2 (1 with Valdis Dombrovskid , VP EU Commission	7
Frank Elderson, Member of the ECB's Executive Bord (15.12.2020- 14.12.2028)	-	1	2 (1 in cooperation)	3 (2 in cooperation)		2 (1 with Luis de Guindos	8
Philip R. Lane, Member of the ECB's Executive Bord (1.6.2019- 31.5.2027)	6	1	2	-	1	-	10
Isabel Schnabel, Member of the ECB's Executive Bord (1.1.2020- 31.12.2027)	6 (4 in cooperation)	2	1 in cooperation	1 in cooperation	2 (1 with I. Rahmouni- Rousseau, 1 with P. Cipollone, P. Lane	3 (1 with J. Manuel Campa – EBA, 1 with I. Rahmouni- Rousseau- ECB, 1 with C. Buch- ECB)	15
Total	23	12	10	13	11	11	80

Source: ECB repository; <https://www.ecb.europa.eu/press/pubbydate/html/index.en.html?>

LEVERAGING COGNITIVE TECHNOLOGIES TO STRENGTHEN ORGANIZATIONAL RESILIENCE

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ABSTRACT

The rapid advancement of digital business ecosystems has fundamentally redefined the landscape of modern risk management. The traditional rules of organizational oversight are undergoing a necessary adaptation. In an era defined by volatility and algorithmic speed, static and periodic auditing methodologies are no longer sufficient to ensure long-term stability. While earlier stages of digital resilience focused on reactive tools for non-compliance detection, this paper explores the strategic transition toward embedding cognitive technologies within the internal audit function. This research seeks to redefine the role of internal auditing as a proactive creator of systemic integrity, leveraging cognitive technologies to transform continuous monitoring into a core mechanism for strengthening organizational resilience. This study synthesizes a multi-disciplinary theoretical framework of organizational resilience, integrating Audit 4.0 principles with cognitive technologies and their governance to transition from continuous monitoring to more autonomous, intelligent control systems that operate across complex, interconnected digital business ecosystems. The content analysis demonstrates that the integration of cognitive technologies into internal auditing transforms organizational resilience from a reactive state of compliance into a proactive dynamic capability, enabling real-time detection of non-linear risks and automated remediation of internal controls to minimize the operational impact of systemic disruptions. Future studies should focus on developing hybrid governance models that integrate human oversight to preserve the ethical integrity of the internal audit function. Ultimately, this research establishes internal auditing as the critical strategic lever for survival in a volatile digital economy. By embracing this proactive role, the function becomes the cornerstone of long-term organizational resilience.

Keywords: *artificial intelligence, cognitive technologies, internal auditing, organizational resilience*

1. INTRODUCTION

Digital ecosystems have evolved beyond mere technological adjuncts to become the foundational infrastructure of the modern economy. Digital Business Ecosystems (DBEs) represent complex, interconnected networks of organizations, individuals, and technologies that collaborate to co-create and capture value. Defined by inherent adaptability, scalability, and resilience, these ecosystems enable participants to leverage collective resources and expertise to drive innovation, enhance operational efficiency, and respond dynamically to shifting market conditions (Aksoy, 2023).

Contemporary organizations no longer function as isolated entities; instead, they operate as nodes within an expansive, hyper-connected network of suppliers, platforms, algorithmic intermediaries, and global stakeholders. Consequently, the environment of modern organizations is best characterized by the VUCA framework (Volatility, Uncertainty, Complexity, and Ambiguity). Market volatility, fueled by geopolitical instability and rapid technological cycles, has created an environment where competitive advantages can be lost overnight, and regulatory requirements evolve faster than internal policies can be updated. In this context, the speed of response has become a key determinant of survival.

However, a significant gap persists: the volume of data generated within DBEs - and the speed at which this data is transformed into risk - exceeds the cognitive capacities of internal auditors and managers. Despite its impressive complexity and processing capacity, the human brain faces severe limitations (Marois and Ivanoff, 2005); it is unable to effectively process, let alone analyze, the thousands of simultaneous signals emerging from the various layers of digital infrastructure. Thus, relying solely on human oversight has become not only a bottleneck but also a primary source of organizational vulnerability. Traditional risk management is predicated on the assumption of linearity (Yang and Wei, 2025) - the belief that cause and effect are proportional and that historical data serves as a reliable predictor of future developments. Organizations can no longer rely on internal audit as a static or purely retrospective function, rendering traditional methodologies that verify compliance only at specific points in time increasingly obsolete (Ilori, 2024). However, within DBEs, the nature of risk has undergone a radical ontological shift. Today's risks are increasingly nonlinear and systemic (Garcia, 2025). Systemic disruptions - such as algorithmic errors propagating through financial markets in milliseconds or cyberattacks compromising entire supply chains - do not follow a Gaussian probability distribution. These are often 'black swan' events, where a minor anomaly in one segment of the system can trigger a catastrophic outcome in another, seemingly unrelated part. The central research question (RQ) addressed in this study is how the integration of cognitive technologies into management control and internal audit systems transforms an organization's capacity to predict, absorb, and adapt to nonlinear disruptions. RQ1: Which specific cognitive technologies are most frequently identified in the literature as drivers of organizational resilience within the internal audit function? RQ2: In what ways do cognitive technologies contribute to the enhancement of organizational resilience within the digital business ecosystems by transforming traditional oversight into proactive management control?

2. THEORETICAL CONTEXT AND CORE DETERMINANTS

DBEs function as complex adaptive systems (CAS) in which the interactions between components are more critical than the components themselves (Garcia, 2025). This collective framework facilitates enhanced organizational agility, allowing the ecosystem to navigate volatility through shared value creation and distributed intelligence. Utilizing a CAS approach allows for a deeper understanding of how organizational resilience and critical thresholds operate within volatile environments (Carmichael and Hadzikadic, 2019). Faced with these challenges, the internal audit function stands at a historic turning point. This research explores the strategic integration of cognitive technologies within internal auditing, establishing a framework known as Audit 4.0. According to Latjampo et al. (2025), Audit 4.0 represents a fundamental transformation of traditional auditing practices, characterized by the integration of technologies such as Artificial Intelligence (AI), Machine Learning (ML), Robotic Process Automation (RPA), and Blockchain. This paradigm shift is most prominently evidenced in the domains of anomaly detection and financial fraud prevention, where AI-driven cognitive systems demonstrate significant analytical advantages over conventional auditing methodologies. The successful implementation of Audit 4.0 is determined by three critical factors: digital competence of auditors, technological readiness, and organizational support (Latjampo et al., 2025). Industry 4.0 represents a comprehensive digital transformation of contemporary production and operational paradigms, whereas cognitive technologies function as the specialized intelligent components - comprised of advanced software and algorithms - that render this transformation both autonomous and intelligent. Drawing on the architectural foundations of Industry 4.0, Audit 4.0 integrates the six core design principles: interoperability, virtualization, decentralization, real-time capability, service orientation, and modularity (Alao and Gbolagade 2019).

Continuous monitoring, as an integral component of Audit 4.0, ensures the uninterrupted validation of control processes, thereby establishing the necessary foundation for the application of advanced cognitive technologies. Cognitive technologies are technologies designed to emulate selected human cognitive functions, such as learning, reasoning, pattern recognition, and decision support, by processing complex, high-dimensional data. Furthermore, Chrisomalis and Miton (2026) define these systems as 'culturally acquired and shared systems for classifying, organizing, or managing information and knowledge'. Within a management context, they facilitate the automatic, real-time analysis of business processes across all organizational levels (Bytniewski, 2020). Cognitive technologies enable the internal audit function to evolve into a strategic lever that not only preserves value by mitigating risk but also generates value by facilitating faster and more secure innovation. True organizational resilience stems from a system's capacity to anticipate disruption and automate its response. Organizational resilience is a multidimensional and cross-level concept that reflects an organization's ability to navigate crises. Unlike adaptability or robustness, organizational resilience specifically denotes the capacity to react, recover, and develop amidst destruction, uncertainty, and emergency (Xiao and Cao, 2017). It is defined through two primary lenses: a dynamic perspective, which views it as a developmental process and a combination of adaptive and predictive capabilities, and a static perspective, which characterizes it as a functional state of successful adaptation and survival following environmental disruption (Chen, Liu, and Zhou, 2021). The central objective of this paper is to investigate and demonstrate how the integration of cognitive technologies redefines the role of internal auditing: transitioning from a reactive compliance function to a proactive creator of organizational resilience. This repositioning establishes internal auditing as a fundamental pillar of sustainability and trust within a complex and unpredictable digital landscape. The cognitive audit strategy follows a structured evolutionary path, beginning with the standardization and digitization of auditing processes, followed by the automation of tasks and the application of advanced analytics, ultimately culminating in the use of cognitive technologies to transform the entire audit function (Munoko, Brown-Liburd, and Vasarhelyi, 2020).

3. METHODOLOGY

The selection and analysis of the literature followed a structured process to ensure academic rigor. Initially, 438 records were identified through searches across primary databases, including Scopus, ScienceDirect, IEEE Xplore, Emerald Insight, and Google Scholar. After the systematic exclusion of 121 duplicate records, the remaining 317 papers underwent a preliminary screening of titles and abstracts to ensure thematic relevance to Audit 4.0 and cognitive technologies. Subsequently, an in-depth eligibility assessment was conducted on 84 documents through a full-text review to verify methodological quality. Ultimately, 12 studies were selected for final inclusion, forming the core evidence base for the content analysis. Search queries were constructed by grouping relevant keywords with the OR operator for synonym expansion, and the AND operator to refine the scope of the intersection between auditing and cognitive technologies. For instance, the query string utilized variations such as: ("Audit 4.0" OR "Internal Audit" OR "Continuous Auditing") AND ("Cognitive Computing" OR "Artificial Intelligence" OR "Machine Learning" OR "Cognitive Technologies") AND "Organizational Resilience". To ensure the rigor and replicability of this study, specific inclusion and exclusion criteria were established to filter the identified literature. The review is limited to peer-reviewed research published between 2020 and 2026, capturing the most recent advancements in cognitive technologies and Audit 4.0. Only studies that explicitly discuss the integration of cognitive technologies within the internal audit function are included. The literature had to address the impact of these technologies on organizational resilience, risk mitigation, or systemic stability to align with the core research questions.

The selection was restricted to English-language publications from high-impact journals, conference proceedings, and recognized professional auditing bodies. Studies focusing solely on traditional auditing without a cognitive or autonomous component were excluded to maintain the focus on Audit 4.0. The synthesis matrix enabled systematic comparison and mapping of emergent themes.

4. CONTENT ANALYSIS

To systematically evaluate the selected literature, a content analysis was performed using a structured synthesis matrix (Table 1). A content analysis was conducted to synthesize diverse perspectives from the literature, driven by the established research questions. The structured comparison provides the necessary clarity to evaluate how cognitive technologies functionally contribute to organizational resilience. This approach allowed for a consistent cross-comparison of the studies by categorizing data based on key dimensions.

Author (Year)	Technology	Research objective	Contribution to organizational resilience	Shortcoming / Limitation of the work
Abbas, De Santis and Kolbjørnsrud (2026)	AI, RPA, ML, GenAI, LLMs	To compare AI adoption in accounting firms and in the accounting function of non-accounting firms, examining current adoption levels, perceived value, and the organizational, environmental, technological, and individual factors that drive or hinder adoption.	Organizational resilience is fundamentally driven by the proactive integration of robotic systems and the cultivation of internal innovation; this synergy between automation and human expertise enables firms to transform complex compliance risks into a strategic advantage, ensuring long-term operational stability and precision in the AI era.	AI is still in an early adoption phase, GenAI research remains immature, and adoption is hindered by rigid business models, skill deficits, trust and ethics issues, privacy and security risks, and the uneven ability of organizations to implement and govern AI effectively. The study's qualitative findings, based on 35 Nordic interviews, offer rich contextual insights rather than generalizability.
Dambe (2023)	AI, ML	To investigate how AI can improve cybersecurity and internal audit practices, including automation, real-time threat detection, better accuracy, and increased organizational visibility.	AI improves system resilience by using anomaly detection software, which enables the system to switch from defense to proactive counterattack and self-healing.	Main vulnerabilities and of AI are lack of transparency/black-box decisions, high data requirements, susceptibility to confusing or poisoned data, maliciously modified models, and the need for human oversight.
El Bahi, Charef, and Bourjila (2025)	AI, big data, RPA, blockchain	To analyze how digitalization transforms the internal audit function and explore the evolution of audit functions in a context marked by technological acceleration and increased governance complexity.	Digitalization shifts internal audit from retrospective control to predictive, continuous and strategic risk management, which the author directly associates with strengthening organizational resilience.	The literature review is based on 23 heterogeneous studies, yielding interpretive rather than exhaustive conclusions. While manual selection ensured depth, the diversity of methods and contexts, alongside potential selection bias, precludes the formation of uniform empirical generalizations.

Han, Shiwakoti, Jarvis, Mordi and Botchie (2023)	Blockchain, AI	To investigate how blockchain can improve transparency and trust in accounting and auditing and how professionals can use blockchain data to improve decision-making; to identify emerging themes in blockchain applications and points of caution in adopting blockchain.	Resilience could be enhanced by combining blockchain with other technology forms, notably, AI, IoT or cloud computing. Blockchain can strengthen resilience by providing shared, verified, consensus-driven, traceable, and auditable data, which reduces information asymmetry and improves trust, transparency, collaboration, assurance, and audit efficiency.	Blockchain is still a new and evolving technology. Main challenges are technical, organizational, and regulatory. Blockchain is not a one-size-fits-all solution. More empirical case-based research is needed; and further standardization, governance, and regulatory adjustment are required before it can become integral part to the financial system.
Ilori (2024)	AI, RPA, data analytics, blockchain	To present a strategic roadmap for transforming internal audit in the era of digital governance, with emphasis on public-private sector synergy, and to examine how emerging digital technologies can improve efficiency, relevance, and impact of internal audits.	Digitally transformed internal audit strengthens resilience through real-time monitoring, data-driven governance, and automated control testing, enhancing anomaly detection and compliance. This requires a shift from retrospective functions to tech-enabled strategic partnerships that leverage cross-sector collaboration to drive ethical leadership and public trust.	The paper identifies major transformation constraints and conditions for success: top management support, continuous upskilling, enterprise-system integration, and an adaptive culture. It also notes interoperability challenges, resistance to change, data privacy and cybersecurity risks, and resource constraints. The paper is more conceptual and prescriptive than directly empirical.
Kokina, Blanchette, Davenport and Pachamanova (2025)	AI, ML, NLP, OCR, RPA, IPA, DL, NN, GenAI	To examine how AI is being implemented in auditing, how audit clients are using AI in financial reporting, what the main challenges of AI implementation are, and what solutions auditors and other fields propose for those challenges.	AI can improve resilience by increasing efficiency, enabling anomaly detection, supporting full-population analysis, extracting key contractual data, and helping auditors prioritize higher-risk areas. Current resilience gains come mainly from simple AI; more advanced AI remains experimental, and auditors still rely heavily on human review rather than fully trusting AI outputs as audit evidence.	The main challenges are transparency and explainability problems, AI bias, data privacy concerns, robustness and reliability issues, fear of auditor overreliance on AI, and the lack of AI-specific guidance. Methodologically, the study is based on 22 qualitative interviews with professionals from large U.S. firms, so findings are field-based and rich but not broadly generalizable to all firm sizes or jurisdictions.

Lombardi, Kim, Sipior and Vasarhelyi (2025)	Blockchain, RPA, AI, cloud computing, NN, expert system, data clustering	To obtain expert predictions on the future directions of advanced technology supporting auditors, and to assess how these technologies will affect audit automation, skill sets, regulation, ethical issues, and audit practice.	Resilience is strengthened through greater automation, continuous monitoring, improved data analysis, and cognitive tools assisting judgment, but the pace and shape of this transformation depend heavily on regulatory frameworks and auditor capabilities.	The study is prediction-based (Delphi) rather than direct empirical testing of outcomes; it highlights significant risks and concerns around ethics, overreliance on technology, algorithmic bias, cognitive distortions in auditing, privacy, cybersecurity.
Loumachi, Lacerda, Ouazzane, Adnane and Adamyk (2026)	AI	To investigate the minimal normative conditions under which AI systems can be recognized as authoritative in cybersecurity and compliance and auditing, such that their outputs can count as valid compliance artefacts and audit evidence.	Resilience must transcend the mere absence of anomalies or the presence of stable telemetry. Because traditional AI audit systems often generate a false sense of security by overlooking missing or ineffective controls, genuine resilience requires a shift from passive monitoring to a proactive validation of control effectiveness. Organizational resilience is not defined by static dashboards, but by the dynamic alignment of regulatory assurance with runtime system behavior and the ability to maintain operations under adversarial conditions.	The study is doctrinal and conceptual rather than empirical; its criteria are minimum conditions, not full certification or validation rules; jurisdiction-specific admissibility, liability, and forensic sufficiency are outside scope. The paper also identifies broader practical limits: opaque AI systems in rule-based domains, lack of provenance, fragile dependence on single models, epistemic misalignment with regulatory logic, and undefined accountability in audit chains.
Nadzari and Yussof (2024)	AI, cloud computing, blockchain, ML	To provide a comprehensive thematic review of how digital transformation affects audit practices and auditor competencies, and to identify emerging trends in digital auditing across public and private sectors from 2020 to 2024.	Digital transformation strengthens resilience by improving efficiency, accuracy, transparency, compliance, and risk identification. Digital auditing supports flexibility and continuity, but resilience depends on auditors developing new competencies and on organizations managing digital risks effectively.	The primary constraint of this thematic review is its reliance on the synthesis of existing literature, as opposed to the empirical testing of research outcomes. The paper highlights practical constraints: cybersecurity and data-privacy risks, regulatory complexity, uneven scalability across sectors, and adoption barriers for smaller firms or public-sector entities with limited resources.

Sayal, Johri, Chaithra, Alhumoudi and Alatawi (2025)	AI, ML, blockchain, IoT, cloud, big data	To develop a robust model for anomaly detection, risk classification, and filing-pattern analysis, while integrating AI, ML, blockchain, IoT, cloud infrastructure, to optimize audit processes at scale.	AI and ML can substantially improve resilience by increasing efficiency, precision, anomaly detection, and risk identification. A stable reporting environment supports reliable audit automation. Cloud, blockchain, and IoT, strengthen collaborative, scalable, and privacy-aware audit systems.	Successful deployment depends on appropriate regulatory frameworks, strong governance for transparency, accountability and trust, stakeholder collaboration, and substantial investment in diverse talent and analytical tools. The limitations found emphasize the need for the necessary comprehensive risk assessment techniques.
Usul and Alpay (2025)	AI, blockchain, RPA, data analytics, ML, cloud computing	To examine how digitalization reshapes internal audit practices, focusing on three interconnected dimensions: technological drivers, emerging risks, and strategic adaptations.	Digital transformation strengthens organizational resilience by enabling real-time insight, continuous monitoring, stronger fraud detection, proactive governance, and more strategic risk anticipation. Internal audit can enhance governance, stakeholder trust, and organizational resilience when digital tools are combined with adaptive methodologies and ethical oversight.	The paper identifies multiple challenges: cybersecurity vulnerabilities, algorithmic bias, ethical dilemmas, regulatory ambiguity, skills gaps, resistance to automation, resource disparities between firms, and the risk of overreliance on automation causing auditor deskilling or missed nuanced anomalies. As a review paper, it is also synthesizing rather than providing original empirical testing.
Zighan (2024)	AI, ML, automation, cloud-based technologies	To present a comprehensive conceptual framework for understanding and advancing digital resilience, and to enhance the transition from traditional business continuity - cyber resilience toward a more robust and adaptive digital resilience strategy.	Digital resilience is a strategic differentiator that fosters organizational strength by developing 'sense, resist, and react' capabilities. This framework accelerates threat detection and recovery while ensuring adaptation to evolving cyber risks.	The paper is conceptual, so its main limitations are limited generalizability and the lack of empirical validation or case studies. The author also notes that implementation may vary depending on business size, industry, and cybersecurity infrastructure.

*Table 1: Content Analysis Synthesis Matrix
(Source: Author)*

To address RQ1, the findings derived from the synthesis matrix indicate that the following cognitive technologies serve as the primary drivers of organizational resilience. At the core of the cognitive revolution lies AI as an overarching concept that enables machines to perform tasks typically associated with human intelligence, such as learning, reasoning, perception, and decision-making. Machine Learning (ML), as a subset of AI, allows systems to identify patterns and improve performance without explicit task-specific programming, while Deep Learning (DL), based on neural networks (NN), enables the processing of high-dimensional and unstructured data.

Together, these technologies form the analytical foundation of organizations, supporting risk prediction and anomaly detection. To interpret unstructured data, organizations use technologies such as Natural Language Processing (NLP), which enables machines to process and interpret human language, and Optical Character Recognition (OCR), which converts scanned or image-based documents into machine-readable text. Generative AI (GenAI) goes beyond analysis by generating new content, reports, and simulations, thereby contributing to operational agility and digital resilience. While Robotic Process Automation (RPA) focuses on repetitive, rule-based tasks, its integration with AI components results in Intelligent Process Automation (IPA). IPA represents the convergence of execution (RPA) and intelligence (AI), enabling the automation or partial automation of complex end-to-end processes, including those that involve judgment-intensive steps, such as internal auditing or compliance management. The Internet of Things (IoT) and Cloud Computing provide the necessary data streams, connectivity, and computational scalability, forming a key part of the digital infrastructure backbone of modern organizations. Data Analytics and Large Language Models (LLMs) further enhance the ability to extract insights and interpret complex information, particularly from large volumes of textual data, while Blockchain technology can strengthen data integrity and immutability where appropriate. The integration of these technologies does not merely represent an incremental improvement in efficiency; rather, it signals a broader paradigm shift in which technological readiness becomes a critical enabler of long-term sustainability and organizational resilience in DBEs. Together, these technologies create a secure, scalable, and intelligent environment that strengthens organizational resilience. To address RQ2, Table 1 illustrates that cognitive technologies strengthen organizational resilience by transitioning the internal audit function from a reactive detection mechanism to a proactive strategic asset. As detailed in the Content Analysis Synthesis Matrix, this contribution is realized through the automation of complex data synthesis, the identification of predictive risk patterns, and the provision of real-time insights, which collectively allow the organization to anticipate and adapt to systemic shocks rather than merely responding to them.

5. CONCLUSION

The findings presented in this paper indicate a fundamental paradigm shift in the mechanisms through which organizations safeguard their integrity. The traditional internal audit model - which for decades functioned as a passive observer and *ex-post* evaluator of processes - has become unsustainable in an environment defined by algorithmic speed and interconnected DBEs. The integration of cognitive technologies has transformed internal auditing into a dynamic, proactive function. The synthesis of the analyzed theoretical frameworks and practical examples demonstrates that cognitive auditing is no longer a mere technological extension for increasing productivity. Rather, it represents an evolutionary leap toward system-wide adaptive resilience and real-time operational oversight. By leveraging cognitive technologies, internal audit transcends its traditional function of retroactive failure documentation. Instead, it serves as a proactive monitoring mechanism capable of identifying early indicators of systemic instability in real time, thereby enabling organizations to absorb shocks and adapt before irreversible damage occurs. The central conclusion of this paper is that organizational resilience in the digital age is no longer a static state of regulatory compliance, but a dynamic capability that directly depends on the velocity and quality of cognitive risk information processing. In the context of nonlinear threats, resilience is defined less by the extensiveness of formal protocols and more by a system's latent capacity to process high-frequency structured and unstructured data, promptly detect anomalies, and trigger immediate corrective actions. Without the capacity for algorithmic monitoring, organizations suffer from a critical lack of awareness regarding high-velocity risks inherent in DBEs.

Therefore, strengthening resilience requires not only more robust controls but more intelligent controls that learn from the environment and evolve in tandem with emerging threats. To successfully implement cognitive technologies, organizations must focus on two critical areas. The first is digital literacy and reskilling. There is an urgent need to invest in internal auditor competencies, as the professional profile of the internal auditor is being redefined through the synthesis of domain knowledge and technological expertise. The imperative is to transition from a compliance analyst to a 'system integrity designer,' a role that entails mastering machine learning methodologies, critically evaluating algorithmic bias, and strategically managing complex digital structures. While human intuition remains irreplaceable, it must be empowered by advanced digital tools. The second area involves the development of ethical frameworks for autonomous systems. The implementation of AI within supervisory functions necessitates strict transparency protocols. Organizations must ensure that the algorithms driving risk-based decisions are explainable (Explainable AI - XAI) to mitigate bias and safeguard the objectivity of audit findings. Finally, this paper raises a critical imperative for future research: the challenge of accountability in the era of autonomy. As oversight systems transition toward full automation - where cognitive agents increasingly make risk remediation decisions with minimal human intervention - the issue of legal and professional liability for potential algorithmic errors becomes paramount. This research entails several limitations that warrant consideration. The highly specialized nature of the domain and the focused timeframe (2020-2026) result in a limited pool of available content analyses for comparison. Furthermore, the manual selection and analysis process introduces a degree of subjective interpretation and selection bias. The synthesis matrix, while useful for structural clarity, necessarily simplifies complex narratives into categorized data. Finally, the study is subject to language bias, as it exclusively includes English-language publications. Future research must establish governance frameworks that ensure internal auditor accountability within autonomous systems, particularly as AI-driven controls increasingly operate with minimal intervention, requiring robust human oversight to safeguard the foundation of corporate governance. Such frameworks are essential to ensuring that, despite rapid technological advancement, the ethical integrity of the internal audit function remains a steadfast foundation of robust corporate governance.

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ECONOMIC PERFORMANCE WITHIN SUSTAINABLE DEVELOPMENT INDICATORS OF SEAPORTS: A BIBLIOMETRIC ANALYSIS

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ABSTRACT

Ports are essential to international trade, tourism, transport, and regional development. They contribute significantly to the competitiveness and economic vitality of port cities and regions while promoting global social well-being. However, ports increasingly face pressure to improve the sustainability of their operations. Over the past two decades, emphasis has grown on integrating economic performance and sustainability indicators within port systems in scientific research. Economic performance focuses on the efficiency and effectiveness of port activities, typically including operational efficiency, cost reduction, revenue generation, and market share. Sustainable development encompasses a broader set of port performance indicators that assess the environmental, social, and governance impacts of port operations. By considering these key concepts in the research, the paper aims to facilitate a clearer understanding of port economic performance within the context of sustainable development. Despite heightened interest, the literature remains fragmented, with variations in research frameworks, conceptualization of performance, and methods for measuring sustainability indicators. This fragmentation hinders a systematic understanding of the field's evolution. This paper conducts a bibliometric analysis of scientific research from the Web of Science database. It uses Biblioshiny (Bibliometrix package in R) to examine publication trends, thematic evolution, geographical distribution, and citation impact on port economic and sustainability performance indicators from 1987 to 2025. The study analyzes the thematic and conceptual structure of research on economic outcomes in seaport sustainability assessment and identifies prevailing directions and emerging research patterns. Findings reveal an overall upward trend in scientific output, with a significant increase since 2019. This analysis offers a systematic overview of the development of this research area and underscores the need for interdisciplinary, internationally coordinated strategies to align economic performance with sustainable port management.

Keywords: Ports, Economic performance, Sustainability indicators, Bibliometric analysis

1. INTRODUCTION

Seaports play a fundamental role in the global economy, serving as critical nodes in international trade, transport, and regional development.

It is widely recognized that approximately 80% of global trade by volume is transported by sea, highlighting the strategic importance of maritime transport and port systems in facilitating economic activity and global connectivity (Woo et al., 2011; Jugović et al., 2025; Notteboom et al., 2026). Beyond their logistical function, ports significantly contribute to the competitiveness and economic vitality of port cities and regions, acting as key interfaces between maritime and land-based economic systems (Notteboom and Rodrigue, 2005; Acciaro, 2015). At the same time, ports increasingly face growing pressures related to environmental protection, social responsibility, and long-term sustainability (Bjerkan and Seter, 2019; Lam and Yap, 2019; Ashrafi et al., 2020; Wan et al., 2025). Moreover, various sustainability responsibilities and performance outcomes associated with port activities remain insufficiently defined and not fully integrated into port business strategies (Battino and Muñoz Leonisio, 2022). Growing concerns over emissions, resource consumption, and environmental impacts have led to a stronger focus on integrating sustainability principles into port operations and management (Bjerkan and Seter, 2019; Ashrafi et al., 2020). Since the publication of the Brundtland Report (Brundtland, 1987), sustainable development has been widely understood as a multidimensional concept encompassing economic, environmental, and social dimensions. In the port sector, this has led to a growing body of research incorporating sustainability indicators into performance evaluation frameworks (Lim et al., 2019; Battino and Muñoz Leonisio, 2022; Alzate et al., 2024; Kishore et al., 2024). Within this context, economic performance remains a central, yet often implicitly defined, component of sustainable port development. In management literature, economic performance is commonly conceptualized through dual lenses of efficiency and effectiveness, both represented with various indicators (Kaplan and Norton, 1996, 2005; Madsen, 2025). For instance, port efficiency may be reflected in indicators such as cost per unit of port services or vessel turnaround time, while effectiveness may be associated with outcomes such as the profitability of innovative and sustainable services, including renewable-based onshore power supply (OPS) and emerging energy-related markets. Efficiency is a crucial economic principle that represents the optimal use of limited resources (inputs) to produce the maximum possible goods or services (outputs) and is typically expressed as the ratio of output to input. While efficiency focuses on how to use inputs (i.e., doing things right), effectiveness primarily concentrates on outputs (i.e., doing the right things). Thus, an efficient port might process a high volume of cargo and vessel traffic at low cost, yet perform ineffectively in terms of profitability and market share growth, particularly if those services are linked to sustainability-related innovations and investments. Although efficiency and effectiveness represent different dimensions, a comprehensive strategic framework, such as the Balanced Scorecard (Kaplan and Norton, 1996, 2005), explicitly integrates both dimensions, a perspective that is also reflected in empirical studies of port sustainability and performance (Lim et al., 2019; Battino and Muñoz Leonisio, 2022; Ge et al., 2025). In the port sector, efficiency is often reflected in economic performance (i.e., economic efficiency) and in operational performance (i.e., operational efficiency), both complex constructs assessed through a wide range of indicators (e.g., Lim et al., 2019; Battino and Muñoz Leonisio, 2022; Pereira et al., 2025). Operational efficiency of ports is typically measured through indicators of resource utilization, throughput optimization, and cost reduction, while economic efficiency often includes financial indicators (i.e., financial efficiency) (Notteboom et al., 2026), as well as market-based indicators such as competitiveness and value creation (Kaplan and Norton, 1996, 2005; Acciaro, 2015; Madsen, 2025). Port efficiency is a multidimensional construct (Notteboom et al., 2026) that reflects port performance across operations, connectivity, market share, governance, safety, security, occupational health, the environment, and social and economic outcomes, reflecting the complexity of port systems and their sustainable management.

As integrated economic and technical systems, ports encompass diverse, interrelated performance dimensions (e.g., operational, financial, environmental, market-related), requiring interdisciplinary approaches to their analysis and performance evaluation (Lim et al., 2019; Ashrafi et al., 2020; Molavi et al., 2020). Sustainable port development has been widely studied in recent years (Lim et al., 2019; Battino and Muñoz Leonisio, 2022; Alzate et al., 2024; Kishore et al., 2024). Furthermore, in sustainability-oriented research, economic performance is frequently embedded within related concepts such as energy efficiency, cost reduction, logistics optimization, and broader operational improvements. For instance, it is commonly embedded in optimization frameworks and energy-efficiency models, particularly in research on port energy systems and decarbonization (e.g., Iris and Lam, 2021; Ge et al., 2025; Singh et al., 2025; Wan et al., 2025). Consistent with this, the prominence of efficiency-related terms suggests that economic performance is frequently operationalized through efficiency measures, applied across diverse research contexts and disciplines. In these contexts, enhancements in resource use and operational processes are implicitly linked to economic outcomes, even when not explicitly defined as such. Efficiency is also considered a key performance indicator (KPI) associated with port profitability, competitiveness, and sustainability (Woo et al., 2011; Acciaro, 2015; Battino and Muñoz Leonisio, 2022). This suggests that the economic dimension of sustainability in seaports remains conceptually dispersed across the literature, reflecting a lack of terminological consistency and unified analytical frameworks. At the same time, these dispersion points to an evolving research field in which economic considerations are increasingly integrated into sustainability-oriented assessments. Furthermore, the effectiveness of specific strategic solutions, such as public–private partnerships, has been shown to support port development and long-term strategic asset control (Battino and Muñoz Leonisio, 2022). More broadly, effectiveness in port systems is also associated with outcomes such as competitiveness, value creation, and long-term financial and market performance (Acciaro, 2015; Notteboom and Rodrigue, 2005). Building on the growing body of research on sustainable port development, increasing attention has been paid over the past two decades to integrating economic performance into sustainability indicator frameworks in port systems (Woo et al., 2011; Lim et al., 2019; Battino and Muñoz Leonisio, 2022; Kishore et al., 2024). Despite this growing interest, the existing literature remains fragmented, with notable variations in research frameworks, conceptualizations of performance, and approaches to the measurement of sustainability indicators. This lack of consistency limits a comprehensive, systematic understanding of the field's evolution and obscures the role and positioning of economic performance within sustainability-oriented research in the port sector. To address this gap, this paper conducts a bibliometric analysis of scientific publications indexed in the Web of Science database. Using Biblioshiny (Bibliometrix package in R), the study examines publication trends, thematic evolution, geographical distribution, and citation impact related to economic performance and sustainability indicators in seaports. The analysis covers the period from 1987, when the concept of sustainable development emerged (Brundtland, 1987), to 2025. This study aims to provide a comprehensive overview of the conceptual and thematic development of research on economic performance within sustainability assessment in port systems. It analyzes how economic performance is represented through indicators such as operational efficiency, cost reduction, revenue generation, and market-related outcomes. By identifying prevailing research directions and emerging patterns, the study seeks to contribute to a clearer and more systematic understanding of the role of economic performance in sustainable port development.

2. MATERIALS AND METHODS

This study examines the development of research on economic performance and sustainable development of seaport systems using bibliometric methods.

It aims to analyze how economic performance indicators are represented in scientific publications on the sustainable development of seaports over the period 1987-2025. The time span begins in 1987, the year the Brundtland Report was published as the conceptual foundation of sustainable development. This study comprises the following five steps (Figure 1): i) research scope (seaports, economic performance, sustainability indicators), ii) data collection, from Web of Science (2026), iii) bibliometric analysis using Biblioshiny: dataset characteristics, annual production, sources, countries, keyword analysis (frequency and trends), and keyword distribution analysis, iv) interpretation of findings (economic performance across research contexts, v) conclusion (key insights and implications).

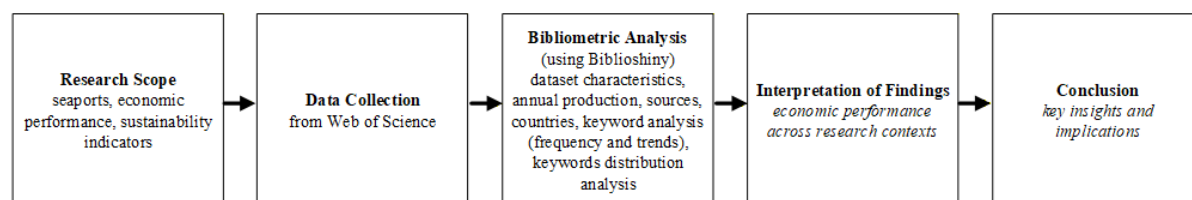


Figure 1. Research design of the study

Given that economic performance represents a multidimensional construct rather than a single, uniformly defined term, the search strategy aimed to capture its diverse conceptualizations within the literature. Instead of relying solely on the explicit term "economic performance", the query incorporates a range of related terms reflecting performance-oriented economic outcomes, such as efficiency, productivity, cost-related measures, revenue generation, financial performance, and competitiveness. This approach acknowledges that, particularly in interdisciplinary fields, economic performance is often embedded within operational, technical, and sustainability-related constructs. The search query in the Web of Science database (accessed in 2026) was defined as follows (Figure 1): (seaport* OR "sea port*" OR "maritime port*") AND ("economic performance" OR "financial performance" OR "economic indicators" OR efficien* OR productiv* OR competitive* OR cost* OR revenue* OR profit* OR "return on investment" OR ROI OR financ* OR investment* OR "resource use" OR "resource efficiency") AND ("sustainable development" OR sustainab* OR "sustainability indicators" OR "sustainable indicators" OR "sustainable port*"). The literature search was limited to English-language publications from 1987 to 2025, resulting in 406 records. Biblioshiny was used to perform bibliometric analysis. This tool enables efficient data extraction, systematic organization, and comprehensive visualization of bibliographic records, thereby supporting the identification of underlying patterns, thematic developments, and research trends within the scientific literature (Aria and Cuccurullo, 2017). This paper examines selected elements from the bibliometric analysis (Biblioshiny), including growth in scientific output over the observed period, the main publication sources, geographical distribution, and the evolution of key research themes, to provide a concise overview of the research landscape aligned with this study's aim. Therefore, this study focuses on: i) annual scientific production, ii) most relevant sources, iii) scientific production by country, iv) keyword analysis (frequency and trends), and v) keyword distribution analysis.

3. RESULTS AND DISCUSSION

3.1. Bibliometric results

Following data retrieval from the Web of Science database, the final dataset comprises 406 publications based on a defined research query. The main characteristics of the dataset are presented in Table 1.

Description	Results	Document contents	Results	Document types	Results
Sources (journals, books, etc.)	205	Keywords Plus (ID)	616	Article	308
Documents	406	Author's Keywords (DE)	1454	Article; book chapter	4
Annual Growth Rate %	22.44	Authors and authors collaboration		Article; early access	5
Average document age	4.96	Authors	1224	Article; proceedings paper	3
Average citations per document	18.51	Authors of single-authored documents	36	Proceedings paper	54
References	17370	Single-authored documents	38	Review	32
		Co-Authors per document	3.54		
		International co-authorships %	31.77		

Table 1: Main characteristics of the dataset (2003-2025)

The dataset includes publications from 205 sources, indicating a broad and interdisciplinary research landscape. The relatively high annual growth rate (22.44%) and the low average document age (4.96 years) suggest that research on sustainability and economic performance in seaports is a rapidly evolving, contemporary field.

Figure 2 shows the annual number of published articles on economic performance and sustainability indicators in the port sector over more than two decades (2003-2025). The results do not show scientific production from 1987, as the Web of Science database has not recorded any before 2003 for the query set used in this study.

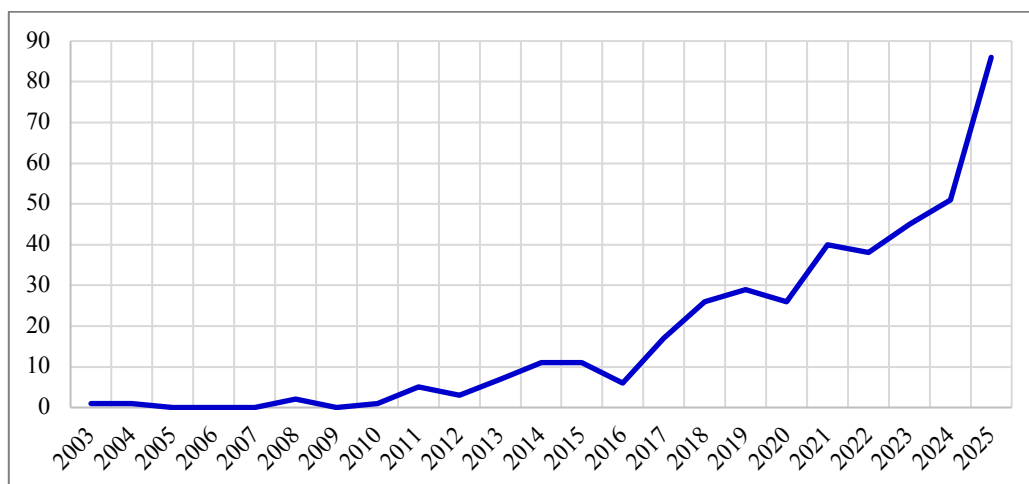


Figure 2. Annual scientific production (2003-2025)

The trendline in Figure 2 shows an increase over the observed period, with significant growth in scientific publications from 2019, though slight decreases in 2020 and 2022 during the global COVID-19 pandemic. The results indicate growing academic interest in economic performance in studies of port sustainability and the indicators associated with it. Figure 3 and Table 2 present the most productive scientific sources in the field on economic performance and the sustainable development of seaports (2003–2025), including the number and share (%) of publications. Of the 205 identified sources, only the most productive journals are presented to enhance the clarity of the results.

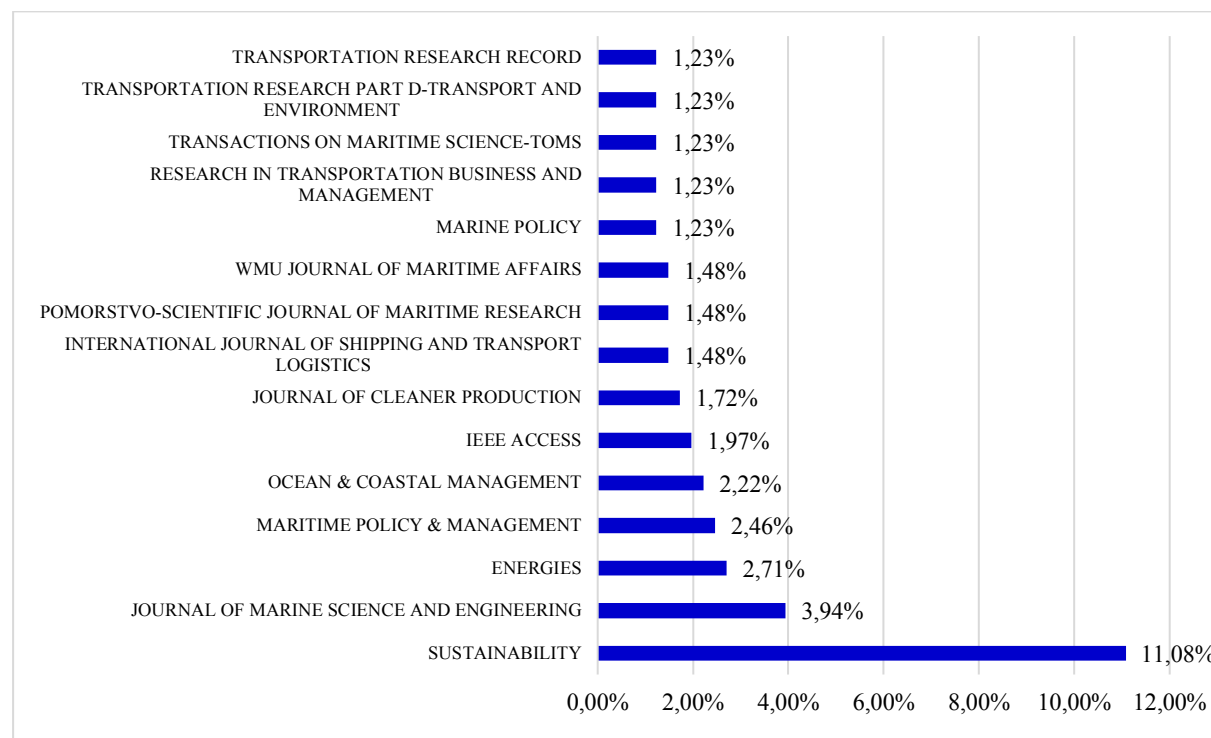


Figure 3. Most relevant scientific sources (2003–2025)

Sources	Publisher	No.	%
Sustainability (Basel)	MDPI	45	11.08
J. Mar. Sci. Eng. (JMSE)	MDPI	16	3.94
Energies (Basel)	MDPI	11	2.71
Marit. Policy Manag.	Taylor & Francis	10	2.46
Ocean Coast. Manag.	Elsevier	9	2.22
IEEE ACCESS	IEEE	8	1.97
J. Clean. Prod.	Elsevier	7	1.72
Int. J. Shipp. Transp. Logist.	Inderscience Enterprises Ltd.	6	1.48
Pomorstvo	Faculty of Maritime Studies, Uni. of Rijeka	6	1.48
WMU J MARIT AFF	Springer Nature/Springer-Verlag	6	1.48
Mar. Policy	Elsevier	5	1.23
RTBM	Elsevier	5	1.23
Trans. Marit. Sci., ToMS	Faculty of Maritime Studies, Uni. of Split	5	1.23
Transp. Res. D. Transp. Environ.	Elsevier	5	1.23
Transp. Res. Rec.	SAGE Publishing	5	1.23

Table 2. The most relevant sources, publishers, and publications (in number and %)

The results (Figure 3 and Table 2) indicate that the publisher MDPI accounts for a substantial share of the total scientific output (18.49%), with the journal Sustainability (11.08%) clearly dominating, followed by Journal of Marine Science and Engineering (3.94%) and Energies (2.71%). Other relevant sources include Maritime Policy & Management and Ocean & Coastal Management, reflecting the interdisciplinary nature of the field studied in this paper. Figure 4 presents the geographical distribution of scientific production based on the number of published articles by country (2003–2025). Of the 66 identified countries (Biblioshiny), only those with more than 10 publications are included to enhance clarity. The results indicate a strong dominance of China, followed by Spain and Italy, while other countries show comparatively lower publication outputs. This distribution reflects a concentration of scientific activity within a limited number of countries.

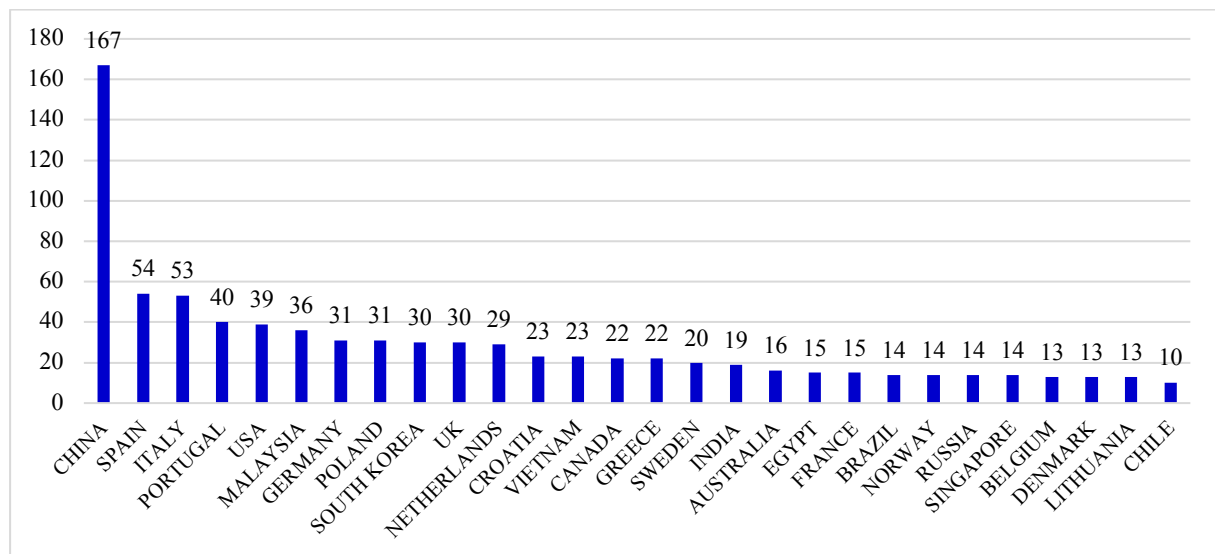


Figure 4. Scientific production by countries (2003–2025)

Figure 5 shows the frequency of the selected keywords over time derived from the Biblioshiny analysis for the period 2019–2025. General terms such as "seaport(s)" and "port" were excluded to improve analytical clarity and focus on more specific research concepts. The selected period corresponds to when these concepts began to appear more frequently in the literature.

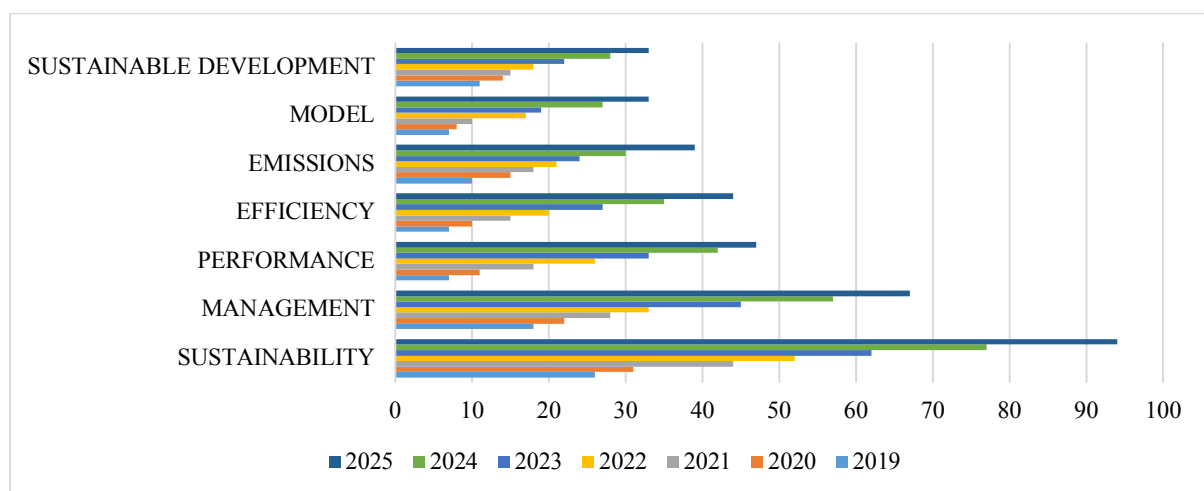


Figure 5. Frequency of the selected keywords in the dataset over time (2019–2025)

The results show a clear increase in the frequency of all selected concepts after 2019, indicating growing research activity in this area. "Sustainability" and "management" appear most frequently, followed by "performance" and "efficiency," while "emissions" also shows a steady upward trend. Figure 6 presents the distribution of the most frequent keywords in the dataset (2003-2025), reflecting the relative prominence of key research themes. The results indicate that "seaports" (12.93%) and "sustainability" (11.91%) are the most dominant terms, followed by "management" (8.49%), "performance" (5.96%), and "efficiency" (5.58%).

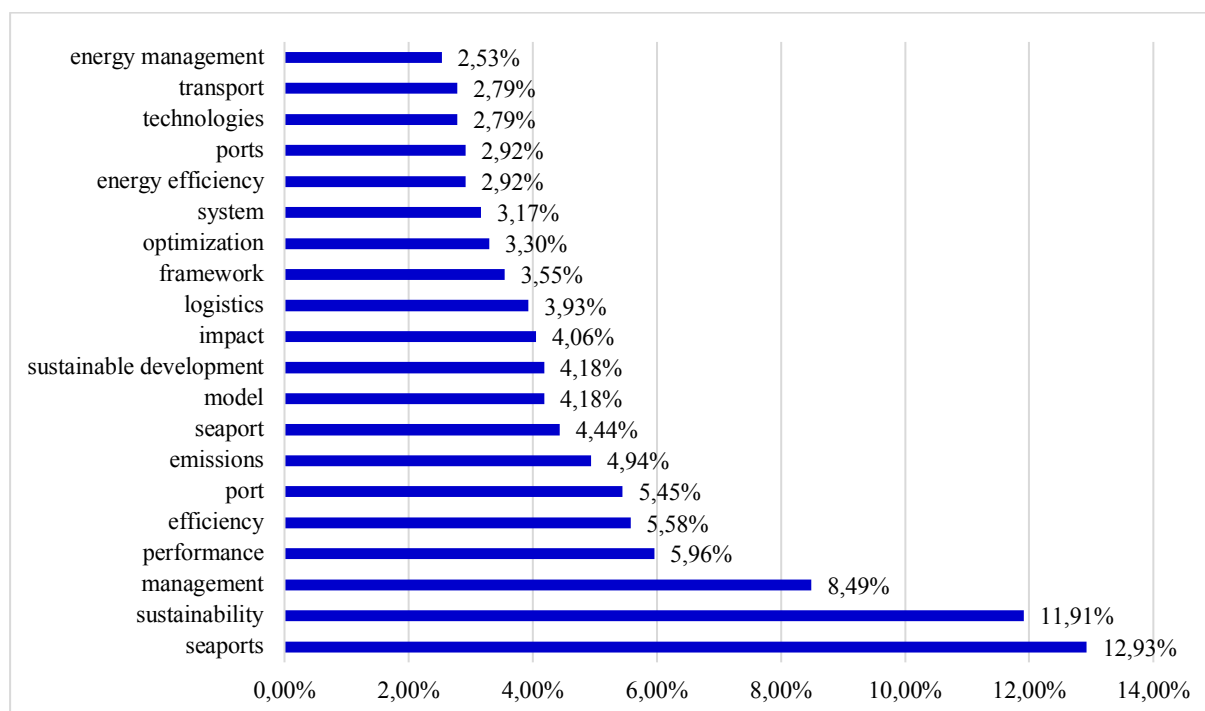


Figure 6. Distribution of the most frequent keywords in the dataset (2003-2025)

3.2. Interpretation and discussion

The results of the bibliometric analysis outline the main patterns in scientific publications over a long period (1987-2025) and provide a solid basis for interpreting economic performance across different research contexts. The observed growth in scientific output, particularly after the mid-2010s and more prominently since 2019, reflects the increasing global emphasis on sustainability, including the adoption of the Sustainable Development Goals (SDGs) in 2015. This trend indicates a rapidly evolving, interdisciplinary research field characterized by rapid growth and a broad distribution of sources and authors. Despite this expansion, explicit references to "economic performance" remain relatively limited. Instead, economic aspects are frequently addressed indirectly through themes such as energy efficiency, operational optimization, and cost-related indicators (e.g., Ge et al., 2025; Iris and Lam, 2021; Singh et al., 2025; Pereira et al., 2025). This suggests that economic performance in port sustainability research is often conceptualized through related constructs, particularly efficiency, cost reduction, and energy performance, highlighting a lack of terminological consistency across the field. In this context, economic performance is commonly associated with efficiency and effectiveness of port activities, including operational efficiency, cost reduction, revenue generation, and market-related outcomes. However, these elements are embedded within broader sustainability frameworks that also encompass environmental and social dimensions. As a result, the interpretation of economic performance depends on the research perspective and methodological approach applied.

To further explore these differences, Table 3 presents the results of the qualitative analysis of economic performance and associated indicators in the context of research on the sustainable development of ports, based on the bibliometric analysis presented in Section 3.1.

Research orientation	Typical focus	Common terms used	Interpretation of economic performance
Highly technical studies	Port operations, infrastructure, logistics, energy systems, optimization, decarbonization	Efficiency, optimization, productivity, energy efficiency, resource efficiency, costs, operational efficiency	Economic performance is implicit, mainly reflected through efficiency, cost reduction, and resource utilization
Mixed studies	Sustainable port management, performance evaluation, ESG frameworks, decision-making	Performance indicators, sustainability assessment, competitiveness, investment, efficiency, economic growth,	Economic performance is partially explicit and linked to broader sustainability indicators and managerial outcomes
Studies with an explicit economic focus	Competitiveness, market share, governance, regional development, port strategies	Financial performance, revenues, costs, profitability, investments, competitiveness	Economic performance is explicitly defined and directly analyzed using core economic indicators

Table 3: Economic performance across different research contexts

(Source: Derived from a synthesis of selected studies representing different research orientations in port sustainability research (e.g., Kaplan and Norton, 2005; Zhou et al., 2008; Notteboom and Rodrigue, 2005; Carić and Mackelworth, 2014; Acciaro, 2015; Lim et al., 2019; Ashrafi et al., 2020; Molavi et al. 2020; Iris and Lam, 2021; Battino and Muñoz Leonisio, 2022; Mahmud et al., 2024; Pallis et al., 2024; Ge et al., 2025; Jugović et al., 2025; Pereira et al. 2025; Singh et al., 2025; Notteboom et al., 2026)

Table 3 groups the analyzed publications into three categories based on economic performance across dominant research orientations: highly technical studies, mixed technical–economic studies, and economic-based studies. Technical-oriented research, for example, frequently evaluates port performance through efficiency and optimization models (e.g., Ge et al., 2025; Iris and Lam, 2021; Singh et al., 2025). In contrast, studies with an explicit economic focus emphasize competitiveness, value creation, and financial performance (e.g., Acciaro, 2015; Notteboom and Rodrigue, 2005). Mixed approaches integrate sustainability indicators with economic and managerial dimensions (e.g., Lim et al., 2019; Battino and Muñoz Leonisio, 2022). The analysis indicates that highly cited contributions are predominantly grounded in technically oriented research, particularly in energy systems, optimization, and operational efficiency. In these studies, economic performance is typically embedded in technical constructs and often expressed through efficiency-related measures rather than explicitly defined economic concepts. In contrast, mixed studies and those with an explicit economic focus explicitly address economic performance through indicators such as competitiveness, investment, revenues, and profitability. However, these approaches are less dominant within the overall research landscape. Overall, the findings suggest that economic performance remains conceptually dispersed across the literature, with varying interpretations depending on research orientation. The dominance of efficiency-related terminology further reinforces this dispersion, as efficiency is used as a proxy for multiple economic dimensions without a consistent definition across studies. This highlights the need for more integrative, conceptually grounded approaches that clearly define and systematically incorporate economic performance into sustainability-oriented port research.

4. CONCLUSION

Seaports are complex economic and technical systems that play a significant role in global economy and sustainable development. This study examined how economic performance is represented within sustainability-oriented port research by analyzing publications indexed in the Web of Science database from 1987 to 2025. A bibliometric analysis of 406 scientific publications was conducted using Biblioshiny (Bibliometrix package in R), focusing on dataset characteristics, annual scientific production, sources, countries, and keyword-based analyses. The results indicate a strong and increasing research interest in port economic performance and sustainability, particularly since 2019. The findings highlight the dominance of multidisciplinary journals and a concentration of scientific output in a limited number of countries, with China leading. Keyword analysis reveals that economic performance is most frequently represented through efficiency-related concepts, which are interpreted differently across studies. Other economic dimensions, such as costs, revenues, competitiveness, and profitability, appear less frequently and are often implicitly embedded within efficiency-related frameworks rather than explicitly addressed. The findings suggest that economic performance remains conceptually dispersed across the scientific literature on the sustainable development of ports, often embedded within broader research contexts related to port operations, technical systems, and management-related aspects. This dispersion reflects the multidisciplinary nature of the field while also indicating a lack of terminological consistency and unified analytical approaches. This study has several limitations related to the scope of the search strategy and the selection of data. The search was limited to a narrow set of keywords and synonyms, which may not fully capture all relevant studies, and the analysis relied solely on the Web of Science database. Future research should expand both the range of search terms and the selection of databases to provide a more comprehensive overview. Further research could examine the disciplinary backgrounds of authors and publications to understand better how different research perspectives shape the conceptualization of economic performance and its associated indicators in the context of port sustainability. This study contributes to the body of knowledge by providing a systematic bibliometric overview of scientific research on economic performance indicators in sustainability-oriented port development, highlighting key research trends, dominant themes, and conceptual gaps. The findings underscore the need for further research and for more consistent, integrated approaches to incorporating economic indicators into sustainable port development frameworks.

ACKNOWLEDGEMENT: *This research was funded by the European Union (NextGenerationEU) under the Croatian Recovery and Resilience Plan 2021–2026 (NRRP), through the University of Split institutional project Improvement of Maritime Traffic Sustainability in Split-Dalmatia County (PomProST) IP-UNIST-42, approved by the Ministry of Science, Education and Youth of the Republic of Croatia. Funded by the European Union – NextGenerationEU: Views and opinions expressed are the authors only and do not necessarily reflect those of the European Union or the European Commission, neither the EU nor EC can be held responsible for them.*

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SPORT MANAGERS' ATTITUDES TOWARDS ICT SKILLS DEVELOPMENT AND TECHNOLOGY ADOPTION

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ABSTRACT

The increasing digitalisation of the sport sector highlights the need for managers to possess adequate ICT skills and to support technology adoption within their organisations. Despite this, little is known about sport managers' perceptions of ICT competencies and their role in fostering digital transformation. The present study addresses this gap by examining attitudes towards ICT skills, continuous professional development, and the promotion of technology adoption among sport managers. Guided by four research questions, the study was conducted on a sample of Croatian sport managers. Participants rated their agreement with the questionnaire statements on a five-point Likert scale. The collected data were analysed using the one-sample Wilcoxon signed-rank test to assess agreement with the statements, and the Mann–Whitney U and Kruskal–Wallis tests to examine differences by demographic and professional characteristics. According to the results, sport managers recognise the importance of ICT competencies for their work, support ongoing professional development, and acknowledge their responsibility in promoting the use and adoption of digital technologies. Furthermore, the analysis of differences revealed a high degree of homogeneity in perceptions across groups defined by age, gender, level of education, and managerial position.

Overall, the study contributes to a better understanding of sport managers' perspectives on ICT implementation and adoption. These insights have implications for both academic knowledge and practical applications, particularly in guiding decision-making and ICT-related policies, informing digitalisation strategies, and supporting training, professional development, and capacity-building initiatives within the sport sector.

Keywords: *sport managers, ICT skills, technology adoption, digital transformation*

1. INTRODUCTION

The sport sector, from grassroots clubs and local associations to elite professional teams and governing bodies at national and international levels, increasingly relies on ICT to cope with complex tasks and adapt to new environmental challenges. As a result, digital transformation has emerged as a strategic imperative for all sport organisations, fundamentally reshaping their management and driving significant changes in internal structures, planning processes, and decision-making practices (Ersöz & Münir, 2023; Christodimitropoulou et al., 2025). In today's dynamic and rapidly evolving world, digital technologies are altering how sport organisations are managed and operate, while also redefining the core competencies expected of sport managers (Frevel, et al., 2022; Kacay et al., 2026). Contemporary sport managers are required to integrate digital skills with traditional managerial expertise to successfully carry out their duties. Research highlights that digital literacy and the ability to adapt to emerging technological demands are now recognised as essential for modern sport managers (Swim et al., 2023; Molina-García et al., 2024). In line with this, technological and digital skills are considered one of the key transversal competencies necessary for sport managers, along with creativity and innovation, leadership, effective interpersonal communication, networking, teamwork, problem-solving, and human resource-related capabilities (Guidotti et al., 2023). ICT encompasses a wide range of tools, platforms, and digital solutions, such as data analytics, communication technologies, cloud computing, customer relationship management (CRM) systems, and artificial intelligence, which enable the collection, storage, retrieval, analysis, visualisation, and utilisation of data to inform decision-making, streamline operations, and strengthen stakeholder interactions. Within sport management, the use of such technologies, among others, facilitates performance analytics, improves operational efficiency, supports marketing activities, and enhances fan experiences (Singh, 2020; Gallardo-Guerrero & Maciá-Andreu, 2024; Jiang & Phakdeephrot, 2024; Qi et al., 2024; Çınar, 2025). Therefore, it is crucial for sport organisations to integrate ICT into their operations in a timely manner. Achieving this, however, requires ongoing investment not only in ICT but also in the development of related skills and competencies among employees, and especially sport managers, who are responsible for leading and guiding the process of technological change within their organisations (Güneş et al., 2024). The effective adoption and use of ICT in sport organisations largely depends on various factors associated with managers' capabilities, attitudes, and behaviours. In addition to possessing digital competencies, managers need to be willing and prepared to embrace change, actively encourage employees to adopt new technologies, and support their continuing professional development in this area. Moreover, successful ICT implementation requires managers to conduct systematic planning and governance of technology-related initiatives, align digital strategies with organisational goals, and create an environment conducive to innovation. They must also secure necessary resources and funding, monitor and control ICT outcomes, ensure compliance with relevant standards, and introduce corrective measures when needed. Based on the above, it is important to examine sport managers' attitudes towards the development of ICT skills and technology adoption within their organisations. This study therefore aims to explore how sport managers view their responsibilities in ICT integration, in order to provide a better understanding of the role they play in the digital transformation of sport organisations.

2. STUDY BACKGROUND AND RESEARCH QUESTIONS

Previous research has consistently highlighted the central role of managers in the successful implementation of ICT within organisations. In particular, top management support has been identified as a critical factor in technology adoption (Yeboah-Boateng & Essandoh, 2014; Hsu et al., 2019; Wrede et al., 2020; Ali et al., 2022; AbuAkel & Ibrahim, 2023; Zhang & Bu, 2024). Several studies have further demonstrated that higher levels of managers' ICT knowledge and skills, together with their positive perceptions of technology, innovation-oriented mindset, and readiness for change, constitute key determinants of digital transformation (Thong, 1999; Ghobakhloo et al., 2011; Van Wart et al., 2017; Zentner et al., 2022; Çallı et al., 2024; Michelotto & Joia, 2024). Thus, managerial capabilities and supportive attitudes towards technology are widely acknowledged as fundamental drivers of ICT adoption and use. Given the accelerating pace of digital transformation, gaining a deeper understanding of the managerial factors that foster or hinder this process has become a research priority. Despite the growing digitalisation of the sport sector, sport managers' perceptions of ICT proficiency and the adoption of new technologies remain largely underexplored. The few studies addressing these issues (e.g., Olaoye et al., 2017; Brakhas et al., 2022; Bassey, 2025) are generally limited in scope and do not provide a comprehensive and systematic analysis of ICT implementation within sport organisations strictly from a managerial perspective. In light of this research gap, the main aim of the present study was to examine sport managers' attitudes towards ICT skills development and technology adoption within their organizations.

The study sought to answer the following research questions:

- Do sport managers consider ICT skills essential for their work, and do they believe it is important to engage in continuous professional development in this area?
- Do sport managers view it as their responsibility to encourage employees to use ICT and develop digital competencies?
- Do sport managers perceive the implementation and adoption of ICT within their organisations as part of their managerial role?
- Are there differences in sport managers' attitudes towards these issues based on age, gender, level of education, and managerial position?

This research extends the findings of Dukić and Bodražić (2022) and Dukić et al. (2022) by focusing on aspects of ICT-related managerial attitudes in the sport domain that were not addressed in those studies. By exploring sport managers' views on the importance of ICT skills, continuous professional development, and the promotion of technology adoption, the study aims to provide greater insight into their perspectives in a digital sport environment. Furthermore, by analysing differences across age, gender, level of education, and managerial position, it seeks to examine whether demographic and professional factors shape managers' perceptions of their role in the digital transformation process. Answering these research questions can contribute to the development of more effective digital strategies and enhance ICT implementation in sport organisations.

3. METHODOLOGY AND PARTICIPANTS

The study was conducted on a sample of individuals holding managerial positions in Croatian national Olympic sport federations and clubs. Data were collected through an online survey using a structured questionnaire. The first part of the questionnaire included items on respondents' demographic and professional background, followed by a section examining various aspects of ICT use and adoption by sport managers.

A total of 310 sport managers responded to the invitation to participate in the survey and completed the questionnaire. For the purpose of analysis, they were divided into three age groups: 85 (27.4%) were aged 21–35 years, 137 (44.2%) were 36–49 years old, and 88 (28.4%) fell within the 50–69 age range. There were 213 (68.7%) men and 97 (31.3%) women. Among the respondents, 93 (30.0%) had completed secondary school, 180 (58.1%) held an undergraduate or graduate degree, and 37 (11.9%) had received postgraduate education. The sample comprised 260 (83.9%) participants who identified themselves as top managers, while the remaining 50 (16.1%) reported holding middle- or lower-level management positions.

Descriptive statistics were used to summarise the characteristics of the sample and the survey responses. Inferential statistics were applied to test the study hypotheses and answer the research questions. Specifically, the nonparametric one-sample Wilcoxon signed-rank, Mann–Whitney U, and Kruskal–Wallis tests were employed in the analysis. The threshold for statistical significance was set at $\alpha = 0.05$.

4. FINDINGS

As part of the survey, sport managers were asked to indicate their level of agreement with statements regarding ICT skills development and technology adoption. Responses were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), with 3 representing a neutral position. Descriptive statistics for participants' responses and the results of the one-sample Wilcoxon signed-rank tests are presented in Table 1.

Table 1: Descriptive statistics of survey items and one-sample Wilcoxon signed-rank test results

Statement	Mean $\pm$ SD	Median (IQR)	<i>p</i> -value
ICT skills are essential for sport managers	4.49 $\pm$ 0.73	5.00 (1.00)	< 0.001*
Sport managers should engage in continuous professional development in ICT	4.24 $\pm$ 0.84	4.00 (1.00)	< 0.001*
Sport managers should encourage employees to use ICT	4.34 $\pm$ 0.78	4.00 (1.00)	< 0.001*
Sport managers should encourage employees to continuously develop their digital competencies	4.26 $\pm$ 0.84	4.00 (1.00)	< 0.001*
Sport managers are responsible for the implementation and adoption of ICT in their organisations	4.33 $\pm$ 0.83	5.00 (1.00)	< 0.001*

SD: Standard deviation; IQR: Interquartile range; *p*-value of the one-sample Wilcoxon signed-rank test.

* Statistically significant at $p < 0.05$.

The descriptive statistics in Table 1 indicated that sport managers generally expressed a high level of agreement with all items. The mean values ranged from 4.24 to 4.49, suggesting that respondents tended to agree or strongly agree with the statements. The highest mean value was observed for the statement that ICT skills are essential for sport managers, reflecting strong consensus on the importance of digital competencies in their work. Based on the means, participants agreed to a somewhat lesser extent that sport managers should encourage employees to use ICT and that they are responsible for the implementation and adoption of ICT in their organisations.

Compared with the other items, respondents showed the lowest level of agreement with the statement concerning sport managers' continuous professional development in ICT. Similarly, the median values ranged between 4 and 5, with relatively small interquartile ranges, indicating fairly consistent responses among surveyed sport managers. In order to examine whether sport managers' ratings were significantly higher than the neutral value of the scale (3), the one-sample Wilcoxon signed-rank test was conducted. The results demonstrated that the medians for all items were significantly above the midpoint. Thus, the hypothesis of agreement was supported, addressing the first three research questions. These findings confirm that sport managers perceive ICT competencies and technology adoption as important aspects of their practice.

Table 2: Differences in sport managers' attitudes towards survey items by demographic and professional characteristics (Mann–Whitney U and Kruskal–Wallis tests)

Characteristic	Category	Statement				
		ICT skills are essential for sport managers	Sport managers should engage in continuous professional development in ICT	Sport managers should encourage employees to use ICT	Sport managers should encourage employees to continuously develop their digital competencies	Sport managers are responsible for the implementation and adoption of ICT in their organisations
		Mean rank				
Age group	21 – 35	150.89	133.94	144.24	140.93	142.56
	36 – 49	157.19	160.99	156.87	157.53	159.68
	50 – 69	157.31	167.78	164.24	166.41	161.49
	Kruskal-Wallis test (<i>p</i> -value)	0.815	0.015*	0.260	0.117	0.224
Gender	Male	146.66	153.38	151.93	153.38	151.34
	Female	174.92	160.16	163.34	160.14	164.63
	Mann-Whitney U test (<i>p</i> -value)	0.003*	0.503	0.252	0.503	0.183
Level of education	Secondary school	145.20	142.48	144.74	144.35	150.26
	Undergraduate or graduate degree	155.75	159.42	159.82	160.12	159.07
	Postgraduate degree	180.18	169.18	161.51	161.05	151.31
	Kruskal-Wallis test (<i>p</i> -value)	0.069	0.154	0.309	0.295	0.660
Management level	Top-level management	154.62	155.46	154.45	153.56	153.06
	Middle- or lower-level management	160.10	155.73	160.98	165.60	168.18
	Mann-Whitney U test (<i>p</i> -value)	0.649	0.984	0.603	0.344	0.229

* Statistically significant at $p < 0.05$

Table 2 shows the mean ranks and p -values obtained using the Mann–Whitney U and Kruskal–Wallis tests to examine differences in sport managers’ attitudes towards ICT skills development and technology adoption by age, gender, level of education, and managerial position. The results indicated that statistically significant differences were found in only two cases. With regard to age, a significant difference was observed for the statement that sport managers should engage in continuous professional development in ICT. Respondents aged 21 to 35 years reported less positive attitudes, as indicated by the lower mean ranks, compared to older participants. Regarding gender, a significant difference was found for the statement that ICT skills are essential for sport managers, with females expressing more positive attitudes than males. Although the mean ranks suggested that younger respondents, men, those with secondary school education, and top-level managers were less likely to agree with the statements, no other statistically significant differences were found. Overall, the findings imply that sport managers are relatively homogeneous in their attitudes towards the issues addressed in the study.

5. CONCLUSION

This study set out to examine sport managers’ attitudes towards the importance of ICT skills, continuous professional development, and the promotion of technology adoption within sport organisations. Guided by four research questions, it further explored how they perceived their role in the process of ICT implementation. The study was conducted on a sample of Croatian sport managers. The findings revealed positive attitudes towards all issues addressed in the survey. Specifically, the results of the one-sample Wilcoxon signed-rank test showed that sport managers tended to rate all statements significantly above the neutral midpoint, suggesting that they recognise ICT competencies as essential for their work, support continuous professional development in this area, and acknowledge their responsibility in fostering digital competence and technology use within their organisations. In addition, the analysis of group differences using the Mann–Whitney U and Kruskal–Wallis tests indicated a high degree of homogeneity in managers’ perceptions. Statistically significant differences were found in just two cases, one related to age and another to gender. This suggests that positive attitudes towards ICT skills development and technology adoption are widely shared across different demographic and professional groups. The present study addresses the identified research gap by providing insights into sport managers’ perspectives on ICT implementation and adoption. The findings highlight the growing recognition of ICT skills as a key component of effective sport management and emphasise the role of managers in promoting digital transformation within organisations. In this way, the study advances both academic knowledge and practical applications, particularly in navigating the challenges of digitalisation. Despite these contributions and implications, the research is not without limitations. Focusing on participants from a single country, potential biases in sampling, and the reliance on self-reported data may limit the generalisability of the findings. Future research should consider a more diverse sample, include additional items in the questionnaire, and incorporate objective measures of ICT use and adoption. It would also be valuable to examine how attitudes translate into actual managerial behaviour and organisational outcomes. In conclusion, the study demonstrates that sport managers generally have positive and consistent attitudes towards ICT skills development and technology adoption, reinforcing the importance of integrating digital competencies into both managerial practice and professional development frameworks within the sport sector.

ACKNOWLEDGEMENT: *The authors would like to acknowledge the support of the European Union – NextGenerationEU, Project No. 581-UNIOS-102.*

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DETERMINANTS OF FINANCIAL INCLUSION IN EMERGING AND DEVELOPING COUNTRIES: A PANEL ARDL APPROACH

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ABSTRACT

The purpose of this article is to study the main determinants of financial inclusion in emerging and developing countries based on a sample of BRICS+ and two North Africa countries (Algeria and Morocco) for the period from 2008 to 2021. Using the ARDL panel approach, the results of this study reveal that in the long term, credit to the private sector and literacy rates have a positive impact on financial inclusion, while GDP per capita has a negative effect. Moreover, access to the internet does not seem to give a decisive role in financial inclusion. In the short term, access to the Internet has a positive effect on financial inclusion, while GDP per capita is negatively associated. Other variables such as literacy rates and credit to the private sector do not appear to have a significant influence on financial inclusion.

Keywords: *ARDL panel, BRICS+, Credit to the private sector, financial inclusion, GDP per capita, Internet access, Literacy rate.*

1. INTRODUCTION

Financial inclusion is a multidimensional issue linked to several economic, financial, social, cultural, technological variables, etc. Its definition, measurement, determinants and impact on the economic and social development of developed and developing countries continue to attract the interest of economists, central banks, governments and international institutions.

Financial inclusion is defined as the ease of access, availability and use of financial services by all individuals and businesses (Sarma, 2008). Numerous empirical studies have highlighted its importance in stimulating economic growth (Lenka & Sharma, 2017; Kim et al., 2018; Makina & Walle, 2019; Singh & Stakic, 2020; Ahmad et al., 2023), reducing social inequalities (Neaime and Gaysset, 2018; Inoue, 2019; Churchill & Marisetty, 2020; Omar & Inaba, 2020; Huang et al., 2020) and the proper functioning of monetary policy (Yetman, 2017). Financial exclusion would prevent certain economic agents, whether households or businesses, from accessing and using financial services. This could have a negative impact on the mobilization of their savings, their consumption and investment behavior, and consequently hinder the country's economic development and increase social inequalities.

It could also weaken some of the transmission channels of monetary policy and complicate the implementation of countercyclical monetary policy. Given its important economic and social role, empirical studies have focused on examining the main factors that explain the development of financial inclusion. The results of some of these studies have shown that income, education and internet access are the most important determinants of financial inclusion (Sarma and Pais 2011; Chithra and Selvam, 2013; Fungacova and Weill, 2014; Tuesta and al., 2015; Evans, O., & Adeoye, B. 2016 ; Evans, 2018). Supply-side factors, such as the bank branch network, have also been linked to the level of financial inclusion (Kumar, 2013). In addition, studies have shown that age and gender can also play a significant role as explanatory factors for this level (Fungacova and Weill, 2014; Zinset Weill, 2016). To deepen research on the determinants of financial inclusion, this paper aims to study the role that income, education, access to the internet and credit granted to the private sector could explain the level of financial inclusion in emerging and developing economies. To do this, an empirical study is conducted on BRICS+ countries¹ and two North Africa countries² (Morocco and Algeria), for the period 2008-2021, using the ARDL panel approach. The choice of this sample is justified by the fact that these countries are characterized by diversity in terms of economic development, social structures and access to financial services, thus providing an opportunity to analyze how different economic contexts influence policies and initiatives to promote financial inclusion. The findings of this study will contribute to understanding the dynamics of financial inclusion in these regions and may help governments design effective policies for more sustainable financial inclusion. The rest of the study is structured as follows: the second section examines a review of the empirical literature on the determinants of financial inclusion. The third section presents the empirical method. The fourth section focuses on the presentation and discussion of the results, as well as robustness analysis before concluding this paper.

2. LITERATURE REVIEW

Financial inclusion is often presented as the opposite of financial exclusion. Both concepts implicitly express a deliberate choice or (and) an imperfection in market mechanisms to cover the entire population and respond in an affordable and sustainable manner to the needs of individuals and businesses in terms of transactions, savings, access to credit, and other aspects. Financial exclusion refers to the non-consumption and/or unavailability of formal banking or financial services for one reason or another. Indeed, at the microeconomic level, financial exclusion can be considered rational behavior on the part of an economic agent who does not wish to enter the formal financial system for economic and/or sociocultural reasons. It can also be explained by natural economic barriers to entry into the sector (cost price, account maintenance costs, file processing costs, minimum guarantee, insurance costs, intermediation margin, management fees, etc.), which require a minimum price for the service, regardless of the level of competition between players. At the macroeconomic level, financial exclusion results in losses in savings, credit, investment, entrepreneurship, consumption, employment, tax revenue, value added, growth, the formal economic circuit, regulation, etc. Hence the economic and social interest of state intervention to make this service accessible to all citizens. This explains the interest and priority given by governments, financial institutions, and various stakeholders to the issue of financial inclusion. The launch of the World Bank's Global Findex database and the IMF's Financial Access Survey (FAS) has enabled the creation and use of more multidimensional composite measures of financial inclusion. These measures take into account a variety of factors related to access to and use of financial services by households and businesses (Sarma, 2008; Demirgüç-Kunt & Klapper, 2012).

¹ Brazil; Russia; India; China; South Africa; Egypt; Ethiopia; Iran; Saudi Arabia; United Arab Emirates.

² Tunisia and Libya were not included in this study because of the exceptional situation these countries have been going through since 2011.

They have paved the way for the exploration and development of macroeconomic impact analyses (Sahay et al., 2015; Rastogi, 2018; Duvendack & Mader, 2020), as well as the study of the determinants of financial inclusion. Numerous studies have addressed this issue, seeking to identify the main factors that impact access to and use of financial services. To this end, we will explore the various studies that have examined the determinants of financial inclusion. In their cross-sectional study of factors associated with financial inclusion, Sarma and Pais (2011) identified income (measured by GDP per capita), adult literacy rates, and access to information (internet and mobile phones) as the main determinants of financial inclusion. They also point out that countries with low GDP per capita have relatively lower levels of connectivity and lower literacy rates, which appear to be associated with significant financial exclusion. These findings converge with those of Tuesta et al. (2015) in Argentina, Pena and Tuesta (2014) in Peru, and Evans and Adeoye (2016) in Africa, who also identify income and education as important factors explaining the level of financial inclusion. Furthermore, several studies have found that education and literacy play a fundamental and decisive role in financial inclusion, independently of other socioeconomic variables. One example is a study conducted in Mexico on the determinants of financial inclusion using multiple correspondence analysis. Pena et al. (2014) found that education is one of the most significant determinants of access to financial services. Similarly, an analysis of the determinants of financial inclusion in sub-Saharan Africa, where the main obstacle to financial inclusion is illiteracy, based on cross-sectional data from the World Bank covering 20 countries, Chikalipah (2017) indicates that illiteracy is a significant factor in low financial inclusion. Thus, despite the geographical diversity of the contexts studied, these studies agree that income and education play an essential role in financial inclusion. Other factors also influence financial inclusion, particularly demographic characteristics, among these, we cite gender and age, which also play a decisive role in financial inclusion. Several studies have highlighted how these variables influence equitable access to financial services in various geographical and economic contexts. For example, Fungacova and Weill (2014) compared financial inclusion in China with that of other BRICS countries. Their findings indicate that income and education promote financial inclusion. They also pointed out that being male and older is associated with greater use of formal accounts and credit, i.e., men and older people have a higher level of financial inclusion. In Africa, Zins and Weill (2016) demonstrated that being male, wealthier, more educated, and older promotes financial inclusion. Indeed, they indicate that education and income have a greater influence than other factors. Although age and gender have an impact, it is mainly levels of education and income that determine financial inclusion in Africa. Other factors also determine financial inclusion, including information and communication technologies (ICT). Several studies have highlighted the key role of ICTs such as the internet, mobile phones, and mobile banking in promoting financial inclusion in regions with limited banking infrastructure. In their analysis of the link between financial inclusion and fintechs accessed via mobile phones and the internet in Africa using a dynamic panel data approach, El Yamani and Betane (2025) showed that fintechs contribute to increasing the level of financial inclusion in the long term. The results also indicate that credit provided to the private sector promotes financial inclusion. Furthermore, Evans (2018) asserts that mobile telephony and the internet have made it easier for people to obtain basic financial services, which has stimulated the inclusion of the financially excluded poor. He also points out that macroeconomic factors such as capital formation, primary schooling, bank credit, broad money, population growth, remittances, agriculture, and interest rates, as well as institutional factors such as the quality of regulation, are important underlying factors for financial inclusion in Africa. These findings are consistent with those of Allen et al. (2014) in their study on financial development and financial inclusion gaps, where they found that innovations in financial services, such as mobile banking and mobile money, have helped overcome infrastructure problems and improve access to financial services.

However, they observed that population density is a more decisive factor for financial development and inclusion in Africa. Similarly, Efobi et al. (2014) conducted a study examining both access to and use of banking services in Nigeria. Their findings highlighted that individual characteristics, namely income and use of ICT (information and communication technology), are significant factors influencing the use of banking services. Furthermore, the findings of Allen et al. (2016) reveal that national and individual characteristics of countries have a significant impact on financial inclusion. Factors such as the quality of institutions, the effectiveness of legal rules, strong contract enforcement, and political stability contribute to promoting formal financial inclusion. In addition, the characteristics of the banking sector also play a decisive role. High costs for opening and using bank accounts, significant distance between financial institutions and users, and high disclosure requirements can reduce access to formal financial services. Furthermore, the existence of a deposit insurance system and the provision of tax incentives also promote financial inclusion.

3. EMPIRICAL METHOD

3.1. Data

Financial inclusion has attracted the interest of international organizations, governments, central banks and financial institutions who have discussed and studied its measures and effects. The World Bank has defined it as the possibility for individuals and companies to access at a lower cost a whole range of useful financial products and services adapted to their needs (transactions, payments, savings, credit and insurance) offered by reliable and responsible providers. So, the essential and main step towards financial inclusion is to offer individuals direct access to a banking account. According to Sarma (2008), financial inclusion is defined as the ease of access, availability and use of the formal financial system by all members of the economy. This definition focuses on several dimensions of financial inclusion, including accessibility, availability, and use of the financial system. These dimensions contribute to forming an inclusive financial system. Sarma (2008) proposes a Financial Inclusion Index (IFI), using a multidimensional approach based on three dimensions similar to that of the UNDP HDI. Bank penetration represented by the size of the banking population, which is often measured by the number of people with a bank account at a bank outlet per 1000 adults. The availability of banking services as indicated by the number of bank outlets per 100.000 inhabitants and the number of ATMs per 100.000 adults. Banking utilization as measured by credit and deposits, expressed as a percentage of GDP. In his study to measure financial access, Arora (2010) calculated the financial inclusion index using the same reasoning as Sarma (2008) for two main groups of countries: advanced economies and developing and emerging economies. Arora incorporated more variables into the accessibility dimension, measured in terms of depth and availability, compared to Sarma. It took into account not only demographic penetration, but also geographical penetration. It also added the ease and cost of transactions dimensions that were not included by Sarma. Gupte, Venkataramani, and Gupta (2012) developed a financial inclusion index by calculating a four-dimensional geometric mean for India in 2008 and 2009. They included all the dimensions considered in previous studies to get a more revealing index of the degree of financial inclusion. This index includes the following dimensions: Awareness: This dimension examines demographic and geographic penetration and accessibility, taking into account variables such as geographic penetration of bank branches, ATMs, and the number of bank accounts per 1000 adults. Utilization includes the volume of credits and deposits as a percentage of GDP. Ease of transactions: The variables included in this dimension relate to the ease or difficulty of opening a savings account, current accounts, or obtaining loans, as well as transaction costs. The IFI for India increased from 0.346 to 0.352 between 2008 and 2009. This improvement is largely due to the first dimension, namely the geographical and demographic penetration of branches, which plays a significant role in this study.

In the empirical part of our study, we selected several key variables to analyze the determinants of financial inclusion in BRICS+ countries and North Africa. These variables were chosen based on their theoretical and empirical relevance to study the determinants of financial inclusion.

3.2. Variables

Financial Inclusion: To measure financial inclusion, we used the method used by Sarma (2008). We calculate two-dimensional synthetic index of financial inclusion due to the availability of data:

- The availability of banking services: this is indicated by the number of bank outlets per 100000 inhabitants and the number of ATMs per 100000 adults.
- The use of the banking system includes two basic services: credit and deposit, measured by the volume of credit and deposit as a proportion of the country's GDP.

To do this, we use the following two formulas:

$$D_i = \frac{A_i - m_i}{M_i - m_i} \quad (1)$$

With:

D_i : The value of the index for dimension i

A_i : The real value of dimension i

m_i : The minimum value of dimension i

M_i : The maximum value of dimension i

According to Sarma, d_i is between 0 and 1. A higher value of d_i indicates that the country reaches dimension i. Taking into account n dimensions of financial inclusion, a country i will be represented by a point $D_i = (d_1, d_2, d_3, \dots, d_n)$ in an n-dimensional Cartesian space³.

The Financial Inclusion Index (IFI) for country i is then measured using the normalized inverse Euclidean distance between the point D_i and the ideal point $I = (1, 1, 1, \dots, 1)$.⁴

$$IFI = 1 - \frac{\sqrt{(1-d_1^2) + (1-d_2^2) + \dots + (1-d_n^2)}}{\sqrt{n}} \quad (2)$$

Since we limit ourselves to two dimensions in our analysis, the availability of banking services and the use of the banking system, the financial inclusion index is defined as follows:

$$IFI = 1 - \frac{\sqrt{(1-A^2) + (1-U^2)}}{\sqrt{2}} \quad (3)$$

This synthetic financial inclusion index can be classified into low, medium and high level according to its values.

- $0.5 < IFI < 1$: high financial inclusion
- $0.3 < IFI < 0.5$: average financial inclusion
- $0 < IFI < 0.3$: low financial inclusion

Income: is measured by GDP per capita. Previous research has identified GDP per capita as an important determinant of financial inclusion in countries (Sarma and Pais, 2011; Fungacova and Weill, 2014; Tuesta and al., 2015; Pena Hoyo and Tuesta, 2014; Chithra and Selvam, 2013).

³ Sarma, M. (2008). *Index of financial inclusion* (p. 6).

⁴ Sarma, M. (2008). *Index of financial inclusion* (p. 7).

Credit extended to the private sector: refers to financial resources provided to the private sector by other deposit-taking companies in the form of trade credits, loans, and other accounts receivable that create a repayment claim. It has been shown to play a key role in financial inclusion. Studies such as that of Chithra and Selvam (2013) show the positive and significant impact of credit penetration on financial inclusion.

Literacy: measured by the literacy rate. Previous studies have highlighted that literacy is one of the most significant determinants of financial inclusion (Sarma and Pais, 2011; Fungacova and Weill, 2014; Tuesta et al., 2015; Pena Hoyo & Tuesta, 2014; Zins and Weill, 2016). However, Chikalipah (2017) highlights that illiteracy is the main barrier to financial inclusion.

The Internet: measured by the percentage of Internet users in the population. People who have used the internet in the last three months, regardless of location, are considered internet users. Internet access is a factor influencing the use of financial services and promotes the financial inclusion of the excluded population (Evans, O. & Adeoye, B. , 2016; Efobi and al., 2014; Allen and al., 2014; Evans, 2018).

In addition to this financial inclusion index, other variables were selected to represent the determinants of financial inclusion. These variables were chosen based on the review of the empirical literature (Sarma and Pais, 2011; Fungacova and Weill, 2014; Evans, O. & Adeoye B., 2016; Peña Hoyo & Tuesta, 2014; Chithra and Selvam, 2013; Tuesta and al., 2015). They include income, credit, Internet access and literacy rates. The data sources for these variables are presented in the table below.

Table 1: Data sources

Variables	Spring
IFI: Financial Inclusion Index	The International Monetary Fund
GDPpc: GDP per capita	The World Bank
CPS: Credit extended to the private sector	The World Bank
LITER: Literacy rate	The World Bank
NET: Internet users	The World Bank

3.3. The model

In order to study the main determinants of financial inclusion in the 12 countries in our sample, we used the autoregressive model with Staggered Delays in Panel Data (ARDL). The choice of this model is motivated by the fact that it allows us, on the one hand, to take into account the bias of heterogeneity between the units observed in the data and the integrated variables of order 0 and 1, and on the other hand, to analyze the long-term dynamics between financial inclusion and the factors that can explain it.

To estimate this model, we first performed an inter-individual panel dependence test. This test allows us to assess the existence of a dependence between individual observations in a panel of data. Then, we studied the stationarity of the variables to determine their orders of integration. Finally, we checked if there is a cointegration relationship between the variables of the model. The specification for this model is written as follows:

$$\begin{aligned}
\Delta IFI_{it} = & \alpha_i + \sum_{i=1}^p \beta_0 \Delta IFI_{i(t-1)} + \sum_{i=0}^q \beta_1 \Delta GDPpc_{i(t-1)} + \sum_{i=0}^r \beta_2 \Delta CPS_{i(t-1)} \\
& + \sum_{i=0}^m \beta_3 \Delta LITER_{i(t-1)} + \sum_{i=0}^n \beta_4 \Delta NET_{i(t-1)} + \delta_0 IFI_{i(t-1)} \\
& + \delta_1 GDPpc_{i(t-1)} + \delta_2 CPS_{i(t-1)} + \delta_3 LITER_{i(t-1)} + \delta_4 NET_{i(t-1)} + \varepsilon_{it}
\end{aligned} \tag{4}$$

With $i = 1, \dots, N$ and $t = 1, \dots, t$ represent the individual dimension and the time dimension respectively. IFI_{it} refers to the synthetic index of financial inclusion and represents dependent variable, and $GDPpc_{it}$, CPS_{it} , NET_{it} and $LITER_{it}$ are the independent variables of the model. In addition, (Δ) represents the first difference operator and ε_{it} denotes the error term. The short-term relationship is represented by the coefficients β_0 to β_4 and the long-term relationship is represented by the coefficients δ_0 to δ_4 . p, q, r, m and n represent the numbers of delays.

4. RESULTS AND DISCUSSIONS

4.1. Relationship between financial inclusion and its determinants

Before studying the determinants of financial inclusion, it is necessary to carry out an analysis of the characteristics of the different variables of the model. This analysis makes it possible to identify trends in the evolution of these variables as well as the potential relationships between them (see Appendix 1).

Financial inclusion

According to the results of the calculation of the Financial Inclusion Index, the countries can be classified into two distinct groups based on their level of financial inclusion. The first group includes countries with high financial inclusion, with an index above 0.5. This group is composed of Algeria, Brazil, China, India, Iran, Morocco, Russia, Saudi Arabia, South Africa and the United Arab Emirates. The second group, on the other hand, includes only two countries, namely Ethiopia and Egypt, which have an average level of financial inclusion, with an index between 0.3 and 0.5. Adopting a different classification of countries according to the BRICS countries, the BRICS+ and the two countries of North Africa, the analysis of the evolution of the financial inclusion index indicates that, on average, this index is high in all three groups of countries, but it remains particularly higher in the countries of North Africa. In terms of progress, the Financial Inclusion Index has seen strong growth in North Africa countries, outpacing other groups. This group contributes to increasing the average of the index in the entire sample, while the level of the BRICS+ countries has a negative impact, despite their high GDP per capita as shown in the following graph.

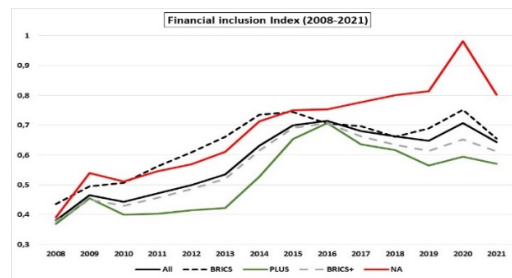


Figure 1: Financial inclusion index (2008-2021)

(Source: Authors' calculation based on IFI data)

GDP per capita

Numerous studies highlight the significant role of GDP per capita as a determinant of financial inclusion. The analysis of its evolution in all the countries in the panel reveals important results, showing that it is generally higher in countries with a high level of financial inclusion compared to those with a medium level. Indeed, it averages \$11,475 in the first group of countries, while it is only \$1,758 in the second group of countries. The correlation analysis between GDP per capita and the financial inclusion index indicates a positive and weak correlation in all countries, a positive and moderate correlation in countries with a medium level of financial inclusion, and a negative correlation close to zero in countries with a high level of financial inclusion. These mixed results do not generally confirm the hypothesis that GDP per capita could be positively associated with financial inclusion (Table 2).

All countries	0.11
Countries with a high level of financial inclusion	-0.05
Countries with a medium level of financial inclusion	0.40

*Table 2: Correlation between financial inclusion and GDP per capita
(Source: Authors' calculation)*

Credit extended to the private sector (% of GDP)

Credit to the private sector contributes to the development of financial inclusion in both emerging and developing countries. It facilitates access for economic agents to sources of finance and financial services, thereby promoting financial sector development and economic growth in general. Analysis of the evolution of this variable reveal that credit to the private sector varies significantly from one country to another. In some countries, such as China and South Africa, these credits represent more than 100% of GDP, which means that economic agents in these countries have wider access to financing resources. In other countries, they average between 50% and 80% of GDP. While in other countries such as Algeria, Russia, Egypt, Ethiopia and Saudi Arabia, they amount to less than 50% of GDP, indicating a situation of low access to finance in these countries. This level of access to finance can be positively linked to that of financial inclusion. The analysis of the degree of linkage between these two variables confirms this hypothesis and demonstrates a positive correlation both in all countries and in those with a high level of financial inclusion. However, the correlation is positive, but very low in countries with a medium level of financial inclusion (Table 3).

All countries	0.37
Countries with a high level of financial inclusion	0.26
Countries with a medium level of financial inclusion	0.02

*Table 3: Correlation between financial inclusion and credit extended to the private sector
(Source: Authors' calculation)*

Literacy rate

The relationship between educational attainment and financial inclusion has been the subject of several empirical studies, which have shown that individuals with a high level of education are more likely to acquire financial literacy. As a result, they are more likely to have a bank account, and to be aware of and use financial products and services. The level of education, as measured by the literacy rate in our study, is generally high in all countries in the sample, exceeding 68%, with the exception of Ethiopia where it is below average. This level of education could be positively linked to financial inclusion.

This intuition is confirmed in all countries as well as in the case of countries with a medium level of financial inclusion, as suggested by the positive correlation between financial inclusion and literacy rates in these two samples. However, this relationship is not confirmed in countries with a high level of financial inclusion (Table 4).

All countries	0.34
Countries with a high level of financial inclusion	-0.02
Countries with a medium level of financial inclusion	0.35

Table 4: Correlation between financial inclusion and literacy rates
(Source: Authors' calculation)

Internet users as a percentage of the population

Internet access encourages unbanked people to open bank accounts and make transactions without the need to physically visit a bank branch. Moreover, it allows them to benefit from digital financial services at a lower cost. Thus, internet access plays an important role in improving financial inclusion by removing geographical barriers and making financial services more accessible. The level of Internet access differs from one country to another in our sample. In some countries such as Saudi Arabia and the United Arab Emirates, the percentage of internet users in relation to the total population is high, averaging 69% and 86.4%, respectively. For other countries such as Algeria, Brazil, China, Iran, Morocco, Russia, South Africa and Egypt, this percentage is average, ranging from 30% to 67%. In contrast, it remains low in Ethiopia and India, with rates of 9% and 18% respectively. The positive evolution of the number of Internet users could have a positive effect on financial inclusion, as shown by the positive correlation coefficient between the percentage of Internet users in relation to the total population and the financial inclusion index in all countries, including those with a high level of financial inclusion and those with a medium level of financial inclusion.

All countries	0.50
Countries with a high level of financial inclusion	0.34
Countries with a medium level of financial inclusion	0.74

Table 5: Correlation between financial inclusion and the percentage of Internet users in relation to the total population
(Source: Authors' calculation)

4.2. Statistical test results

Inter-individual panel independence test

The study of interindividual dependence using the Lagrange Multiplier tests of Breusch-Pagan (1980), CD of Pesaran (2004) and LM adj of Pesaran and al. (2004) show that there is a significant interindividual dependence in the model data (Table 6).

Test	LM	LM adj	LM CD
Statistics	126.3***	6.185***	5.116***
	*** Significant at the 1% level		

Table 6: Inter-individual dependency test results
(Source: Authors)

Unit Root Testing

The results of the tests of interindividual dependence indicate the presence of interindividual dependence. Therefore, the appropriate unit root tests are the second generation. In this study, the unit root test of Pesaran (2007) was used.

The results of this test reveal that variables representing financial inclusion, GDP per capita, private sector credit, and Internet users are integrated at order 1, while the literacy variable is integrated at order 0. Thus, the variables of the model have a mixed level of integration between 0 and 1, which is an essential condition for the use of ARDL modeling (Table 7).

Variables	CIPS ⁵	10%	5%	1%	Level of integration
Log (IFI)	-3.445	-2.69	-2.83	-3.09	I (1)
Log (GDPpc)	-3.397	-2.68	-2.82	-3.07	I (1)
Log (CPS)	-4.061	-2.68	-2.82	-3.07	I (1)
Log (LITER)	-3.842	-2.68	-2.82	-3.07	I (0)
Log (NET)	-3.09	-2.68	-2.82	-3.07	I (1)

Table 7: Unit Root Test Results
(Source: Authors)

Cointegration Testing

To verify whether there is a long-term relationship between financial inclusion and its main determinants, we used the panel cointegration tests proposed by Pedroni (2004) and Westerlund (2007). The results of these tests indicate that there is a co-integrating relationship between financial inclusion and its main potential determinants.

	Pedroni (2004)	Westerlund (2007)
	Statistics	Statistics
Modified Phillips–Perron	4.4140***	0.8387
Phillips–Perron	-2.7365***	
Augmented Dickey–Fuller	-1.7172**	
*** Significant at the 1% level, **significant at the 5% level		

Table 8: Cointegration Test Results
(Source: Authors)

Selecting the optimal lag

To determine the optimal delay in the ARDL model for panel data, we searched for the best practice and adopted the method proposed in the Statalist forum ⁶. Anat Tchetchik proposes a code⁷ to calculate the optimal delays for each country individually (Kripfganz, S. & D. Schneider, 2022). Then, the most frequent delay for each variable was selected to represent the optimal model offsets.

Based on the above criteria (see Appendix 3), we have selected the optimal delay of our model. The table below shows the optimal delay for each variable:

⁵ Cross sectionally Augmented IPS

⁶ Optimal lag length for ARDL in panel - Statalist ; <https://www.statalist.org/forums/forum/general-stata-discussion/general/1333077-optimal-lag-length-for-ardl-in-panel>

⁷ forval i = 1/50 {ardl Y x1, x2, x3, x4 if (country_code=`i'), maxlag(3 3 3 3) matrix list e(lags) di }

Variables	Log (IFI)	Log (GDPpc)	Log (CPS)	Log (LITER)	Log (NET)
Optimal Delay	1	0	0	0	0

Table 9: Optimal lag
(Source: Authors)

4.3. Results and interpretations

Based on the results of the ARDL model in panel data with the PMG estimator⁸ (Table 10), the variables representing credit to the private sector (CPS) and the literacy rate (LITER) have a positive and significant long-term impact on financial inclusion (IFI). Nevertheless, the variable measuring GDP per capita (GDPpc) has a negative and significant effect on financial inclusion, both in the short and long term. Indeed, credit to the private sector and literacy have a positive and significant impact on financial inclusion (IFI) in the long term. This result shows the important role of these determinants in improving the level of financial inclusion in these countries. For example, an increase of one unit of credit to the private sector improves financial inclusion by 1.18 percentage points in the long term.

Pooled Mean Group (PMG)	
Variables	Coefficient
Long Run Equation	
LGDPpc	-0.3371***
LCPS	1.1872***
LLITER	0.5548**
LNET	0.0216
Short Run Equation	
COINTEQ 01	-0.3965***
Δ LGDPpc	-0.5970***
Δ LCPS	0.3007
Δ LLITER	-6.0219
Δ LNTER	0.7157***
Const	-1.9732***
*** Significant at the 1% level	
** Significant at the 5% level	

Table 10: Results of Model Estimates
(Source: Authors)

Moreover, a one-unit increase in the literacy rate leads to an increase in the financial inclusion index of 0.55 percentage points. This finding is consistent with several studies that have examined the determinants of financial inclusion (Sarma and Pais, 2011; Fungacova and Weill, 2014; Evans, O. & Adeoye B., 2016). Education is a critical component in fostering sustainable financial inclusion. Trained individuals are better prepared to make informed decisions about their finances, including the use of financial products and services. In sum, credit to the private sector and education are key factors in promoting long-term financial inclusion. The combination of accessible financial services and tailored financial education can help build people's confidence and financial autonomy, promoting their active and informed participation in the financial system.

⁸ The choice of the PMG estimator is confirmed by the Hausman test.

However, in the long term, GDP per capita has a negative impact on financial inclusion: when GDP per capita increases by one unit, the level of financial inclusion decreases by 0.33 percentage points with a significance level of 1%. We find that high income can reduce financial inclusion in emerging economies. This result corroborates the findings of (Eshun and Kočenda, 2025), which indicate that banks tend to prioritize serving businesses and the wealthiest segments of the population, neglecting the needs of the population as a whole, particularly the rural population and those in the informal sector. This result can also be explained by the population density of the countries studied, which is a determining factor in financial inclusion (Allen et al., 2014). We note that high population density implies that a large number of individuals live in a relatively small geographical area. This can lead to specific challenges in terms of access to financial services such as bank branches and ATMs. However, lower population density can be explained by less developed environmental conditions compared to densely populated areas. According to Allen et al. (2014), low bank branch penetration rates in Africa can be attributed to difficulties in achieving a minimum viable scale in sparsely populated, low-income regions. This is why technological advances, such as mobile banking services, are seen as a promising way to facilitate financial development and inclusion outside of major cities. In addition, this result can also be explained by the growing demand for cash. Indeed, this has increased in most countries, both in absolute terms and relative to GDP (Heinonen, 2023). Cash is a secure form of central currency with no risk of default. It also offers a very high degree of liquidity. In other words, it is distinguished by its tangibility, its issuance by a public institution, and the absence of intermediaries in transactions. These characteristics give it a number of unique advantages which, beyond the individual choices and preferences of consumers, are of particular importance to society (Krueger & Seitz, 2017). Moreover, cash plays a stabilizing role in times of financial crisis, when uncertainty and mistrust of banks increase. The possibility of converting bank deposits into cash reassures customers and helps restore confidence in the financial system (Rösl & Seitz, 2022). In addition, cash plays a vital role in the social inclusion of people who have difficulty with electronic payments. Without it, certain at-risk groups such as the elderly, the digitally illiterate, low-income individuals, and undocumented migrants would find themselves unable to participate fully in everyday economic activities (van der Crujisen & Reijerink, 2023). Furthermore, this result can also be attributed to financial exclusion. A distinction can be made between voluntary exclusion from financial services, motivated by cultural or religious reasons, or by a perceived lack of need (Beck et al., 2009; Demirgüç-Kunt et al., 2022), and involuntary exclusion, linked to various structural and behavioral barriers that hinder financial inclusion (Dittus and Klein, 2011; Zins and Weil, 2016; Allen et al., 2016; Demirgüç-Kunt et al., 2022). Voluntary exclusion refers to individuals who choose not to use formal financial services, despite their accessibility. This choice may be motivated by religious reasons, which can play a key role in financial exclusion in certain regions of the world, such as Sub-Saharan Africa, North Africa, and the Middle East, where religion is a barrier to accessing financial services (Demirgüç-Kunt et al., 2013, Demirgüç-Kunt et al., 2022). In addition, it may be motivated by cultural or social preferences, such as the use of informal finance, which can serve as a substitute in contexts where formal finance is limited (Allen, Qian, and Qian, 2005, 2008). In addition, in the short term, the rise in financial inclusion is closely linked to Internet use, so that an improvement of one unit of Internet users leads to a 0.71 increase in the level of financial inclusion. This finding corroborates those of several studies analysing the effect of the internet on financial inclusion (Efobi, Beecroft and Osabuohien, 2014; Allen et al., 2014; Evans, 2018; El Yamani and Betane, 2025). We note that there is a strong link between the level of Internet access and financial inclusion. Indeed, access to the Internet and information technology has great potential to extend the reach of the formal banking system in countries where access to financial services is limited.

With the proliferation of the internet, new concepts like mobile money and mobile banking have emerged. These payment methods have become essential, as households with a mobile money account tend to be banked, receive/send funds. Thus, mobile technology has great potential to extend the reach of the formal banking system in countries where most of the population remains unbanked (or informally banked), while still having a mobile phone and an internet connection.

4.4. Robustness analysis

To assess the robustness and reliability of these results and to overcome the limitations of this study, we performed a sensitivity analysis using an alternative variable to represent financial inclusion. We have chosen to use deposits with commercial banks as a percentage of GDP. While some studies such as Naceur et al. (2015) and Evans and Adeoye (2016) used the number of depositors at commercial banks (per 1000 adults), we opted for commercial bank deposits as a percentage of GDP due to the availability of data. The results obtained from the estimation of this second model are consistent with those of the first model. The sensitivity and robustness analysis demonstrated that the conclusions of our study remain broadly constant when the financial inclusion indicator is changed by another variable frequently used in other empirical studies on the determinants of financial inclusion. This consistency reinforces the validity of

	Model (1)	Model (2)
Variables	Coefficient	Coefficient
Long Run Equation		
LGDPpc	-0.3371***	-0.2230***
LCPS	1.1872***	1.0376***
LLITER	0.5548**	0.3806***
LNET	0.0216	-3.7503***
Short Run Equation		
COINTEQ 01	-0.3965***	-0.3411***
ΔLGDPpc	-0.5970***	-0.0894
ΔLCPS	0.3007	0.2342
ΔLLITER	-6.0219	-2.0229
ΔLNET	0.7157***	0.1143
Const	-1.9732***	5.9280***
*** Significant at the 1% level, ** significant at the 5% level		

the results obtained in the first model (Table 11).

Table 11: Robustness Analysis

(Source: Authors)

5. CONCLUSION

The objective of this study is to analyze the relationship between financial inclusion and its main determinants, namely income, education, access to the Internet and credit to the private sector. To do this, we conducted an empirical study on BRICS+ countries, Morocco and Algeria, for the period from 2008 to 2021, using the ARDL panel approach. The results of this empirical study highlight that in the long term, credit to the private sector and literacy rates have a positive impact on financial inclusion in the countries in our sample. In contrast, GDP per capita has a negative and significant effect on financial inclusion, which runs counter to the findings of several studies indicating that increasing GDP per capita promotes financial inclusion. However, these results highlight that internet access does not seem to be an explanatory factor for financial inclusion. Moreover, in the short term, financial inclusion is positively and significantly related to internet access, while it is negatively associated with GDP per capita.

Other variables such as the literacy rate and the credit granted to the private sector do not seem to play an explanatory role in this financial inclusion. Algeria and Morocco with the lowest level of GDP per capita have the highest level of financial inclusion. And conversely, the 5 new BRIC+ countries have a very low level of financial inclusion than Algeria and Morocco while they exceed them by more than 3 times in terms of the level of GDP per capita. Thus, it's not enough to be rich to improve the level of financial inclusion. Instead, more credit should be given to the private sector, the literacy level of the population should be improved and the use of the Internet should be made more accessible to the entire population. Further research is needed to explain qualitatively and quantitatively the negative relationship between financial inclusion and GDP per capita. The results of this study depend largely on the variable chosen to represent the level of financial inclusion. They are also influenced by the other variables of the model as well as by the panel of selected countries. The use of a financial inclusion measure integrating other dimensions such as the quality of financial services, financial innovation and other aspects, could improve the results of this study on the determinants of financial inclusion. The use of micro-econometric studies could also deepen our understanding of these determinants.

ACKNOWLEDGMENT: *Fadwa BETANE would like to thank the National Centre for Scientific and Technical Research (CNRS) of Morocco for funding's PhD-ASSociate Scholarship – PASS.*

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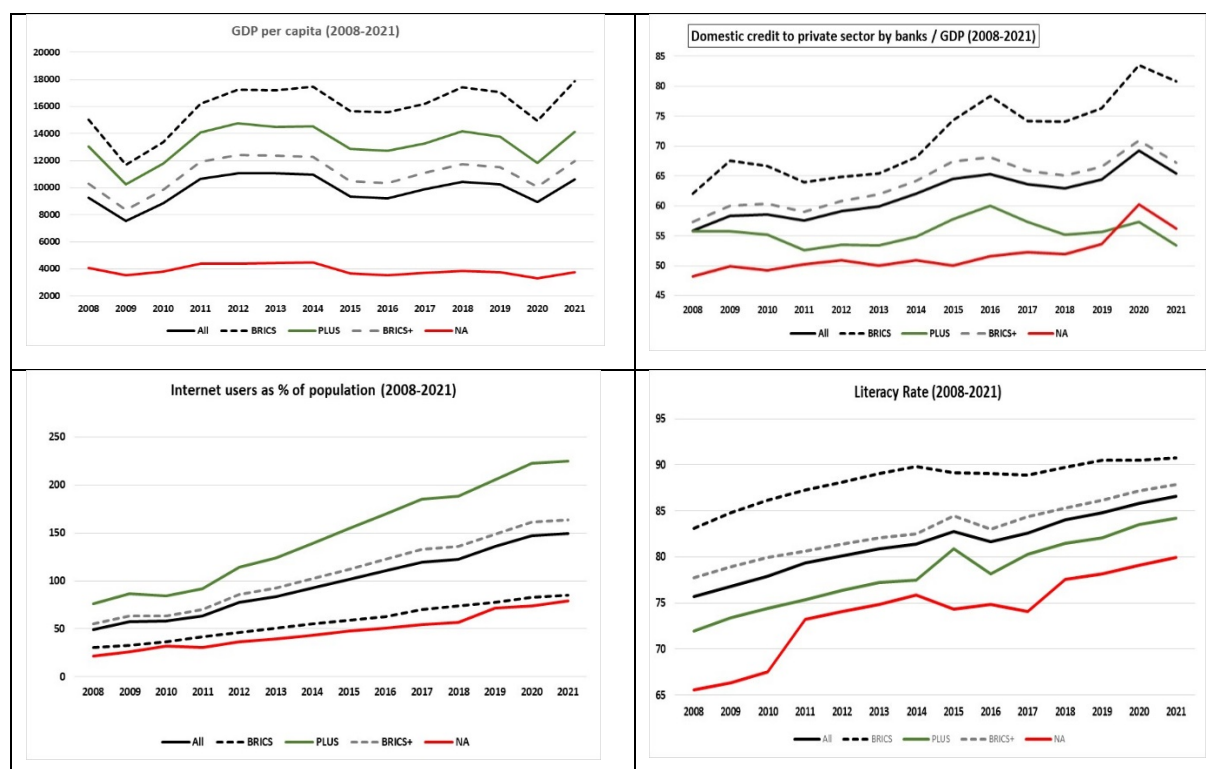
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APPENDIX:

Appendix 1: Evolution of the determining variables by country groups*



* In order to analyse the variables of the study and by integrating the dynamics of enlargement of this grouping of countries, 5 country groups have been set up:

- **BRICS:** Brazil; Russia; India; China and South Africa;
- **MORE:** Egypt; Ethiopia; Iran; Saudi Arabia and the United Arab Emirates;
- **BRICS+ :** BRICS & PLUS
- **NA:** Algeria & Morocco.
- **ALL :** BRICS+ & NA

Appendix 2: Swamy Homogeneity Test Results

LIVE	Coefficient	Std. Dev	Z	P > Z
LGDPpc	-0.2974	0.353	-0.84	0.40
LCPS	0.5866	0.3636	1.61	0.107
LLITER	3.2894	20.084	0.16	0.870
LNET	0.4007	0.2178	1.84	0.066
Const	-16.706	92.565	-0.18	0.857
Chi2(55) = 772.25 Probe > Chi2 = 0.0000				

Source: Authors using STATA

Appendix 3: Results of Optimal lag Selection

1										2									
ARDL(1,1,1,0,0) regression										ARDL(1,1,0,0,0) regression									
Sample: 2009 thru 2021					Number of obs = 13 F(7, 5) = 58.39 Prob > F = 0.0002 R-squared = 0.9879 Adj R-squared = 0.9710 Root MSE = 0.0619					Sample: 2009 thru 2021					Number of obs = 13 F(6, 6) = 40.20 Prob > F = 0.0001 R-squared = 0.9757 Adj R-squared = 0.9515 Root MSE = 0.0439				
Log likelihood = 23.940568										Log likelihood = 27.225508									
logIFI	Coefficient	Std. err.	t	P> t	[95% conf. interval]					logIFI	Coefficient	Std. err.	t	P> t	[95% conf. interval]				
logIFI L1.	-.3371685	.3973729	-0.85	0.435	-1.358648	.6843111				logIFI L1.	.7358642	.1121962	6.56	0.001	.4613299	1.010399			
logGDPpc --. L1.	-.0860113 .9889554	.4310586 .5633023	-0.20 1.76	0.850 0.140	-1.194083 -.4590592	1.02206 2.43697				logGDPpc --. L1.	-.0367167 .3939452	.1074257 .1881513	-0.34 2.09	0.744 0.081	-.2995779 -.0664444	.2261445 .8543349			
logCPS --. L1.	1.610655 1.135962	.5075683 .9805191	3.17 1.16	0.025 0.299	-.3059095 -1.384542	2.915401 3.656467				logCPS --. L1.	-.0039142 .3219385	.3219385 .3219385	-0.01 0.991	0.991 0.991	-.7916694 -.7916694	.7838409 .7838409			
logLITER logNET _cons	.0014771 -.263662 -15.6211	1.727474 .2147009 7.360761	0.00 -1.23 -2.12	0.999 0.274 0.087	-4.439135 -.8155683 -34.54254	4.44209 .2882442 3.300339				logLITER logNET _cons	-.9233122 -1.1602491 1.411279	4.622435 .3085362 20.0817	-0.20 -0.52 0.07	0.848 0.622 0.946	-12.234 -.9152101 -47.72687	10.38738 .5947119 50.54943			
e(lags)[1,5] logIFI logGDPpc logCPS logLITER logNET r1 1 1 1 0 0										e(lags)[1,5] logIFI logGDPpc logCPS logLITER logNET r1 1 1 0 0									
3										4									
ARDL(1,0,0,0,0) regression										ARDL(1,0,0,0,0) regression									
Sample: 2009 thru 2021					Number of obs = 13 F(5, 7) = 56.06 Prob > F = 0.0000 R-squared = 0.9756 Adj R-squared = 0.9582 Root MSE = 0.0740					Sample: 2009 thru 2021					Number of obs = 13 F(5, 7) = 22.95 Prob > F = 0.0003 R-squared = 0.9425 Adj R-squared = 0.9014 Root MSE = 0.2080				
Log likelihood = 19.420653										Log likelihood = 5.988057									
logIFI	Coefficient	Std. err.	t	P> t	[95% conf. interval]					logIFI	Coefficient	Std. err.	t	P> t	[95% conf. interval]				
logIFI L1.	.5706458	.5358715	1.06	0.322	-.696489	1.837781				logIFI L1.	.2097169	.3145124	0.67	0.526	-.5339868	.9534205			
logGDPpc logCPS logLITER logNET _cons	-.0330513 -.2103273 2.192475 .4174955 -10.45453	.7631236 .6905254 4.171466 .9002445 17.24181	-0.04 -0.30 0.53 0.46 -0.61	0.967 0.770 0.615 0.657 0.563	-1.837552 -1.843161 -7.671475 -1.711244 -51.22493	1.771449 1.422506 12.05643 2.546235 30.31587				logGDPpc logCPS logLITER logNET _cons	-.6985597 1.348917 -2.589298 1.725484 5.197568	.93092 .9827898 3.267623 .6373703 13.41407	-0.75 1.37 -0.79 2.71 0.39	0.477 0.212 0.454 0.030 0.710	-2.899836 -.9750117 -10.316 .2183433 -26.52167	1.502716 3.672845 5.137403 3.232626 36.91681			
e(lags)[1,5] logIFI logGDPpc logCPS logLITER logNET r1 1 0 0 0 0										e(lags)[1,5] logIFI logGDPpc logCPS logLITER logNET r1 1 0 0 0 0									
5										6									
ARDL(1,0,1,0,1) regression										ARDL(1,1,1,0,1) regression									
Sample: 2009 thru 2021					Number of obs = 13 F(7, 5) = 5.33 Prob > F = 0.0419 R-squared = 0.8818 Adj R-squared = 0.7164 Root MSE = 0.1997					Sample: 2009 thru 2021					Number of obs = 13 F(8, 4) = 33.69 Prob > F = 0.0021 R-squared = 0.9854 Adj R-squared = 0.9561 Root MSE = 0.0736				
Log likelihood = 8.7040936										Log likelihood = 23.124787									
logIFI	Coefficient	Std. err.	t	P> t	[95% conf. interval]					logIFI	Coefficient	Std. err.	t	P> t	[95% conf. interval]				
logIFI L1.	.0536376	.2857113	0.19	0.858	-.6808067	.788082				logIFI L1.	.9953037	.2228524	4.47	0.011	.3765662	1.614041			
logGDPpc --. L1.	-3.272277	1.107259	-2.96	0.032	-6.118577	-.4259776				logGDPpc --. L1.	-.5831674 .7006011	.5182116 .4609592	-1.13 1.52	0.323 0.203	-2.021953 -.5792269	.8556186 1.980429			
logCPS --. L1.	-1.294628 .9786227	.5863483 .4355816	-2.21 2.25	0.078 0.075	-2.801884 -.1410755	.2126282 2.098321				logCPS --. L1.	.7488916 1.20439	1.074582 1.224949	0.70 0.98	0.524 0.381	-2.234627 -2.196612	3.73241 4.605392			
logLITER logNET _cons	10.15483 1.400792 -.8732684 -19.41622	3.330908 .405298 .4043472 9.875328	3.05 3.46 -2.16 -1.97	0.028 0.018 0.083 0.106	1.592464 .3589407 -1.912676 -44.80156	18.71721 2.442644 .1661391 5.96912				logLITER logNET _cons	-.7741917 .3611868 -.4958143 -4.826317	2.548148 .2911125 .3350522 12.44754	-0.30 1.24 -1.48 -0.39	0.776 0.283 0.213 0.718	-7.848984 -.447071 -1.426068 -39.38622	6.300601 1.169445 .4344396 29.73358			
e(lags)[1,5] logIFI logGDPpc logCPS logLITER logNET r1 1 1 1 0 0										e(lags)[1,5] logIFI logGDPpc logCPS logLITER logNET r1 1 1 1 0 1									

7							8						
ARDL(1,1,1,0,0) regression							ARDL(1,0,0,0,1) regression						
Sample: 2009 thru 2021			Number of obs = 13 F(7, 5) = 3.52 Prob > F = 0.0923 R-squared = 0.8314 Adj R-squared = 0.5953 Root MSE = 0.2499				Sample: 2009 thru 2021			Number of obs = 13 F(6, 6) = 27.67 Prob > F = 0.0004 R-squared = 0.9651 Adj R-squared = 0.9302 Root MSE = 0.0295			
Log likelihood = 5.7897506							Log likelihood = 32.395575						
logIFI	Coefficient	Std. err.	t	P> t	[95% conf. interval]		logIFI	Coefficient	Std. err.	t	P> t	[95% conf. interval]	
logIFI L1.	-.1462557	.3383079	-0.43	0.684	-1.015904 .7233925		logIFI L1.	.1253347	.1087154	1.15	0.293	-.1406822 .3913517	
logGDPpc --.	.3805633	.5415307	0.70	0.514	-1.011486 1.772612		logGDPpc --.	-.5814346	.2057111	-2.83	0.030	-1.084791 -.0780777	
L1.	1.06946	.720374	1.48	0.198	-.7823205 2.921214		logCPS --.	.3120938	.2205614	1.41	0.207	-.2276006 .8517882	
logCPS --.	3.869125	1.965745	1.97	0.106	-1.183984 8.922234		logLITER --.	.6736239	.2886527	2.33	0.058	-.0326839 1.379932	
L1.	-2.655342	1.950869	-1.36	0.232	-7.670211 2.359527		logNET --.	-.0217228	.0849646	-0.26	0.807	-.2296238 .1861782	
logLITER --.	-4.980936	19.02263	-0.26	0.804	-53.88017 43.9183		L1.	.1766524	.1263958	1.40	0.212	-.132627 .4859317	
logNET --.	.7243034	.2679494	2.70	0.043	.0355177 1.413089		_cons	-.3396326	1.792448	-0.19	0.856	-4.725594 4.046329	
_cons	1.395457	83.16524	0.02	0.987	-212.3876 215.1785								
e(lags)[1,5] logIFI logGDPpc logCPS logLITER logNET r1 1 1 1 0 0							e(lags)[1,5] logIFI logGDPpc logCPS logLITER logNET r1 1 0 0 0 1						
9							10						
ARDL(1,0,1,0,0) regression							ARDL(1,1,0,0,1) regression						
Sample: 2009 thru 2021			Number of obs = 13 F(6, 6) = 23.31 Prob > F = 0.0007 R-squared = 0.9589 Adj R-squared = 0.9177 Root MSE = 0.0466				Sample: 2009 thru 2021			Number of obs = 13 F(7, 5) = 20.61 Prob > F = 0.0021 R-squared = 0.9665 Adj R-squared = 0.9196 Root MSE = 0.1189			
Log likelihood = 26.44453							Log likelihood = 15.449966						
logIFI	Coefficient	Std. err.	t	P> t	[95% conf. interval]		logIFI	Coefficient	Std. err.	t	P> t	[95% conf. interval]	
logIFI L1.	.7412367	.0863999	8.58	0.000	.5298239 .9526495		logIFI L1.	.5871023	.162593	3.61	0.015	.1691436 1.005061	
logGDPpc --.	.7189206	.1387505	5.18	0.002	.3794105 1.058431		logGDPpc --.	-.6583033	.7903149	-0.83	0.443	-2.689872 1.373266	
L1.	.3975756	.2890764	1.38	0.218	-.3097688 1.10492		L1.	1.402147	.6768751	2.07	0.093	-.3378158 3.142211	
logCPS --.	.993443	.255532	3.89	0.008	.3681786 1.618707		logCPS --.	1.865104	.9071155	2.06	0.095	-.4667108 4.196918	
L1.	.3975756	.2890764	1.38	0.218	-.3097688 1.10492		logLITER --.	-.0741235	.8300885	-0.09	0.932	-2.207934 2.059687	
logLITER --.	-65.1658	73.01382	-0.89	0.406	-243.8242 113.4926		L1.	-1.476418	.9155039	-1.61	0.168	-3.829795 .87696	
logNET --.	-.7599055	.200569	-3.79	0.009	-1.25068 -2.2691308		logNET --.	-.0741235	.8300885	-0.09	0.932	-2.207934 2.059687	
_cons	290.8405	335.2759	0.87	0.419	-529.5501 1111.231		L1.	-1.476418	.9155039	-1.61	0.168	-3.829795 .87696	
							_cons	-35.60271	11.70793	-3.04	0.029	-65.69891 -5.506512	
e(lags)[1,5] logIFI logGDPpc logCPS logLITER logNET r1 1 0 1 0 0							e(lags)[1,5] logIFI logGDPpc logCPS logLITER logNET r1 1 1 0 0 1						
11							12						
ARDL(1,0,0,0,1) regression							ARDL(1,1,1,0,1) regression						
Sample: 2009 thru 2021			Number of obs = 13 F(6, 6) = 4.03 Prob > F = 0.0571 R-squared = 0.8011 Adj R-squared = 0.6022 Root MSE = 0.0480				Sample: 2009 thru 2021			Number of obs = 13 F(8, 4) = 10.02 Prob > F = 0.0205 R-squared = 0.9525 Adj R-squared = 0.8574 Root MSE = 0.0599			
Log likelihood = 26.063814							Log likelihood = 25.811493						
logIFI	Coefficient	Std. err.	t	P> t	[95% conf. interval]		logIFI	Coefficient	Std. err.	t	P> t	[95% conf. interval]	
logIFI L1.	-.8784291	.3846924	-2.28	0.063	-1.819737 .0628793		logIFI L1.	1.12276	.1500712	7.48	0.002	.7060959 1.539425	
logGDPpc --.	-.5778328	.147498	-3.92	0.008	-.9387475 -.2169181		logGDPpc --.	.7824169	.3733032	2.10	0.104	-.2540391 1.818873	
L1.	.0228983	.2485363	0.09	0.930	-.5852481 .6310447		L1.	.8818761	.284917	3.10	0.036	-.0908197 1.672933	
logCPS --.	-.0361845	.6387329	-0.06	0.957	-1.599107 1.526738		logCPS --.	.2008377	.5682263	0.35	0.742	-1.376811 1.778487	
L1.	.2247979	.1337414	1.68	0.144	-.1024555 .5520513		L1.	1.49008	.6339125	2.35	0.078	-.2699433 3.250103	
logNET --.	-.154122	.0984527	-1.57	0.169	-.3950272 .0867831		logLITER --.	-3.549814	3.251457	-1.09	0.336	-12.57731 5.477678	
L1.	.2247979	.1337414	1.68	0.144	-.1024555 .5520513		logNET --.	-2.705552	.9839007	-2.75	0.051	-5.437299 .0261939	
_cons	4.157981	3.693209	1.13	0.303	-4.878976 13.19494		L1.	1.947258	.784014	2.48	0.068	-.2295142 4.124029	
							_cons	-5.516202	13.79134	-0.40	0.710	-43.80711 32.7747	
e(lags)[1,5] logIFI logGDPpc logCPS logLITER logNET r1 1 0 0 0 1							e(lags)[1,5] logIFI logGDPpc logCPS logLITER logNET r1 1 1 1 0 1						

Source: Authors using STATA

Appendix 4: Results of the PMG MG & DFE estimators

Three estimation methods are often used to estimate dynamic panel data models: the Mean Group (MG) developed by Pesaran, Smith and Im (1995) and the Pooled Mean Group (PMG) and Dynamic Fixed Effect DFE introduced by Pesaran, Shin and Smith (1999). We used the three estimators PMG, DFE and MG. Therefore, we applied a robustness test to arbitrate between the three and choose the most efficient estimator for this model. The results indicate that PMG is the most appropriate estimator for this model.

	PMG	MG	DFE
Variables	Coefficient	Coefficient	Coefficient
Long Run Equation			
LGDPpc	-0.3371***	-0.4113	0.6249
LCPS	1.1872***	-0.7903	-0.5160
LLITER	0.5548**	25.831	-1.2187
LNET	0.0216	-0.3334	0.2245
Short Run Equation			
COINTEQ 01	-0.3965***	-0.7329***	-0.2873***
Δ LGDPpc	-0.5970***	-0.6231***	-0.5298***
Δ LCRD	0.3007	0.0084	0.5980***
Δ LLITER	-6.0219	-3.6435	-0.5097
Δ LNET	0.7157***	0.6566*	0.0942
Const	-1.9732***	-11.002	0.2030
*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level			

Source: Authors using STATA

	Appendix 5: Results of the Hausman PMG/DFE test				Appendix 6: Hausman PMG/MG Test Results			
	PMG	DFE	Difference	Std.err	PMG	MG	Difference	Std.err
LGDPpc	-0.3371	0.6249	-0.9620	2.4512	-0.3371	-0.4113	-0.9620	2.4512
LCPS	1.1872	-0.5160	1.7032	2.3754	1.1872	-0.7903	1.7032	2.3754
LLITER	0.5548	-1.2187	1.7736	5.0319	0.5548	25.8313	1.7736	5.0319
LNET	0.0216	0.2245	-0.2029	0.7554	0.0216	-0.3334	-0.2029	0.7554
Chi2(4) = 1.59 prob > Chi2 = 0.8098					Chi2(4) = 0.62 prob > Chi2 = 0.9608			

Source: Authors using STATA

THE DARK TRIAD OF PERSONALITY AND JOB SATISFACTION: AN EMPIRICAL STUDY

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ABSTRACT

This study investigates the relationship between the Dark Triad personality traits Machiavellianism, psychopathy, and narcissism and job satisfaction, contributing to the growing body of research on personality in organizational behavior. Drawing on a quantitative research design, data were collected from a sample of 90 employees across public and private sectors in Vlora, Albania. The study employs reliability analysis, exploratory factor analysis, correlation analysis, and multiple linear regression to test the proposed conceptual model. The findings reveal that narcissism exerts a statistically significant positive effect on job satisfaction, whereas Machiavellianism and psychopathy do not demonstrate significant predictive power. The regression model explains 23.9% of the variance in job satisfaction, indicating a moderate explanatory capacity. These results highlight the complex and non-uniform influence of dark personality traits in workplace contexts, suggesting that certain traits traditionally perceived as negative may have adaptive outcomes under specific conditions. The study offers theoretical contributions by refining the understanding of the Dark Triad in organizational settings and provides practical implications for human resource management, particularly in recruitment, employee development, and organizational culture design.

Keywords: *Dark Triad, narcissism, Machiavellianism, psychopathy, job satisfaction*

1. INTRODUCTION

Job satisfaction is a key determinant of employee performance and organizational success. Personality traits play a critical role in shaping attitudes toward work. The Dark Triad traits have gained attention for their potential influence on workplace outcomes. The study of individuals with “dark personality traits,” such as psychopathy and narcissism, suggests that they are more likely to display cold, disagreeable, and antagonistic behaviors. Empathy, however, is a multifaceted construct that includes both affective empathy—the ability to share others’ emotions—and cognitive empathy, which refers to understanding others’ mental states. Interestingly, the group known as “dark empathy” demonstrates high levels of both dark traits and empathy, scoring higher in both cognitive and affective empathy compared to traditional Dark Triad and typical groups. Although dark empathy are less overtly aggressive than individuals high in classic Dark Triad traits, they may still engage in indirect forms of aggression, such as manipulation, social exclusion, or guilt induction. Within this context, job satisfaction represents a central concept in organizational psychology, reflecting the extent to which individuals feel positively about their work and encompassing emotional responses shaped by workplace conditions. Achieving a balance between employees and their work requires effective management practices, including improved working conditions, flexibility, motivation, and overall quality of work life, as employees are key contributors to organizational outcomes. Therefore, fostering strong relationships within organizations is essential for enhancing job satisfaction. This study aims to provide a comprehensive analysis of employee personality by examining both the dark and positive aspects of personality, alongside a general overview of job satisfaction. The primary objective is to investigate the nature of the relationship between the Dark Triad traits—Machiavellianism, narcissism, and psychopathy—and job satisfaction, specifically by analyzing these traits, examining job satisfaction, and assessing the impact of the Dark Triad variables on employees’ job satisfaction.

2. LITERATURE REVIEW

Personality refers to the distinctive patterns of thoughts, emotions, and behaviors through which individuals adapt to life situations and respond to environmental demands (Mischel, 1981). In organizational research, personality is considered a key factor shaping motivation, interpersonal behavior, emotional regulation, and work-related attitudes such as job satisfaction and performance. Within this broad framework, increasing attention has been given to the “dark side” of personality, particularly the Dark Triad, which includes narcissism, Machiavellianism, and psychopathy (Paulhus & Williams, 2002). Narcissism is characterized by grandiosity, entitlement, and a strong need for admiration, and is most commonly measured through the Narcissistic Personality Inventory and its shorter forms (Raskin & Hall, 1979; Ames et al., 2006; Krizan & Herlache, 2018). Machiavellianism refers to manipulation, strategic calculation, and the pursuit of power and personal success, and has traditionally been measured through the Mach IV scale and its later adaptations (Christie & Geis, 1970; Jones & Paulhus, 2009). Psychopathy, in turn, is associated with low empathy, impulsivity, shallow emotional responses, and antisocial tendencies, with the Self-Report Psychopathy Scale being one of the most widely used assessment tools in this field (Cleckley, 1941; Hare, 1996). Together, these three traits represent socially aversive tendencies that are highly relevant to understanding workplace behavior, interpersonal conflict, and organizational outcomes.

2.1 The Five-Factor Model and the HEXACO Model of the Dark Triad

The Five-Factor Model (FFM) conceptualizes personality across five broad dimensions—Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness to Experience—and has been widely used to examine the Dark Triad traits (Costa & McCrae, 1991). Empirical evidence consistently shows that narcissism, Machiavellianism, and psychopathy are negatively associated with Agreeableness and Conscientiousness, reflecting tendencies toward low empathy, antagonism, impulsivity, and reduced self-discipline (Paulhus & Williams, 2002; Jonason et al., 2010; Miller et al., 2010). While the three traits share common patterns, they also differ in their associations within the FFM, with narcissism linked to low modesty and high achievement striving, and psychopathy to low responsibility and poor self-control. Complementing this framework, the HEXACO model introduces a sixth dimension, Honesty–Humility, which captures prosocial versus antisocial tendencies (Ashton & Lee, 2001; Lee & Ashton, 2005). Research indicates that all three Dark Triad traits are strongly and negatively related to Honesty–Humility, making it a particularly relevant construct for understanding socially aversive personality characteristics in organizational contexts.

2.2 Job Satisfaction

One of the most widely accepted definitions of job satisfaction in organizational psychology was proposed by Locke (1969), who described it as a pleasurable emotional state resulting from the appraisal of one’s job as achieving or facilitating the achievement of important job values. Similarly, Spector (1997) emphasized that job satisfaction reflects the degree to which people like their jobs and encompasses a substantial emotional component shaped by workplace experiences. Job satisfaction is particularly important in helping professions because it influences not only employee well-being and productivity but also the quality of care or service provided to clients. Previous studies have shown that job satisfaction is shaped by a wide range of factors, including workplace relationships, supervision, salary, benefits, work content, organizational culture, communication, and recognition (Dockery & Barns, 2005; Gurková, 2012; Kožuchová & Vargová, 2015; McNeese-Smith, 1999). Among social workers, perceived work meaningfulness and professional competence have been shown to play a central role in job satisfaction (Hricová, Nežkusilová, & Mesárošová, 2017).

Among caregivers, team communication, cohesion, and effectiveness appear especially important (Vermeire et al., 2017). Similar findings have been reported in educational, healthcare, and law-enforcement settings (Chmelárová & Prekopová, 2012; Lukáčová, 2013; Lokesh, Patra, & Venkatesan, 2016; Fleury, Grenier, & Bamvita, 2017). Traditionally, research in occupational psychology focused more on the positive aspects of personality as predictors of work behavior and performance (Bolton, Becker, & Barber, 2010). More recently, however, scholars have begun to examine the darker aspects of personality because of their potentially harmful effects on workplace behavior, including counterproductive work behavior, interpersonal conflict, and unethical conduct (Jonason, Slomski, & Partyka, 2012; O'Boyle et al., 2012; Spain, Harms, & LeBreton, 2014). Nevertheless, some studies suggest that dark traits do not always operate destructively in the workplace and may under certain conditions contribute to effectiveness, influence, or confidence (Judge & LePine, 2007).

2.3 Machiavellianism and Employees' Job Satisfaction

The literature generally suggests that high levels of Machiavellianism are associated with greater work strain, lower job satisfaction, and lower career satisfaction. Bakir et al. (2003), for instance, found that Machiavellian physicians reported lower job satisfaction than the general population. The authors suggested that age and career advancement may partly explain this relationship, as older physicians may show lower Machiavellianism and higher job satisfaction due to higher status and income. Other studies have similarly reported a negative relationship between Machiavellianism and job satisfaction across different occupational groups (Wilson, Near, & Miller, 1996). Gamble and Topol (1987) also found that women with higher Machiavellian scores reported lower job satisfaction than men with lower Machiavellian tendencies. An additional explanation for this negative association concerns supervisory relationships. Walter, Anderson, and Martin (2005) argued that Machiavellian subordinates may attempt to manipulate their supervisors to gain control over workplace situations, thereby increasing interpersonal conflict and reducing satisfaction with supervision. Overall, the literature suggests that Machiavellianism tends to undermine workplace trust and relational quality, which in turn reduces overall job satisfaction.

2.4 Psychopathy and Employees' Job Satisfaction

Research on psychopathy and job satisfaction has produced mixed findings. On the one hand, Boddy (2011) concluded that job satisfaction tends to decrease as psychopathy increases. One reason may be that individuals with stronger psychopathic characteristics receive fewer social rewards and have more problematic interpersonal relationships than those with lower psychopathic traits (Foulkes et al., 2014). On the other hand, some researchers argue that subclinical psychopaths may thrive in work environments that reward emotional detachment, risk-taking, power, and strategic ruthlessness (O'Boyle et al., 2012). They may also view themselves positively in terms of communication ability, strategic thinking, or creativity and may sometimes occupy managerial roles (Babiak, Neumann, & Hare, 2010). Despite these potential adaptive features, psychopathy is more often associated with cold interpersonal behavior, low empathy, and low concern for the well-being of others. Because such individuals may struggle to maintain healthy relationships with colleagues and supervisors and may be denied organizational rewards such as promotions or salary increases, their overall job satisfaction may be negatively affected (Spain, Harms, & LeBreton, 2014).

2.5 Narcissism and Employees' Job Satisfaction

Among the three Dark Triad traits, narcissism appears to have the most complex relationship with job satisfaction. Abbas and Kant (2017) found that employees with higher levels of narcissism reported higher job satisfaction than colleagues with lower narcissism.

This may be explained by narcissists' generally optimistic view of their own performance and their tendency to interpret workplace experiences in self-enhancing ways (Williams & Williams, 2017). However, not all evidence is consistent. Benson, Jordan, and Christie (2016) found that lower job involvement among narcissistic employees could reduce job satisfaction, particularly when such individuals are assigned subordinate roles that do not align with their inflated self-view. Narcissistic employees often see themselves as overqualified and may prefer positions of status, visibility, and authority. Because power is highly important to narcissists, they may seek opportunities to secure admiration and influence in the workplace (Mead et al., 2018). Thus, while narcissism may promote confidence and subjective satisfaction in some contexts, it may also undermine teamwork and create tension when individuals perceive themselves as undervalued or insufficiently recognized.

2.6 Conceptual Framework and Hypotheses Development

The conceptual framework of this study is grounded in the broader literature on the antecedents and consequences of job satisfaction, particularly the model proposed by Ghazzawi (2008), which identifies motivation, social influence, life satisfaction, values, and personality as key predictors of job satisfaction. Within this framework, personality emerges as an especially relevant determinant, providing the theoretical basis for examining the relationship between Dark Triad traits and job satisfaction. This relationship is particularly important in professions that depend heavily on interpersonal interaction, ethical conduct, and organizational citizenship behavior. As George and Jones (2008) noted, job satisfaction is associated not only with employee well-being and engagement but also with prosocial workplace outcomes such as altruism, courtesy, sportsmanship, and conscientiousness. Therefore, low job satisfaction among employees with stronger dark personality traits may have broader implications for organizational functioning and service quality. Based on the reviewed literature, the following hypotheses are proposed:

- **H1:** Machiavellianism is positively related to job satisfaction.
- **H2:** Psychopathy is positively related to job satisfaction.
- **H3:** Narcissism is positively related to job satisfaction.

Although the literature reviewed above suggests a more negative relationship for Machiavellianism and psychopathy, these hypotheses are retained in line with the original conceptual model used in the study

3. METHODOLOGY

The methodology employed in this study is aligned with the research objectives and is designed to examine the relationship between the Dark Triad traits and job satisfaction. The study is based on both secondary and primary data sources.

Secondary data were obtained through an extensive review of the existing literature in the field of management and organizational behavior. A wide range of academic articles, books, and scientific publications accessed through electronic databases were analyzed. This comprehensive literature review provided the theoretical foundation for the study and supported the development of the conceptual model and research hypotheses.

Primary data were collected using a structured questionnaire, which represents one of the most widely used methods in empirical research. The data gathered through the questionnaire were used to test the conceptual model and the proposed hypotheses empirically, employing multiple linear regression analysis.

The questionnaire was divided into three main sections. The first section included demographic information, consisting of individual characteristics such as gender, age, level of education, years of work experience, and employment sector. The second section focused on the dimensions of the Dark Triad, which served as the independent variable. This section was based on the Short Dark Triad scale (Jones & Paulhus, 2014) and included 12 items, with three subscales: Machiavellianism (e.g., “Most people can be manipulated”), narcissism (e.g., “I insist on getting the respect I deserve”), and psychopathy (e.g., “I like to get revenge on authorities”). Each dimension consisted of four items, measured using a 5-point Likert scale ranging from strongly disagree to strongly agree.

The third section addressed job satisfaction, which served as the dependent variable. This part of the questionnaire was adapted from Spector’s (1985) Job Satisfaction Survey and included multiple factors such as pay, promotion, supervision, benefits, rewards, working conditions, nature of work, and communication. Each factor was measured through items rated on a 5-point Likert scale. The study uses a quantitative design with 90 participants. Data were collected using structured questionnaires and analyzed using SPSS. Reliability and regression analyses were conducted.

Table 1. Reliability Analysis (Cronbach Alpha)

Variable	Alpha
Machiavellianism	0.711
Psychopathy	0.719
Narcissism	0.722
Job Satisfaction	0.765

4. DATA ANALYSIS

This section presents the statistical analysis conducted to achieve the main objective of the study. It begins with a descriptive analysis of the respondents’ demographic characteristics, followed by inferential statistical analysis aimed at testing the relationship between the Dark Triad traits (Machiavellianism, narcissism, and psychopathy) and job satisfaction among employees in the city of Vlora.

4.1 Descriptive Statistical Analysis

Descriptive statistical analysis was used to summarize and present the general characteristics of the respondents. The findings are categorized and discussed in this section based on the data collected through the questionnaire.

4.1.1 Demographic Characteristics of Respondents

The demographic data of the respondents were analyzed and classified into five main categories: gender, age, level of education, years of work experience, and employment sector, as presented in Table 2. The gender distribution indicates that 51.1% of respondents were female, while 48.9% were male, showing a relatively balanced gender composition. In terms of age, the largest group of respondents (47.8%) falls within the 29–39 age category, followed by 28.9% aged 40–50. The 18–28 age group represents 17.8% of the sample, while only 5.6% are above 50 years old. These results suggest an increasing presence of younger employees in the labor market. Regarding the employment sector, 66.7% of respondents work in the private sector, while 33.3% are employed in the public sector. In terms of educational attainment, the majority of respondents (46.7%) hold a Master’s degree, followed by 36.7% with a Bachelor’s degree and 12.2% with secondary education. The high proportion of respondents with higher education levels likely contributed to a better understanding of the questionnaire and more accurate responses.

With respect to work experience, 40.0% of respondents have less than 4 years of experience, 24.4% have between 5 and 14 years, 17.8% have between 15 and 20 years, and 17.7% have more than 20 years of experience.

Table 2: Demographic Characteristics of Respondents

Category	Classification	Frequency	Percentage (%)
Gender	Female	46	51.1
	Male	44	48.9
Age	18–28 years	16	17.8
	29–39 years	43	47.8
	40–50 years	26	28.9
	Above 50 years	5	5.6
Education Level	Secondary	11	12.2
	Bachelor's Degree	33	36.7
	Master's Degree	42	46.7
Employment Sector	Private	60	66.7
	Public	30	33.3
Work Experience	0–4 years	36	40.0
	5–14 years	22	24.4
	15–19 years	16	17.8
	Over 20 years	16	17.7

4.2 Factor Analysis and Reliability of the Dark Triad Variables

To assess the reliability of the measurement instrument, Cronbach's alpha coefficient was employed. The results indicated acceptable reliability levels, with all values exceeding the recommended threshold of 0.70. In addition to reliability testing, factor analysis was conducted to examine the relationship between the questionnaire items and the conceptual structure of the study. Based on the SPSS output, the overall Cronbach's alpha for the Dark Triad variables was 0.753, with a total of 12 measurement items, consisting of four items for each dimension: Machiavellianism, psychopathy, and narcissism (Table 2).

Table 3: Reliability Analysis of Dark Triad Variables

Variable	N	Cronbach's Alpha	Number of Items
Machiavellianism	90	0.711	4
Psychopathy	90	0.719	4
Narcissism	90	0.722	4
Overall Dark Triad	90	0.753	12

To measure the independent variable **Machiavellianism**, four items were included (Table 3). The reliability analysis yielded a Cronbach's alpha of 0.711, which is considered acceptable according to Hair et al. (1998). Additionally, the Kaiser-Meyer-Olkin (KMO) measure (.739) and Bartlett's Test of Sphericity ($p = .000$) indicated that the data were suitable for factor analysis. The extracted factor explained 52.19% of the total variance. Machiavellianism was calculated as the mean score of the four items included in this factor.

Table 4: Items Measuring Machiavellianism (N = 90)

Item	Factor Loading
I tend to manipulate others to achieve my goals	0.729
I have used deception or lies to achieve my goals	0.704
I use flattery to achieve my goals	0.787
I tend to exploit others to achieve my objectives	0.665

Note: All items were measured using a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree)

Finally, the variable **Narcissism** was measured using four items (Table 5). These items were subjected to both factor and reliability analysis. The results indicated a single-factor structure with a Cronbach's alpha of 0.722, which is considered acceptable. Factor loadings exceeded the threshold of 0.40, ranging from 0.620 to 0.857. This factor explained 54.71% of the total variance.

Table 5 Items Measuring Narcissism (N = 90)

Item	Factor Loading
I tend to want others to admire me	0.738
I tend to seek attention from others	0.857
I tend to seek prestige or status	0.724
I expect special favors from others	0.620

Note: All items were measured using a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree).

4.3 Factor Analysis and Reliability of Job Satisfaction

To evaluate the reliability of the job satisfaction scale, Cronbach's alpha was calculated, yielding a value of 0.765, which indicates acceptable internal consistency. Additionally, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.597, and Bartlett's Test of Sphericity was statistically significant ($p = .000$), confirming the suitability of the data for factor analysis. The analysis included variables related to key dimensions of job satisfaction, namely pay, promotion, supervision, benefits, rewards, co-workers, nature of work, and communication. The results of the factor analysis indicate that all variables exhibited factor loadings greater than 0.40, meeting the recommended threshold for inclusion. Furthermore, the extracted components explained 75.09% of the total variance, suggesting a strong underlying factor structure.

Table 6: Factor Loadings of Job Satisfaction Variables

Variable	Component 1	Component 2	Component 3
Pay		0.822	
Promotion		0.700	
Supervision	0.738		
Benefits	0.846		
Rewards	0.568		
Co-workers	0.735		
Nature of Work			0.743
Communication	0.674		

Extraction Method: Principal Component Analysis

Note: Three components were extracted.

4.4 Correlation Analysis between Variables

When conducting regression analysis, it is essential to first examine the correlations between independent and dependent variables in order to assess the strength and direction of their relationships. According to Jayasinghe (2004), correlation values within the range of -0.7 to +0.7 do not indicate multicollinearity issues. In this study, all correlation coefficients fall within this acceptable range, suggesting that multicollinearity is not a concern. The correlation matrix presented below illustrates the relationships between the independent variables (Machiavellianism, psychopathy, and narcissism) and the dependent variable (job satisfaction).

Table 7: Correlation Matrix of Study Variables

Variable	Machiavellianism	Psychopathy	Narcissism	Job Satisfaction
Machiavellianism	1			
Psychopathy	0.291**	1		
Narcissism	0.268*	0.885**	1	
Job Satisfaction	0.258*	0.468**	0.582**	1

Significance levels: ** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

4.5 Linear Regression Analysis

To address the research question—“Which personality traits (*Machiavellianism, psychopathy, and narcissism*) influence employees’ job satisfaction?”—the following hypotheses were formulated:

- **H1:** Machiavellianism is positively related to job satisfaction.
- **H2:** Psychopathy is positively related to job satisfaction.
- **H3:** Narcissism is positively related to job satisfaction.

To test these hypotheses, a multiple linear regression analysis was conducted. In this model, **job satisfaction** was treated as the dependent variable, while **Machiavellianism, psychopathy, and narcissism** were included as independent variables. To evaluate the overall validity of the regression model, an ANOVA test was performed. The results indicate that the model is statistically significant. Specifically, the independent variables explain approximately **23.9% of the variance** in job satisfaction (Adjusted R²=0.239). The F-statistic is **8.782**, with a significance level of **p = .000**, which is below the threshold of 0.05, confirming that the model is valid.

Table 8: ANOVA Results for the Regression Model

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	4198.364	3	1399.455	8.782	.000
Residual	13385.624	84	159.353		
Total	17583.989	87			

Dependent Variable: Job Satisfaction

Predictors: Narcissism, Machiavellianism, Psychopathy

Table 9: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.489	0.239	0.212	12.62350

The regression coefficients indicate that **narcissism** is the only variable with a statistically significant effect on job satisfaction ($p < 0.05$), while Machiavellianism and psychopathy do not show significant effects (table 10).

Table 10 Regression Coefficients

Variable	B	Std. Error	Beta	t	Sig.
Constant	63.080	5.988		10.534	.000
Machiavellianism	0.280	0.461	0.060	0.607	.545
Psychopathy	1.363	0.926	0.303	1.472	.145
Narcissism	1.194	0.278	0.428	4.298	.000

Dependent Variable: Job Satisfaction

Regression analysis shows that narcissism significantly predicts job satisfaction ($p < 0.05$), while other variables are not significant. These results indicate that **H3 is supported**, while **H1 and H2 are not supported**. Specifically, Machiavellianism and psychopathy do not have a significant positive effect on job satisfaction, whereas narcissism demonstrates a **significant positive impact** on employees’ job satisfaction.

5. CONCLUSION

The findings of this study provide a comprehensive understanding of how the elements of the Dark Triad influence job satisfaction among the employees included in the sample. Through the use of the research instrument (questionnaire), it was possible to identify the presence and levels of Machiavellianism, psychopathy, and narcissism among employees, as well as to evaluate how these individuals perceive key dimensions of job satisfaction, such as pay, promotion, supervision, benefits, rewards, co-workers, nature of work, and communication.

The factor analysis of the dependent variable (job satisfaction) revealed that all dimensions exhibited factor loadings above the acceptable threshold of 0.40. Among these factors, **benefits and pay** demonstrated the highest factor loadings, indicating their strong influence on job satisfaction, while **rewards and communication** showed comparatively lower factor loadings. The regression results revealed that Machiavellianism had a weak positive but statistically insignificant relationship with job satisfaction, indicating that this trait does not meaningfully predict employees' satisfaction levels in the present sample. Likewise, psychopathy showed a positive but statistically insignificant effect, suggesting no reliable influence on job satisfaction. Although previous studies often reported negative relationships, these findings indicate that such effects were not supported in this study (Bakir et al., 2003; Boddy, 2011; Babiak et al., 2010; Foulkes et al., 2014). In contrast, the results align with findings from Abbas and Kant (2017), showing that individuals with higher levels of narcissism tend to report higher job satisfaction. This study confirms a **positive relationship between narcissism and job satisfaction**, suggesting that narcissistic traits—such as self-confidence and a strong need for recognition—may enhance individuals' perceptions of their work environment. In conclusion, the study demonstrates that **Machiavellianism and psychopathy are negatively associated with job satisfaction, whereas narcissism has a positive effect**. Therefore, hypotheses **H1 and H2 are not supported**, while **H3 is supported**.

Limitations of the Study

Despite its contributions, this study has several limitations that should be acknowledged. First, the relatively small sample size and the focus on a single geographic location (Vlora) may limit the generalizability of the findings. Second, the use of self-reported data may introduce response bias, as participants may not accurately reflect their true attitudes or behaviors. Third, the cross-sectional nature of the study does not allow for the examination of causal relationships between variables. Future research could address these limitations by including larger and more diverse samples, as well as applying longitudinal research designs.

Recommendations

Based on the findings of this study, several recommendations can be proposed: Future research should focus on specific professional groups, particularly in helping professions, to better understand how Dark Triad traits influence interactions with clients and colleagues, and to identify potential risks associated with these traits. Additional studies are needed to further explore the role of dark personality traits in organizational settings, contributing to both academic knowledge and practical applications. Employers and managers should pay closer attention to employees who exhibit Dark Triad traits, particularly in terms of how they communicate and interact within the workplace. Organizations should place greater emphasis on enhancing job satisfaction among employees, especially those with pronounced personality traits, by improving working conditions, communication, and organizational support systems.

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ORIGIN AS BOND: A CONSUMER CULTURE THEORY AND PLACE ATTACHMENT PERSPECTIVE ON DIASPORIC CONSUMPTION

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ABSTRACT

Country-of-Origin (COO) research has long established that the geographical origin of a product influences consumers' perception, evaluation, and purchase intention. This influence is typically explained through extrinsic cues — signals about quality and provenance. However, consumers can develop deep emotional connections with a product's origin, as is the case for diaspora consumers when purchasing or consuming products from their country of origin, such as terroir products. This relationship is often emotional and identity-laden, rather than a matter of simple perception or rational evaluation. This paper presents an integrative conceptual review aimed at reframing origin — from a product attribute to a symbolic bond between person and place — and at developing a richer theoretical account of origin-related consumption in diasporic contexts. It explores different conceptual frameworks related to COO and origin cue research, place attachment and place meaning theory, Consumer Culture Theory (CCT), and diasporic consumption studies, with a focus on food and place-related products. The review highlights a structural limitation in the COO tradition and argues that place attachment theory and CCT together offer a more complete account of how diaspora consumers relate to origin. An integrative conceptual framework is proposed, along with a set of research propositions intended to guide future empirical investigation. This paper extends COO theory beyond evaluation and purchase intention, introduces place attachment into marketing research on origin, and offers a conceptual framework for studying diaspora consumers, food heritage, and homeland-oriented consumption.

Keywords: *Consumer Culture Theory (CCT), Country-of-Origin (COO), Diasporic consumption, Place attachment*

1. INTRODUCTION

Research on country of origin (COO) has demonstrated that the origin of a product significantly influences consumers' perceptions, evaluations, and purchase intentions. Traditionally, origin is regarded as an informational cue associated with quality, authenticity, and reputation. However, this perspective becomes inadequate when consumption is motivated not only by evaluation but also by memory, attachment, identity, and belonging, as is frequently the case for diaspora consumers. This study contends that homeland-oriented consumption cannot be comprehensively explained using only a cue-based COO framework. For diaspora consumers, particularly concerning food, terroir, and place-linked products, origin may serve as a symbolic connection between an individual and a place. Consuming such products may signify continuity with the homeland, attachment to a cultural milieu, and identity negotiation within the migration context. To address this gap, this study develops an integrative conceptual review by synthesizing four streams of literature: COO research, place attachment and meaning, Consumer Culture Theory (CCT), and diasporic consumption studies. Its objective is to highlight the limitations of the traditional COO perspective and propose a more comprehensive framework for understanding origin-related consumption in diasporic contexts.

2. FROM COUNTRY-OF-ORIGIN TO PLACE ATTACHMENT

The COO literature has long treated origin as an informational cue shaping product evaluation and purchase intention. While this perspective is well-suited to cognitive, evaluation-driven consumption, it becomes insufficient when the consumer's relationship to a place of origin is rooted in memory, identity, and emotional attachment.

2.1. Country-of-Origin (COO) effect and related concepts

In international marketing research, the country-of-origin (COO) effect has long been recognized as a key extrinsic cue that shapes consumers' product evaluations and purchase intentions. Prior work shows that consumers associate specific images, stereotypes, and expectations with countries and that these country images influence perceived quality, value, and willingness to buy. In a previous literature review, Housni & Machrafi (2023) synthesized the main conceptualizations of COO and related constructs, such as country image, product-country image, and brand origin, and examined the principal theoretical frameworks mobilized to explain the COO effect, including cue utilization theory, the elaboration likelihood model, and categorization theory.

2.1.1. Definition of COO

In the marketing literature, the COO effect is typically described as a mechanism that triggers positive or negative associations with a country in consumers' minds (Aaker, 1996; Keller, 2003). These associations, in turn, shape consumers' willingness to purchase—or to avoid—products from that country (Chen, 2004; Hamzaoui & Merunka, 2006; Han, 1989; Han & Terpstra, 1988; Nagashima, 1970; Obermiller & Spangenberg, 1989; Schooler, 1965). This influence is exerted mainly through a country's image, which is often seen as the primary channel through which COO operates (Papadopoulos & Heslop, 1993). More broadly, COO reflects buyers' beliefs about the relative quality of goods and services produced in different countries—beliefs that frequently take the form of widely shared stereotypes.

Figure 1 synthesizes these country- and brand-related constructs and their links to the overall COO effect and key consumer response.

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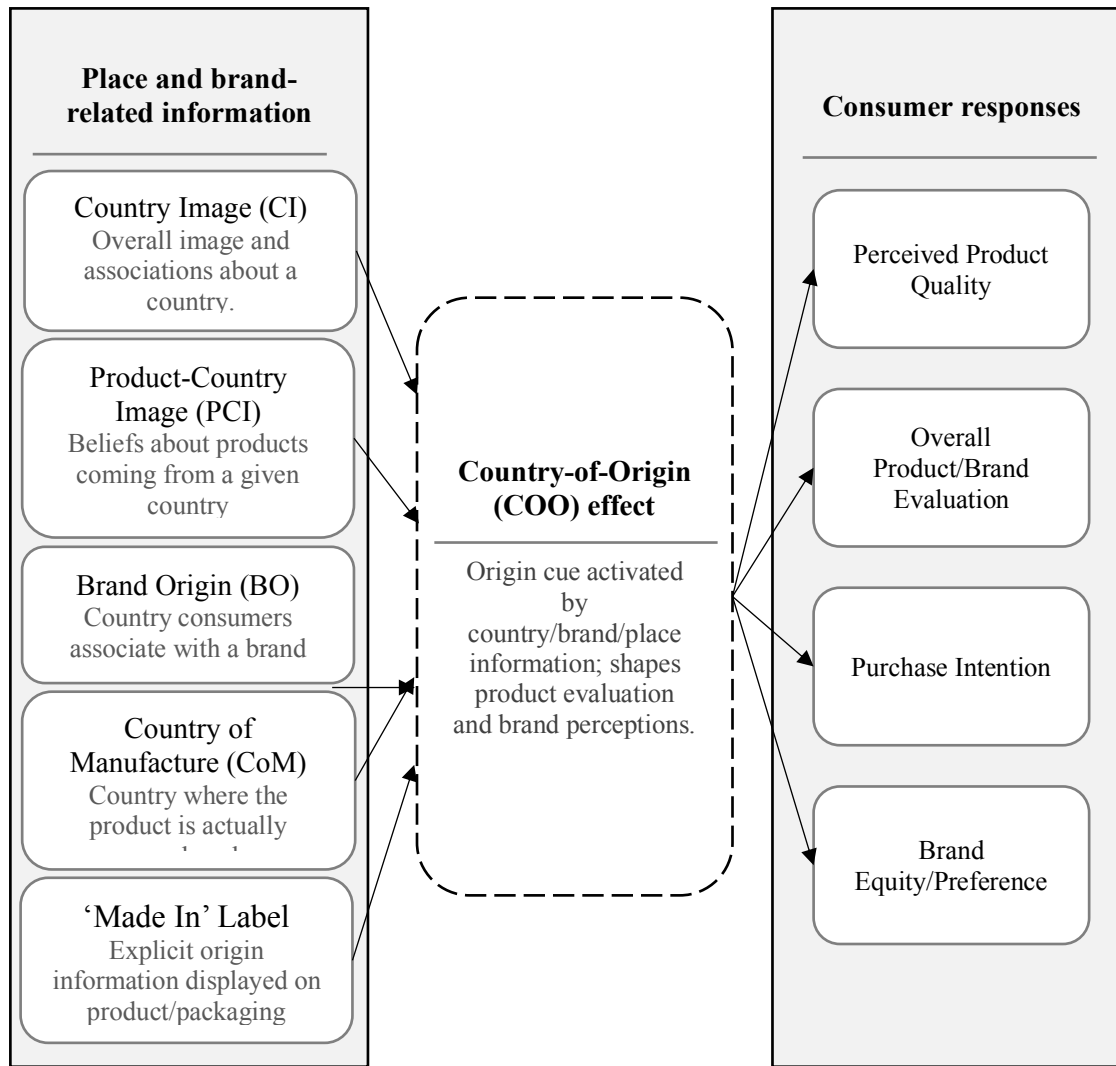


Figure 1. Main constructs related to the Country-of-Origin (COO) effect and their links to consumer responses

(Source: adapted from Schooler, 1965; Papadopoulos & Heslop, 1993; Martin & Eroglu, 1993; Thakor & Kohli, 1996; Housni & Machrafi, 2023).

2.1.2. Dimensions of COO

As noted by Matarazzo (2013), Roth & Diamantopoulos (2009) argue that COO is not a simple, single indicator but a complex and multidimensional construct, an idea also emphasized by subsequent work. From this perspective, several distinct yet interrelated dimensions can be identified.

- **Country image (CI)** refers to the overall set of descriptive, inferential, and informational beliefs that individuals hold about a given country, as well as the emotional and aesthetic qualities, experiences, memories, and impressions they associate with that place.
- **Product-country image (PCI)** narrows this focus to beliefs about specific products originating from a particular country, organized meaningfully in consumers' minds.
- **Product image (PI)** captures how the quality of particular products is perceived when they are associated with different national origins.

Beyond these conceptual distinctions, recent research on partitioned COO further refines the traditional view of COO as a single undifferentiated cue. In the context of hybrid products that may be designed, manufactured, assembled, and branded in different countries, studies such as De Nisco & Oduro (2022) show that consumers differentiate between several origin-related dimensions, including the **country of design (COD)**, **country of manufacture (COM)**, **country of brand (COB)** and **country of parts (COP)**. Their meta-analysis indicates that these COO sub-dimensions can have distinct effects on product evaluations, brand evaluations, and purchase intentions, and that these effects are contingent on factors such as product complexity, consumer involvement, product category, and the economic development level of the countries involved. Taken together, this body of work suggests that decomposing COO into multiple components—CI, PCI, PI, and partitioned COO dimensions—provides a more nuanced understanding of how origin information shapes consumer responses to hybrid products, even though origin is still largely conceptualized as a set of informational cues rather than as a deeper emotional or symbolic bond with the place.

2.2. Place attachment and place meaning

Overall, the literature on place attachment and meaning helps move beyond origin as a simple market signal. This shows that origin may also operate as an affective and symbolic bond linking consumers to a meaningful place. This is especially relevant in migration contexts, where attachment may persist, even when consumption practices change. To understand how these meanings are enacted through consumption, the next section turns to CCT and diasporic consumption.

2.2.1. Concept and dimensions of place attachment

Place attachment may be understood as an enduring affective bond linking individuals to a place and the meanings they associate with it. In recent place and country research, places are no longer treated as simple geographical containers. Rather, it is approached as a socially and symbolically constructed entity shaped by memories, heritage, experiences, and identity-related associations (Papadopoulos et al., 2018; Papadopoulos & Cleveland, 2021). From this perspective, attachment is not limited to physical proximity or residence. This reflects the extent to which a place becomes meaningful in personal and collective life. The literature generally treats place attachment as multidimensional. A central distinction concerns place identity and dependence. Place identity refers to the way a place becomes integrated into one's sense of self through feelings of belonging, symbolic identification, and emotional resonance. In contrast, place dependence refers to the functional importance of a place, that is, the extent to which it is perceived as irreplaceable for achieving valued goals or fulfilling everyday needs. These two dimensions are analytically distinct, although they often overlap in practice. A place may matter because it expresses who one is, supports what one does, or does both simultaneously (Casais & Boleixa, 2025). This multidimensional understanding highlights the close relationship between place attachment and meaning. The meanings attributed to a place are not neutral descriptions of territory; they are interpretive constructions that combine physical, social, cultural, and emotional elements. Such a perspective is especially useful for research concerned with country-related consumption, because it moves beyond the narrow conception of origin as a mere market cue. A country, region, or locality may matter not only because of what it produces, but also because of what it symbolizes, the memories it activates, and the forms of belonging it sustains. In this sense, place attachment helps explain why a place can remain salient even in the absence of immediate utilitarian benefits and why products associated with a place may acquire symbolic significance for consumers (Papadopoulos et al., 2018; Papadopoulos & Cleveland, 2021).

Dimension	Definition	Example	Implications for COO research
Place identity	The extent to which a place becomes part of an individual's self-concept.	Sense of belonging, identification with the homeland, feeling that the place "means a lot," emotional bond.	Suggests that COO products may be valued not only for utility, but also for their symbolic role in expressing identity and maintaining ties to the home country.
Place dependence	The functional importance of a place in satisfying needs or achieving valued goals.	Perceived irreplaceability of the place, preference for it over alternatives, practical attachment.	Helps explain why strong attachment does not always translate into high COO consumption abroad: host-country products may replace homeland products at the functional level.
Place meaning	The broader interpretive layer through which a place is associated with memories, culture, heritage, and social experience.	Childhood memories, traditions, routines, cultural references, shared representations of home.	Clarifies why certain COO products, especially food and regional products, may retain emotional salience among migrants and diaspora consumers.

*Table 1. Main dimensions of place attachment and their relevance for COO research
(Source: Author's elaboration based on the literature)*

Place attachment is most commonly conceptualized through complementary dimensions of place identity and place dependence. For COO research, these dimensions become particularly useful when read alongside broader place meanings, including memory, heritage, and symbolic belonging.

2.2.2. Place attachment, migration and COO consumption

The relevance of place attachment is especially visible in migration contexts. Relocation does not necessarily weaken the bonds to the home place. In contrast, migration may intensify the salience of the homeland by turning it into a key reference point for memory, continuity, and identity. Simultaneously, these bonds should not be viewed as fixed or uniform. They may be maintained, reconfigured, or selectively expressed as migrants adapt to new social, cultural and consumption environments. Therefore, migration offers a particularly useful context for examining how place meanings persist beyond territorial boundaries and continue to shape orientations toward the place of origin (Papadopoulos et al., 2018). Recent evidence suggests that strong attachment to the home country does not automatically translate into high levels of country-of-origin product consumption abroad. In their study of Portuguese emigrants, Casais & Boleixa (2025) reported relatively high levels of place attachment and national identity, while the relationship between these variables and the actual purchase of Portuguese COO products remained weak to moderate. This finding is important because it points to an attachment-consumption gap: emotional ties to the homeland may coexist with only moderate or selective consumption of homeland products.

This gap can be understood through the interaction between symbolic motives and market conditions. Casais & Boleixa (2025) show that emigrants often value homeland products for their cultural and emotional significance, especially in food-related categories; however, actual consumption is constrained by practical factors such as limited availability, selective distribution, and higher prices. Their results also indicate that acculturation is important. As time abroad increases, attachment to the home country may remain, but its behavioral expression is mediated by adaptation to the host environment, the availability of substitutes, and the incorporation of new consumption routines. Therefore, COO consumption among emigrants should be analyzed not only as an outcome of affective attachment but also as a practice shaped by access, affordability, and everyday market opportunities. From this perspective, place attachment offers a useful bridge between socio-cultural approaches to consumption and the more traditional COO literature. Rather than treating origin solely as an informational cue affecting product evaluation, it becomes possible to consider origin as part of a lived relationship with a place. This is particularly relevant for migrant and diasporic consumers, for whom homeland products may function as material supports of memory, belonging, and identity, while still remaining subject to the constraints of host-country markets. Accordingly, place attachment should be approached as a potentially important explanatory lens for COO consumption, but not as a deterministic predictor of it (Casais & Boleixa, 2025; Papadopoulos et al., 2018).

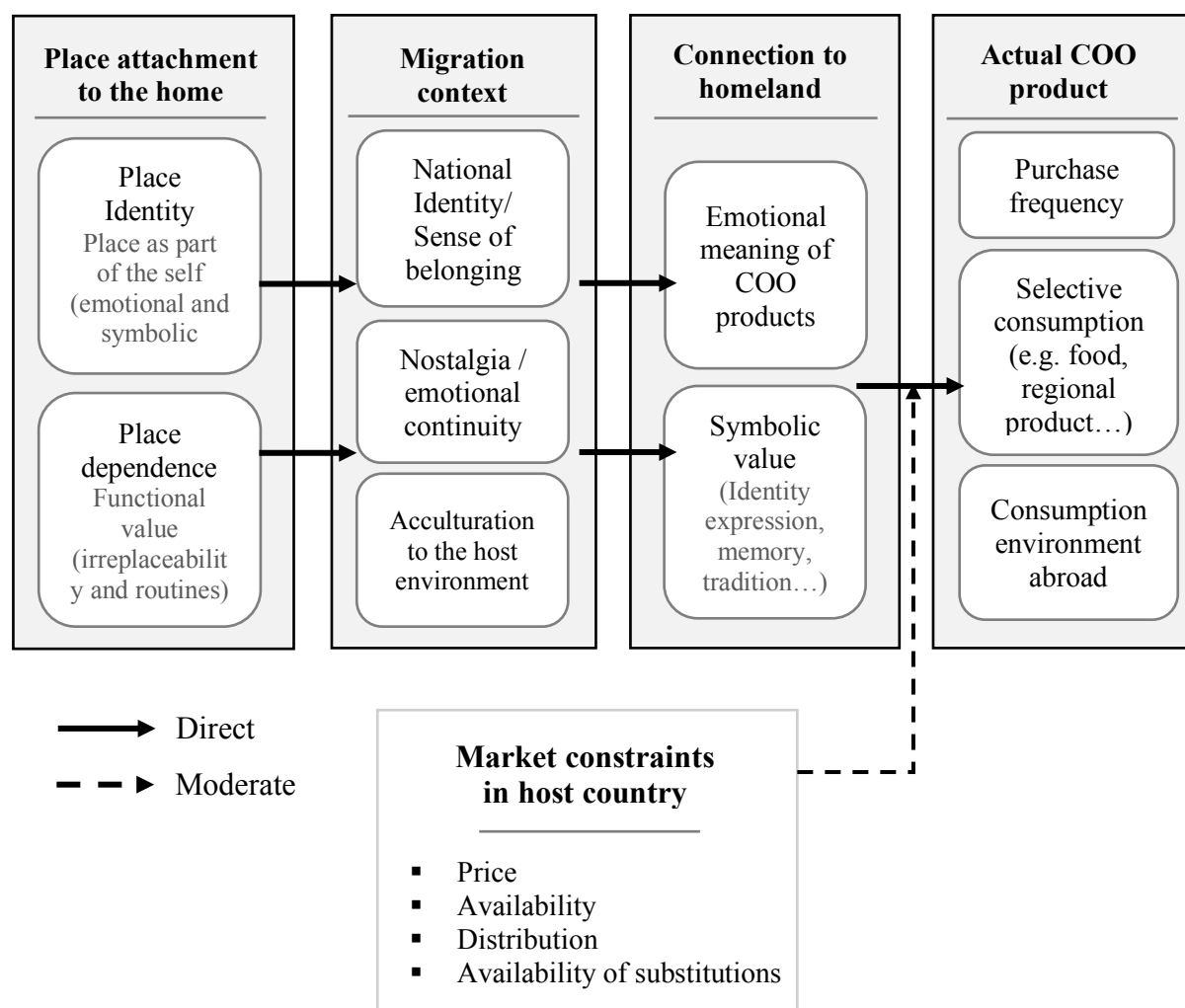


Figure 2. Conceptual framework linking place attachment, migration context, and COO product consumption abroad
 (Source: Author's elaboration based on the literature)

3. DIASPORIC CONSUMPTION AND CONSUMER CULTURE THEORY

Diasporic consumption goes beyond the purchase of homeland products as ordinary market goods. In migration contexts, consumption becomes a way of sustaining memory, expressing belonging, and negotiating identity between home and host society. A Consumer Culture Theory perspective helps capture these symbolic and cultural dynamics, especially in relation to terroir products that materialize attachment to place.

3.1. Consumer Culture Theory: consumption, culture and identity

Consumer Culture Theory (CCT) is a research tradition that examines the sociocultural, experiential and symbolic dimensions of consumption, rather than treating consumers as purely rational decision makers responding to attributes or price. It is not a single unified theory, but an umbrella for interpretive, qualitative and critical work that studies how consumption is shaped by broader social and historical structures (Arnould & Thompson, 2005). Within this tradition, four main domains are often distinguished: consumer identity projects, marketplace cultures, the socio-historic patterning of consumption, and mass-mediated marketplace ideologies and consumers' interpretive strategies (Arnould & Thompson, 2005). Research on consumer identity projects shows how people use goods, brands and places to construct and negotiate who they are, while work on marketplace cultures analyzes subcultures of consumption, brand communities, consumer tribes and lifestyle communities as sites where shared meanings and practices emerge (Hungara & Nobre, 2021). Studies on the socio-historic patterning of consumption and acculturation demonstrate how class, ethnicity and migration shape consumer possibilities and constraints, indicating that migrants often develop hybrid or “betwixt-and-between” identities through their consumption practices rather than following a linear assimilation pattern (Arnould & Thompson, 2005). In all of these domains, CCT converges on the view that consumption is a form of cultural practice and identity work embedded in specific social and historical contexts (Arnould & Thompson, 2005; Hungara & Nobre, 2021). This perspective is particularly relevant for the study of diasporic consumers and origin-linked consumption, since it foregrounds how issues of place, heritage and belonging are negotiated through everyday market practices.

3.2. Diasporic consumption practices

Diasporic consumption practices refer to the ways migrants use consumption to maintain, negotiate, and sometimes transform their ties to the homeland. From a Consumer Culture Theory perspective, consumption is not only utilitarian; it is also symbolic, experiential, and identity-related. In diasporic contexts, products—especially food and other culturally marked goods—often carry meanings linked to memory, belonging, and self-definition (Joy & Li, 2012; Mintz, 2008). At the same time, diasporic consumption is shaped by acculturation and market conditions in the host country. Immigrants may preserve some original consumption patterns, selectively adapt to the host culture, or combine both logics depending on context (Duan, 2024). Moreover, diasporas do not act only as consumers: they may also function as distributors, marketers, and facilitators of homeland products abroad. In this sense, ethnic and homeland goods often circulate through a “diaspora pull”, whereby diasporic actors actively seek, diffuse, and valorize products associated with home (Elo et al., 2020). Diasporic consumption practices are therefore best understood as selective, meaning-rich, and socially embedded practices situated between continuity and adaptation (Duan, 2024; Elo et al., 2020). Among the products through which diasporic consumers enact these symbolic practices, terroir products occupy a distinctive position — as objects that condense geographical origin, cultural heritage, and sensory memory into a single material form, and that therefore function as particularly powerful supports of homeland attachment.

3.3. Terroir products as symbolic supports of homeland attachment

Terroir products combine geographical origin, cultural heritage, and sensory memory in a single object (Housni & Machrafi, 2024b; Mintz, 2008). This combination gives them a distinctive position within diasporic consumption, where origin is not only an informational cue but also a symbolic and identity-laden bond (Papadopoulos & Cleveland, 2021). As such, terroir products can operate as symbolic supports of homeland attachment: material forms through which emotional ties to the home country are activated, maintained, and expressed in the host environment. Research on Moroccan consumers has shown that terroir products are perceived not only in terms of quality or geographic origin, but also through the lens of cultural authenticity, natural character, and rootedness in local traditions (Housni et al., 2023; Housni & Machrafi, 2024a). These perceptions suggest that the value attributed to terroir products extends beyond instrumental or hedonic considerations; it also encompasses a symbolic and identity-related dimension that makes such products particularly meaningful for consumers with strong ties to their place of origin. In diasporic contexts, this symbolic dimension becomes especially salient. For migrants, consuming a homeland terroir product — such as argan oil, a regional food specialty, or a traditional medicinal preparation — may constitute a practice of cultural continuity, a way of keeping the homeland present in everyday life. In this sense, terroir products function as material anchors of place attachment: they hold, in tangible form, the meanings, memories, and affiliations that define one's relationship to the homeland (Mintz, 2008; Papadopoulos & Cleveland, 2021). This connection between terroir products and homeland belonging also resonates with the CCT perspective on consumer identity projects: the choice to seek out and consume homeland goods in a foreign market is not only a purchasing decision, but also an act of identity work, an affirmation of who one is and where one comes from (Arnould & Thompson, 2005; Joy & Li, 2012).

4. INTEGRATIVE FRAMEWORK AND RESEARCH PROPOSITIONS

Building on the three streams of literature reviewed above — COO research, place attachment theory, and CCT — this section proposes an integrative conceptual framework and a set of research propositions intended to guide future empirical investigation. The framework argues that origin-linked consumption in diasporic contexts cannot be fully captured by the traditional COO model alone. Rather, it emerges from the interplay between cognitive evaluations of product origin, affective attachment to the homeland, and cultural identity work enacted through consumption practices.

4.1. Integrative framework

The framework is based on three core arguments. First, the COO effect in diasporic settings is not primarily a matter of quality inference or information cue processing. For diaspora consumers, origin is a relational signal that connects a product to a place that carries personal and collective meaning (Papadopoulos et al., 2018; Papadopoulos & Cleveland, 2021). Second, place attachment — understood through its dimensions of place identity and place dependence — shapes the salience of origin as a consumption driver. Consumers who maintain strong emotional bonds with their homeland are more likely to assign symbolic value to homeland products, even when practical constraints limit actual consumption (Casais & Boleixa, 2025). Third, CCT provides a cultural and identity layer that connects attachment to consumption practices: it shows how diasporic consumers use origin-linked products — especially terroir products and food — as instruments of identity negotiation, memory maintenance, and symbolic belonging (Arnould & Thompson, 2005; Elo et al., 2020).

Together, these three dimensions form an integrative model in which COO consumption among diaspora consumers is best understood as the outcome of three mutually reinforcing dynamics: the evaluative logic of origin cues, the affective logic of place attachment, and the symbolic logic of cultural identity work. These dynamics do not operate in isolation; they interact with market conditions in the host country (availability, price, and distribution) which ultimately constrain the behavioral expression of attachment and identity (Casais & Boleixa, 2025; Duan, 2024).

4.2. Research propositions

Drawing from the framework, five propositions are offered to guide future empirical research:

- **Proposition 1:** Diaspora consumers with higher levels of place identity toward the homeland will assign greater symbolic and emotional value to homeland terroir products, independently of their perceived quality.
- **Proposition 2:** The relationship between place attachment and actual COO product consumption among diaspora consumers is moderated by market constraints in the host country, particularly product availability and price.
- **Proposition 3:** Diaspora consumers who engage in stronger identity work through consumption — as reflected in deliberate choices of homeland food, regional specialties, or terroir products — will exhibit higher levels of homeland-oriented consumption over time.
- **Proposition 4:** Acculturation to the host country weakens the behavioral expression of place attachment (i.e., actual COO consumption) more than it weakens the emotional dimension of attachment itself, producing a persistent attachment–consumption gap.
- **Proposition 5:** Terroir products, as materially and symbolically dense objects, will elicit stronger emotional responses and higher willingness to purchase among diaspora consumers than generic homeland branded products, due to their perceived authenticity and heritage character (Housni & Machrafi, 2024b; Housni et al., 2023).

5. CONCLUSION

This paper has developed an integrative conceptual review aimed at reframing the role of origin in consumption — from a product attribute to a symbolic bond between person and place. For diaspora consumers, origin operates through memory, attachment, and identity rather than through simple quality inference, and the traditional COO perspective alone cannot account for this complexity. By bringing together COO research, place attachment theory, and CCT, the paper proposes a framework in which homeland-oriented consumption emerges from three mutually reinforcing dynamics: the evaluative logic of origin cues, the affective logic of place attachment, and the symbolic logic of cultural identity work — all moderated by market conditions in the host country. The five research propositions derived from this framework are intended to guide future empirical investigation into diaspora consumers, food heritage, and homeland-oriented consumption. This work is not without limitations. As a conceptual review, it does not provide empirical validation of the proposed framework or propositions. Future research should test these propositions in specific diaspora communities and product categories, with particular attention to how acculturation trajectories, host-country market conditions, and product type interact to shape the expression of homeland attachment in consumption. Beyond its theoretical contribution, the framework also carries practical implications for brand managers and place branding practitioners seeking to reach diaspora consumers: emotional appeals rooted in cultural identity and heritage may be necessary, but they must be accompanied by concrete efforts in distribution, pricing, and product availability to bridge the persistent gap between attachment and actual consumption.

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DECARBONISATION OF MARITIME TRANSPORT: AN ANALYSIS OF THE IMO AND EU REGULATORY FRAMEWORKS AND THEIR IMPLEMENTATION CHALLENGES

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ABSTRACT

Maritime transport plays a crucial role in global trade and in the economy of the European Union (EU). Although it is considered one of the most energy-efficient modes of transport, the sector remains a notable and steadily growing source of greenhouse gas (GHG) emissions. In recent years, increasing regulatory attention has been directed toward the decarbonisation of shipping at both the international and EU levels. At the international level, the International Maritime Organization (IMO) has taken several steps to address this issue, most notably through the adoption of the Initial IMO Strategy on the Reduction of GHG Emissions from Ships in 2018 and its revised 2023 Strategy. The IMO GHG Strategy represents a framework for Member States, setting out the future vision for international shipping, the levels of ambition to reduce GHG emissions and guiding principles, and, also, identifies barriers and supportive measures including capacity building, technical cooperation and research and development. Furthermore, the EU has adopted a more proactive regulatory approach as part of its broader climate policy and its objective of achieving climate neutrality by 2050. The main legislative instruments include the following: Directive (EU) 2023/959, Regulation (EU) 2023/957, and Regulation (EU) 2023/1805. The aim of this paper is to analyse the evolving international and EU legal frameworks for reducing carbon emissions in maritime transport, with particular focus on the regulatory approaches adopted by the IMO and the EU. The paper further examines the potential legal and practical challenges associated with the implementation of these measures.

Keywords: *decarbonisation, EU regulation, IMO regulation, maritime transport*

1. INTRODUCTION

All transport modes need to become more sustainable, with green alternatives widely available and the right incentives put in place to drive the transition. (European Commission, 2020). As one of the most energy-efficient modes of transport, shipping has traditionally been perceived as relatively environmentally sustainable (IMO, 2020). Nevertheless, the sector continues to be a significant and steadily growing source of greenhouse gas (GHG) emissions (European Environment Agency, 2025; IMO, 2020), which has raised increasing concern within the context of global climate change and environmental protection. In response to these challenges, both international and regional regulatory frameworks have evolved considerably in recent years, placing greater emphasis on the decarbonisation of maritime transport. At the global level, regulatory efforts are primarily coordinated through the International Maritime Organization (IMO), which has established strategic objectives and policy instruments aimed at reducing emissions from ships (IMO, 2018; IMO, 2023).

At the same time, the European Union has adopted a more proactive approach, integrating maritime transport into its broader climate policy framework and introducing legally binding measures to support its goal of achieving climate neutrality by 2050 (Directive (EU), 2023, no 959; Regulation (EU) 2023 no 957; Regulation (EU) 2023 no 1805). The aim of this paper is to analyse the evolving international and the European Union legal frameworks for reducing carbon emissions in maritime transport, with particular focus on the regulatory approaches adopted by the IMO and the European Union. In order to achieve this objective, the paper employs several fundamental scientific methods, including the method of analysis and synthesis, the comparative method, and the descriptive method. The research is primarily based on the examination of relevant IMO international conventions and the European Union legislation. Furthermore, the paper explores the potential legal and practical challenges associated with the implementation of these regulatory measures, particularly in light of the complex interaction between global and regional governance frameworks. The following section therefore focuses on the role of the IMO in the protection of the marine environment.

2. THE IMO AS A GLOBAL REGULATOR OF MARITIME ENVIRONMENTAL PROTECTION

The IMO serves as a central regulatory authority in the field of international maritime transport. As a specialized agency of the United Nations, its primary function is to establish a coherent framework of rules aimed at ensuring safe, efficient, and environmentally responsible shipping. While its early efforts were largely focused on vessel safety and the facilitation of global maritime trade, growing industrial activity and the expansion of shipping have progressively shifted attention toward environmental protection (Grabovac, Petrinović, 2006). With the development of the law of the sea and increasing global environmental awareness, the IMO has gradually constructed a comprehensive regulatory system encompassing a wide range of measures to prevent marine pollution (Ćorić, 2009). In this context, the IMO not only provides a forum for cooperation among states but also acts as a legislative body, shaping obligations for flag states and ship operators through international conventions and technical standards. A significant turning point in the evolution of marine environmental protection was the *Torrey Canyon* oil spill, which highlighted the potentially severe consequences of maritime accidents (Ćorić, 2009). In the aftermath of this incident, the development of international legal instruments intensified, particularly those aimed at preventing pollution from ships, especially in relation to the transport of oil and hazardous substances (Padovan, 2012). At the core of the current regulatory regime is the International Convention for the Prevention of Pollution from Ships (MARPOL Convention, 1973 as modified by the 1978 and 1997 Protocols), which systematically addresses various sources of pollution originating from maritime activities (Milošević Pujo, 2005). Annex VI of the MARPOL Convention is of particular importance, as it focuses on air pollution by introducing limits on harmful emissions and establishing standards for fuel quality and ship engine performance. Through these measures, the maritime sector has become increasingly integrated into broader efforts to reduce atmospheric pollution. In addition to regulatory measures, the IMO has developed practical tools to enhance the energy efficiency of ships. These include technical requirements for the design and construction of new vessels, as well as operational mechanisms aimed at optimizing energy use in existing fleets. Furthermore, the implementation of a fuel consumption data collection system has enabled more effective monitoring of emissions, providing a solid basis for future regulatory developments (Činčurak Erceg; Ižaković, 2025). Despite its relatively high level of energy efficiency compared to other modes of transport, maritime transport remains a notable contributor to global greenhouse gas emissions.

As a result, the sector has become more closely aligned with international climate policies, particularly in relation to the objectives set out in the Paris Agreement on Climate Change (Paris Agreement, 2015; see also Bullock, 2024). Consequently, the decarbonisation of shipping has evolved into not only an environmental concern but also a significant legal and economic issue on a global scale (Whitbourn, 2025). In response to these challenges, the IMO has established a long-term strategic framework for emission reduction. An important milestone was the adoption of the Initial IMO Strategy in 2018, which introduced quantitative targets and guiding principles for Member States (IMO, 2018). This framework was further strengthened with the adoption of the 2023 IMO GHG Strategy, emphasizing the need for a gradual yet decisive transition toward a climate-neutral maritime sector (IMO, 2023). Overall, the IMO today performs a multifaceted role, acting both as a regulatory authority and as a coordinator of international cooperation in environmental protection. Its activities form the foundation of global efforts to mitigate the environmental impact of maritime transport and to promote sustainable development within the shipping industry (IMO, 2020).

2.1. The Initial 2018 IMO GHG Strategy

The adoption of the Initial IMO Strategy on the Reduction of GHG Emissions from Ships in 2018 marked a significant step in the IMO's efforts to address climate change within the maritime sector (Činčurak Erceg; Ižaković, 2025). The Strategy was developed under the auspices of the Marine Environment Protection Committee (MEPC) and represents the first comprehensive global framework specifically targeting greenhouse gas emissions from international shipping (IMO, 2018). The overarching objective of the Strategy is to reduce, and ultimately phase out, greenhouse gas emissions generated by maritime transport. It establishes a set of guiding principles, levels of ambition, and a range of candidate measures intended to facilitate the transition toward a more sustainable shipping industry. In doing so, it aligns the maritime sector with broader international commitments, including the United Nations Sustainable Development Goals (IMO, 2018). The adoption of the Strategy was largely influenced by projections presented in the Third IMO Greenhouse Gas Study (IMO, 2014), which indicated that, in the absence of regulatory action, emissions from shipping could increase substantially by mid-century. Against this background, the Strategy defines a structured approach based on three key elements: strengthening the IMO's role in global climate governance, identifying appropriate measures for the shipping sector, and setting clear targets for emission reductions (IMO, 2018). In terms of ambition, the Strategy outlines several quantitative objectives. These include improving the energy efficiency of ships through technological innovation, reducing the carbon intensity of international shipping by at least 40% by 2030 compared to 2008 levels, and pursuing efforts towards a 70% reduction by 2050. Furthermore, it introduces a long term objective of reducing total annual greenhouse gas emissions by at least 50% by 2050, with a view to their complete elimination within this century (IMO, 2018). To achieve these targets, the Strategy envisages a phased approach consisting of short, medium, and long term measures. Short term actions, initially expected to be agreed upon within the period 2018–2023, focus primarily on improving operational and technical efficiency. Medium- and long-term measures include the development of innovative technologies and the transition to alternative fuels. At the same time, the Strategy acknowledges potential barriers to implementation, such as technological limitations, financial constraints, and disparities between developed and developing states, and calls for supportive measures including capacity-building, technical cooperation, and development (IMO, 2018; Činčurak Erceg; Ižaković, 2025). An important regulatory development associated with the Strategy is the introduction of a mandatory data collection system for fuel oil consumption.

Through amendments to Annex VI of the MARPOL Convention, the IMO established the Data Collection System (DCS) (IMO Resolution MEPC.278(70), 2016), which entered into force on 1 January 2019. Under Regulation 22A of MARPOL Annex VI, ships of 5,000 gross tonnage and above are required to monitor and report their annual fuel consumption to their flag State. This mechanism enhances transparency and provides a data-driven foundation for future policy measures. Further progress was made in 2021 with the adoption of additional short term measures aimed at improving the carbon intensity of ships. These include the Energy Efficiency Existing Ship Index (EEXI) and the Carbon Intensity Indicator (CII), introduced through amendments to MARPOL Annex VI (notably Regulations 23 and 28). These instruments combine technical standards with operational requirements, obliging ships to assess and improve their energy performance over time (IMO, 2021). Despite its importance, the Initial IMO Strategy does not constitute a legally binding instrument. Rather, it functions as a policy framework that relies on the commitment of Member States to implement its objectives through national legislation and through amendments to binding international conventions. Its effectiveness therefore depends largely on the willingness of states to cooperate and translate its provisions into enforceable rules (IMO, 2018). The Strategy also encourages the development of national action plans aimed at reducing emissions from maritime transport. While the global nature of shipping raises questions about the effectiveness of purely national measures, such plans can nevertheless play a valuable role in coordinating domestic policies and supporting the overall objectives of the IMO (IMO, 2018; Činčurak Erceg; Ižaković, 2025).

2.2. The Revised 2023 IMO GHG Strategy

Building upon the Initial Strategy, the IMO adopted a revised and more ambitious framework in 2023, commonly referred to as the 2023 IMO GHG Strategy. This updated Strategy reflects the growing urgency of climate action and introduces more stringent objectives, particularly in relation to achieving climate neutrality in the maritime sector (IMO, 2023). A central element of the 2023 Strategy is the commitment to reach net-zero greenhouse gas emissions from international shipping by or around 2050. This represents a significant shift from the earlier target of a 50% reduction and signals a clear intention to fully decarbonise maritime transport within the coming decades. The Strategy further emphasizes the importance of transitioning from fossil fuels to alternative energy sources, including zero- and near-zero-emission fuels (IMO, 2023). In addition to long term goals, the Strategy introduces intermediate targets and indicative checkpoints designed to monitor progress. These include a reduction in total greenhouse gas emissions of at least 20%, striving for 30% by 2030, and 70%, striving for 80% by 2040, compared to 2008 levels. Furthermore, it establishes a specific objective for the uptake of zero- or near-zero-emission technologies, aiming for such solutions to account for at least 5%, and preferably 10%, of the energy used by international shipping by 2030 (IMO, 2023). An important conceptual development in the 2023 Strategy is the adoption of a “well-to-wake” approach to emissions, which considers the full lifecycle of marine fuels, from production to final use. This broader perspective enhances the accuracy of emissions accounting and ensures that decarbonisation efforts are not undermined by upstream emissions (IMO 2023). However, achieving these ambitious targets presents significant challenges. The transition to low and zero emission technologies requires substantial financial investment, technological innovation, and infrastructure development (Smith, Corbett, 2024). These requirements may pose particular difficulties for developing countries, raising concerns about equity and the need for financial and technical support mechanisms (Činčurak Erceg; Ižaković, 2025).

The Strategy also acknowledges that existing measures, such as the Energy Efficiency Existing Ship Index (EEXI), the Carbon Intensity Indicator (CII), and the Ship Energy Efficiency Management Plan (SEEMP), while important, may not be sufficient on their own to achieve the long-term decarbonisation objectives. Additional regulatory measures and stronger enforcement mechanisms will therefore be necessary (IMO 2023). Moreover, the effectiveness of the Strategy ultimately depends on its implementation at the national level and the continued development of binding international rules. The IMO has indicated that further revisions of the Strategy are expected, with a new review scheduled for 2028, which may introduce even more ambitious targets in line with evolving climate science (Smith, Corbett, 2024). While the 2023 IMO GHG Strategy represents a significant advancement in the global governance of maritime emissions, its success will depend on coordinated international action, the adoption of robust legal instruments, and sustained commitment from Member States.

2.3. From Initial to Revised: Comparison to the 2018 and 2023 framework

In comparison to the 2018 framework, the 2023 Strategy of the International Maritime Organization represents a significant strengthening of ambition. While the initial 2018 Strategy set a target of reducing total greenhouse gas (GHG) emissions from international shipping by at least 50% by 2050 compared to 2008 levels, the revised 2023 Strategy introduces a more ambitious objective of achieving net-zero GHG emissions by or around 2050. This shift reflects a closer alignment with global climate goals, particularly those established under the Paris Agreement (IMO 2018; IMO 2023). Moreover, the 2023 Strategy broadens its regulatory scope by incorporating a life-cycle approach to emissions, commonly referred to as “well-to-wake,” thereby addressing not only emissions produced during ship operation but also those generated throughout the production and supply of marine fuels. In addition, it explicitly promotes the uptake of zero and near-zero GHG emission technologies, fuels, and energy sources, setting indicative checkpoints for 2030 and 2040 to guide the transition. These intermediate targets aim to ensure measurable progress and reduce the risk of delayed action (IMO 2018; IMO 2023). Another important advancement lies in the increased emphasis on the development of mid- and long-term measures, including the potential introduction of market-based mechanisms, such as carbon pricing, to complement existing technical and operational measures. This reflects a more integrated approach that combines regulatory, economic, and technological instruments. Overall, the 2023 Strategy demonstrates a clear transition from a relatively cautious and incremental approach toward a more comprehensive, structured, and transformative decarbonisation pathway for international shipping, reinforcing the role of the IMO as a central actor in global maritime climate governance (IMO 2018; IMO 2023).

2.4. Challenges and Limitations of IMO Regulation in Decarbonisation of Maritime Transport

Despite the significant progress achieved through the development of the Initial IMO GHG Strategy and its 2023 revision, the regulatory framework established by the IMO continues to face a number of structural, legal, and practical challenges. These limitations stem primarily from the global nature of maritime transport, the complexity of international decision-making processes, and the non-binding character of key strategic instruments. One of the main challenges lies in the consensus based decision making model within the IMO. As an international organization composed of Member States with diverse economic interests and levels of development, the adoption of ambitious regulatory measures often requires compromise. This can result in slower regulatory progress and, in some cases, the adoption of less stringent targets than those recommended by climate science.

The evolution from the 2018 Initial Strategy to the more ambitious 2023 Strategy illustrates this gradual and negotiated approach to strengthening climate commitments. A further limitation is the predominantly non binding nature of the IMO GHG strategies. While they provide an important policy framework and set clear objectives, their implementation depends on the willingness of Member States to incorporate these goals into national legislation or to support amendments to binding instruments such as MARPOL Annex VI. Consequently, the effectiveness of the IMO framework is closely linked to the level of political commitment and administrative capacity at the national level, which can vary significantly between states. In addition, enforcement remains a persistent issue in the regulation of international shipping. The IMO regulatory system relies heavily on flag State control, meaning that compliance with environmental standards depends on the ability and willingness of flag States to enforce applicable rules. This creates potential inconsistencies in implementation, particularly in cases involving flags of convenience, where regulatory oversight may be less stringent. From a technical and economic perspective, the transition towards low and zero emission shipping presents considerable challenges. The targets set out in the 2023 IMO GHG Strategy, including the achievement of net-zero emissions by or around 2050 and the increased uptake of alternative fuels, require substantial investment in new technologies, infrastructure, and research and development. Although the IMO plays a central role in shaping the global framework for maritime decarbonisation, its regulatory approach is constrained by institutional, legal, and practical limitations. Addressing these challenges will be essential for achieving the objectives set out in the 2018 and 2023 GHG strategies and for ensuring an effective transition towards a sustainable and climate-neutral maritime sector.

3. THE EUROPEAN UNION FRAMEWORK FOR MARITIME DECARBONISATION

The European Union has progressively integrated maritime transport into its broader climate policy framework. This approach reflects the European Union's commitment to achieving climate neutrality by 2050 and aligns the maritime sector with the objectives of the European Green Deal.

To this end, several key legislative measures have been adopted:

- Directive (EU) 2023/959 of the European Parliament and of the Council of 10 May 2023, amending Directive 2003/87/EC and establishing a system for greenhouse gas emission allowance trading within the Union, as well as Decision (EU) 2015/1814 concerning the Market Stability Reserve (Directive (EU), 2023, no 959);
- Regulation (EU) 2023/957 of the European Parliament and of the Council of 10 May 2023, amending Regulation (EU) 2015/757 in order to provide for the inclusion of maritime transport in the EU Emissions Trading System and to expand the monitoring, reporting and verification (MRV) of emissions (Regulation (EU) 2023 no 957);
- Regulation (EU) 2023/1805 of the European Parliament and of the Council of 13 September 2023 on the use of renewable and low-carbon fuels in maritime transport (FuelEU Maritime Regulation) (Regulation (EU) 2023 no1805).

These instruments form the core of the European Union regulatory framework for the decarbonisation of maritime transport.

3.1. The Inclusion of Maritime Transport in the European Union Emissions Trading System

A key development in the European Union's regulatory approach is the extension of the European Union Emissions Trading System (EU ETS) to maritime transport. This was achieved through amendments to the original emissions trading framework, notably by Directive (EU) 2023/959.

By incorporating shipping into the EU ETS, the European Union has introduced a market-based mechanism aimed at reducing emissions through economic incentives (Directive (EU), 2023, no 959). Under this system, shipping companies are required to monitor, report, and surrender allowances corresponding to their greenhouse gas emissions. This creates a financial cost for carbon emissions and encourages operators to adopt cleaner technologies and improve energy efficiency. The inclusion of maritime transport in the EU ETS represents a significant shift from purely technical regulation towards a more economically driven model of environmental governance (Directive (EU), 2023, no 959).

3.2. Monitoring, Reporting and Verification of Emissions (MRV System)

An essential component of the European Union's regulatory framework is the system for monitoring, reporting, and verification (MRV) of emissions from maritime transport. The MRV Regulation, as amended by Regulation (EU) 2023/957, establishes detailed rules for the collection and verification of emissions data from ships operating within the EU (Regulation (EU) 2023 no 957). The purpose of this system is to ensure transparency and accuracy in emissions reporting, thereby providing a reliable basis for regulatory measures such as the EU ETS. It also extends the scope of reporting to additional greenhouse gases and ship categories, strengthening the overall effectiveness of the regulatory framework (Regulation (EU) 2023 no 957). By requiring ship operators to systematically collect and submit emissions data, the MRV system plays a crucial role in enhancing accountability and supporting evidence-based policymaking within the maritime sector (Regulation (EU) 2023 no 957).

3.3. The FuelEU Maritime Regulation and the Transition to Alternative Fuels

In addition to market-based instruments and monitoring systems, the EU has introduced specific regulatory measures aimed at promoting the use of cleaner energy sources in maritime transport. The FuelEU Maritime Regulation (Regulation (EU) 2023/1805) is a central instrument in this regard (Regulation (EU) 2023 no1805). This Regulation establishes requirements for the gradual reduction of the greenhouse gas intensity of energy used on board ships, thereby encouraging the uptake of renewable and low-carbon fuels. It also introduces obligations related to the use of onshore power supply in ports, further contributing to emission reductions in coastal areas (Regulation (EU) 2023 no1805). The FuelEU Maritime framework reflects a technology-neutral approach, allowing for different pathways towards decarbonisation while setting clear targets for emission reductions. It thus complements the EU ETS by addressing not only the cost of emissions but also the technological transition required to achieve long-term climate objectives (Regulation (EU) 2023 no1805).

3.4. Challenges and Limitations of the EU Regulatory Framework for Maritime Decarbonisation

Despite the European Union's ambitious and comprehensive approach to reducing greenhouse gas emissions in maritime transport, a number of legal and practical challenges continue to affect the effectiveness of its regulatory framework. One of the key challenges arises from the interaction between the European Union legislation and the global regulatory system established under the IMO. Since maritime transport operates across international boundaries, the coexistence of the European Union specific rules and global standards may lead to regulatory fragmentation and legal uncertainty. This is particularly relevant in the context of measures such as the inclusion of shipping in the EU Emissions Trading System (EU ETS), which imposes obligations on operators regardless of their flag State. As a result, concerns have been raised regarding the compatibility of European Union measures with international maritime law and the potential for conflicts of jurisdiction.

Instruments such as the EU ETS and the FuelEU Maritime Regulation (Regulation (EU) 2023 no1805) introduce additional costs for shipping companies, which may affect their competitiveness in the global market. There is also a risk of carbon leakage, whereby shipping activities could be redirected to ports outside the European Union in order to avoid regulatory burdens. This could undermine the environmental effectiveness of European Union measures while creating distortions in international trade. Another important limitation relates to the administrative and technical complexity of the European Union regulatory framework. The requirements associated with monitoring, reporting, and verification (MRV) of emissions, as well as compliance with multiple regulatory instruments, impose a considerable administrative burden on ship operators. Ensuring accurate data collection and compliance across a diverse and globally dispersed fleet remains a challenging task. Furthermore, the transition to low and zero emission fuels, as promoted by the FuelEU Maritime Regulation, requires substantial technological development and infrastructure investment. The availability of alternative fuels and the necessary port infrastructure is still under development. This creates uncertainty for shipowners and may slow down the pace of decarbonisation in practice. Finally, the effectiveness of European Union measures is closely linked to their enforcement and the level of coordination among Member States. Differences in administrative capacity and enforcement may lead to inconsistencies in the application of rules, thereby reducing their overall impact.

4. CONCLUSION

This paper has examined the evolving international and regional frameworks aimed at addressing this challenge, with particular emphasis on the regulatory approaches developed within the IMO and the European Union. At the global level, the IMO has established a comprehensive, though predominantly framework-based, system for the reduction of emissions from maritime transport. Through instruments such as the MARPOL Convention and the adoption of the Initial 2018 and revised 2023 GHG Strategies, the IMO has defined long term objectives, introduced technical and operational measures, and created mechanisms for monitoring emissions. These efforts represent an essential foundation for global maritime decarbonisation. However, the analysis has shown that the effectiveness of the IMO framework is constrained by its non-binding nature, the need for consensus among Member States, and challenges related to enforcement and implementation. The European Union has adopted a more proactive and legally binding approach, integrating maritime transport into its broader climate policy. Through the extension of the European Union Emissions Trading System, the development of the MRV system, and the adoption of the FuelEU Maritime Regulation, the European Union has introduced a combination of market based and regulatory instruments aimed at accelerating the transition to low and zero emission shipping. This approach demonstrates a higher level of regulatory ambition and has the potential to drive innovation and behavioural change within the sector. Nevertheless, the EU framework is not without its limitations. Similar to the IMO framework, the success of EU measures ultimately depends on consistent enforcement, international cooperation, and the availability of adequate technological solutions. Strengthening the legal bindingness of international measures, enhancing cooperation between the IMO and the EU, and supporting technological and financial innovation will be essential steps toward reducing emissions and ensuring the sustainable development of the maritime sector.

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CULTURAL TOURISM, PUBLIC RELATIONS AND DESTINATION BRANDING: CROATIA AS A CASE STUDY

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ABSTRACT

Cultural tourism has become a key component of contemporary tourism development, particularly in countries that rely on cultural heritage and creative industries. In this context, communication plays a central role in shaping how cultural resources are presented, interpreted, and perceived. This paper examines the relationship between cultural tourism, public relations, and destination branding, using Croatia as a case study. Destination branding is approached as a communication process in which public relations act as a link between cultural production, tourism policy, and public perception. The analysis is based on a qualitative review of selected cultural tourism practices, communication strategies, and branding initiatives in Croatia, with particular attention to communication fragmentation, film-induced visibility, and the positioning of major cultural events. The findings indicate that Croatia possesses significant cultural resources, but their potential remains constrained by the lack of a coordinated communication framework that integrates cultural production, institutional communication, and tourism positioning into a coherent destination narrative. The paper further shows that visibility alone does not ensure meaningful representation: externally generated media narratives may significantly enhance recognition while simultaneously reconfiguring, simplifying, or even displacing historically grounded cultural identities when not strategically mediated. The paper concludes that the main challenge of Croatian cultural tourism lies not in the lack of cultural content, but in the strategic integration of cultural communication. Stronger coordination of communication activities, clearer narrative frameworks, and a more strategic use of public relations are therefore necessary to improve the visibility, coherence, and long-term competitiveness of cultural tourism in Croatia.

Keywords: Cultural tourism, Destination branding, Public relations, Strategic communication, Digital communication

1. INTRODUCTION

Cultural tourism can no longer be understood only as a segment of the tourism industry, but as a field in which destinations construct visibility, meaning, and recognition within complex global media environments. What is at stake is not only the presentation of cultural assets, but also the processes through which these assets are selected, interpreted, and communicated to different audiences. In this context, communication becomes a central dimension of tourism value. The perceived quality of a destination increasingly depends on the availability, credibility, and circulation of information, particularly in digital environments where user-generated content and online communication significantly influence tourist decision-making and experience (Karamehmedović, 2019). Cultural tourism is therefore not based only on resources, but on the communication processes that make those resources visible and relevant. At the same time, contemporary approaches to cultural tourism emphasize experience, participation, and the co-creation of meaning rather than passive consumption of heritage. This means that destination identity is not fixed but continuously shaped through interactions among visitors, local communities, and cultural institutions (Richards, 2021). As a result, cultural tourism can be understood as a dynamic communication process in which meaning is constantly negotiated.

These developments directly affect destination branding. Rather than being limited to promotion, destination branding can be seen as a long-term communication process in which identity, image, and reputation are formed through the alignment of cultural production, institutional communication, and public perception (Anholt, 2016; Skoko, 2021). In this sense, destinations function as communication constructs whose value depends on the coherence and credibility of their narratives. Within this process, public relations play an important role. They are not only a promotional tool, but a strategic function that connects stakeholders, coordinates communication activities, and shapes relationships in complex communication environments (Sriramesh and Verčič, 2020). In cultural tourism, this role is particularly important because it enables the integration of diverse cultural elements into a recognizable destination narrative. The importance of communication is further reinforced by digital transformation and the growing role of artificial intelligence in tourism. Digital platforms, user-generated content, and algorithmic systems increasingly influence how destinations are perceived, often reducing the level of institutional control over communication processes (Wang et al., 2025). As a result, destination image emerges from the interaction between institutional communication and decentralized digital content. Croatia provides a relevant case for examining these processes. Although it has a rich cultural heritage, festivals, and internationally visible cultural production, these elements often operate in the absence of a centralized, strategically coordinated communication framework and a clearly defined, consistent destination narrative. This gap represents not only an empirical inconsistency but a structural communication problem that shapes the limits of destination branding in Croatia. The aim of this paper is to analyze the relationship between cultural tourism, public relations, and destination branding in Croatia, with a focus on communication processes. The analysis is guided by the following research questions:

- a) In what ways are cultural resources in Croatia incorporated into destination branding strategies?
- b) What role do public relations play in connecting cultural production, institutional communication, and tourism positioning?
- c) To what extent can a coherent communication-based destination narrative be identified?

2. THEORETICAL FRAMEWORK

2.1. Cultural tourism as a communicative process

Cultural tourism is no longer understood only as the consumption of heritage or cultural attractions. Contemporary approaches emphasize that cultural resources become tourism assets through processes of interpretation, mediation, and communication (Timothy, 2011). Their value, therefore, depends not only on their existence but on the ways in which they are presented and integrated into meaningful narratives for different audiences. Recent research also highlights a shift from passive consumption to experience-based and participatory forms of tourism. Tourists are increasingly active participants in the co-creation of meaning and experience (Richards, 2021). This shift places communication at the center of cultural tourism and moves the focus from static resources to dynamic processes of meaning-making.

From this perspective, cultural tourism can be understood as a communicative field in which meanings are continuously produced, negotiated, and shared among visitors, local communities, and institutions.

2.2. Destination branding and public relations

Destination branding is increasingly conceptualized as a communication process rather than a set of promotional activities. It involves aligning identity, image, and reputation through the interaction among cultural production, institutional communication, and public perception (Anholt, 2016; Skoko, 2021).

Branding is therefore not imposed, but developed over time through consistent and credible communication. Within this process, public relations plays a key integrative role. Their function goes beyond promotion and includes coordinating communication between institutions, cultural actors, media, and audiences. In the context of cultural tourism, PR helps connect diverse cultural elements and translate them into coherent and recognizable narratives (Sriramesh and Verčič, 2020). The effectiveness of destination branding thus depends not only on visibility, but on the coherence and credibility of communication. This perspective aligns with broader approaches that understand destination branding as a process of meaning construction shaped through multiple stakeholders and communication channels.

2.3. Digital communication and the transformation of destination image

Digital media have significantly changed the way the destination image is formed. Traditional sources such as official tourism organizations and mass media are increasingly complemented or replaced by digital platforms, social media, and user-generated content (Llodra-Riera et al., 2015; Kim et al., 2017). Research shows that online communication has a central role in shaping tourist perceptions and decision-making processes, including in the Croatian context (Karamehmedović, 2019). As a result, destination image is no longer controlled solely by institutions, but emerges through the interaction of multiple actors. This transformation is further intensified by the growing role of artificial intelligence in tourism. AI-driven systems influence how information is searched, filtered, and presented to users. Recent research further confirms that artificial intelligence is becoming a structural factor in tourism development, influencing decision-making processes, information flows, and the sustainability of tourism systems (Wang et al., 2025). Consequently, destination image is formed within a more complex and less controllable communication environment. In such conditions, strategic communication and public relations become even more important, as they help maintain coherence and credibility in fragmented digital spaces. In this context, artificial intelligence does not simply introduce new tools, but restructures communication environments by algorithmically filtering, prioritizing, and personalizing information flows. As a result, the destination image is increasingly shaped by fragmented, individualized communication trajectories rather than centrally coordinated narratives (Wang et al., 2025).

3. METHODOLOGY

This paper adopts a qualitative research approach, using Croatia as a case study to examine the relationship among cultural tourism, public relations, and destination branding. The research focuses on communication processes through which cultural resources are incorporated into destination identity. The study is based on a qualitative, conceptually oriented analysis that combines theoretical interpretation with selected empirical illustrations. In addition to reviewing relevant academic literature and strategic documents, the analysis includes specific examples of cultural tourism initiatives, branding campaigns, and cultural events in Croatia. Particular attention is given to cases such as the national tourism campaign *Croatia Full of Life*, film-induced tourism related to Dubrovnik, and major cultural events such as the Dubrovnik Summer Festival and the Pula Film Festival. These cases are used as illustrative examples to examine patterns of communication coherence, the role of public relations, and the relationship between cultural production and destination branding. A qualitative content analysis was applied to identify key patterns in communication structures, including the level of integration between cultural actors, institutional communication, and tourism promotion. The analysis focuses on how meaning is constructed, communicated, and fragmented across different actors and platforms, including digital environments.

The main limitation of the study lies in its qualitative and interpretative nature, as well as in the selective scope of the analyzed cases. However, this approach allows for a deeper understanding of communication dynamics and provides a basis for further research.

4. STRATEGIC CONTEXT: CROATIA

4.1. Cultural resources and tourism positioning

Croatia has a rich concentration of cultural resources, including historical heritage, UNESCO-listed sites, festivals, performing arts, and a diverse cultural production that extends beyond traditional tourism attractions. These resources position culture as an important component of the country's tourism identity. However, their role in tourism depends not only on their existence but also on the way they are integrated into broader communication and branding strategies. Research on cultural heritage and tourism in Croatia shows that cultural resources are widely recognized as important elements of national identity and tourism attractiveness, but their contribution to a clearly defined and recognizable tourism brand remains uneven (Knežević, 2023). This suggests that the main issue is not the lack of cultural content, but the limited communication coherence through which that content is presented. From a policy perspective, the National Plan for Sustainable Tourism Development emphasizes sustainability, diversification, and year-round tourism as strategic priorities. Within this framework, cultural tourism is recognized as a segment with strong potential to reduce seasonality and strengthen destination differentiation. At the same time, strategic documents place greater emphasis on development goals than on the communication processes through which these goals are translated into public perception.

4.2. Communication fragmentation and institutional frameworks

Despite the richness of cultural resources, tourism communication in Croatia remains relatively fragmented. Cultural institutions, tourism organizations, and local stakeholders often operate through separate communication channels and priorities, producing narratives that are not always mutually connected. As a result, the overall destination image may appear inconsistent or insufficiently differentiated. This fragmentation is especially visible in the relationship between cultural production and tourism promotion. Cultural institutions usually communicate within artistic, educational, or professional frameworks, while tourism communication often presents cultural content in a simplified or selective way for wider audiences. This is also evident in national tourism campaigns. For example, the Croatian National Tourist Board has developed international campaigns such as *Croatia Full of Life*, which successfully increased global visibility but primarily functioned as a promotional platform rather than as a mechanism for integrating diverse cultural elements into a coherent narrative. This example highlights the distinction between promotional visibility and communicative integration. The campaign largely relied on visually attractive and experience-oriented imagery—such as coastal landscapes, lifestyle scenes, and generic cultural motifs—without systematically linking specific cultural institutions, festivals, or heritage narratives into a structured and recognizable cultural identity. Consequently, although it strengthened visibility, it did not resolve the structural fragmentation of cultural representation at the national level. This problem is reinforced by the growing importance of digital communication. Research on tourist behavior in Croatia shows that online platforms and social media play a major role in shaping perceptions and travel decisions (Institut za turizam, 2022). User-generated content therefore increasingly influences destination image alongside, and sometimes independently from, official communication.

4.3. Film-induced tourism and international visibility

An important dimension of Croatia's tourism positioning concerns film-induced tourism and international media exposure. Croatia has gained global visibility as a filming location for internationally distributed productions, boosting interest in particular destinations. Among these, the most prominent example is Dubrovnik, whose international visibility increased significantly after it was used as a filming location for the television series *Game of Thrones*. This case demonstrates how mediated audiovisual narratives can directly influence destination recognition, visitor flows, and symbolic associations with place. In this context, Dubrovnik became strongly associated with the fictional city of King's Landing, transforming it into a globally recognizable visual symbol shaped by an externally constructed narrative. From the perspective of tourist perception, this shift is significant, as visitors may engage with Dubrovnik as a media landscape defined by fictional associations rather than as a historically layered cultural destination. However, such visibility introduces a structural tension between global recognition and local identity. Dubrovnik possesses a complex and historically grounded cultural identity shaped by its architectural heritage, urban continuity, and the legacy of the Republic of Ragusa. The dominance of media-generated representations may therefore simplify this identity, reducing it to a set of visually recognizable elements linked to popular culture. Studies on film-induced tourism emphasize that audiovisual representation creates emotional engagement, symbolic associations, and visual recognition, all of which can motivate tourist interest (Beeton, 2016; Abd Rahman et al., 2019). In the Croatian context, film tourism demonstrates the strong promotional potential of cultural visibility in international media. At the same time, the Dubrovnik case shows that visibility does not automatically translate into coherent representation. Film-related visibility in Croatia often operates as a separate promotional effect rather than as part of a coordinated national communication framework. This points to the absence of a clearly defined communicative center capable of aligning cultural production, institutional communication, and tourism narratives at the national level.

4.4. From cultural potential to communication coherence

Taken together, these elements show that Croatia has a strong cultural and symbolic basis for developing a distinctive tourism identity. The main challenge, however, lies in transforming this potential into a coherent communication framework. Cultural tourism, destination branding, and public relations are all present, but they are not always sufficiently aligned. The central limitation is therefore structural rather than resource-based: the absence of a coordinated communication framework capable of integrating diverse cultural elements into a stable and recognizable destination narrative. This provides the basis for the analysis that follows.

5. ANALYSIS

5.1. Cultural resources without communication integration

The Croatian case clearly demonstrates the central assumption of this paper: the existence of rich cultural resources does not automatically produce a recognizable destination identity. Although Croatia has a dense network of heritage sites, festivals, and performing arts initiatives, these elements often function as separate units rather than as parts of a coherent communication system. This limits their strategic tourism value. Cultural resources may be visible at the level of individual events or destinations, but they are not consistently connected within a broader narrative that would strengthen recognition and differentiation. In this sense, the main gap is not between culture and tourism, but between symbolic potential and the articulation of meaning through communication. The findings, therefore, suggest that cultural tourism in Croatia still operates more as a collection of individual attractions than as an integrated communication field.

5.2. Public relations as an insufficiently used integrative mechanism

The analysis further indicates that public relations do not function as a consistent integrative mechanism in Croatian cultural tourism. PR activities are present, but they are often limited to promotion and visibility rather than to the strategic coordination of stakeholders and narratives. This is particularly visible in the relationship between cultural institutions and tourism organizations. Cultural actors mainly communicate within artistic and professional frameworks, while tourism communication selectively adapts cultural content for wider audiences. As a result, communication between these sectors remains only partially connected. From this perspective, public relations should be understood not only as a promotional tool, but as a strategic function capable of linking cultural production, institutional communication, and public perception. Without such coordination, destination branding remains fragmented. This fragmentation is therefore not accidental, but reflects the absence of a central communication structure capable of integrating stakeholders and narratives.

5.3. Digital communication and loss of narrative control

Digital communication adds another layer of complexity. Online platforms, social media, and user-generated content increasingly shape how destinations are perceived, reducing institutional control over destination image. In Croatia, tourist perceptions are strongly influenced by digital information sources and decentralized online representation (Institut za turizam, 2022; Karamehmedović, 2019). This means that official communication no longer operates in isolation but is constantly interacting with user-generated content and platform dynamics. Destination image is therefore produced through multiple, sometimes competing, narratives. The growing role of artificial intelligence intensifies this process even further. Algorithmic recommendations, automated content distribution, and personalized visibility make communication environments more fragmented and less predictable. In such conditions, the absence of a coherent destination narrative becomes even more visible. In this sense, artificial intelligence not only complicates communication environments but also further undermines the possibility of establishing a coherent and centrally coordinated destination narrative.

5.4. Film tourism as a model of symbolic visibility

Film-induced tourism represents the most visible example of successful communication integration in the Croatian context. Unlike many other cultural resources, film-related destinations in Croatia often achieve strong international visibility and recognition because they are linked to globally distributed media narratives. Research on film tourism shows that visual memorability, emotional engagement, and narrative identification can significantly influence tourist motivation (Beeton, 2016; Abd Rahman et al., 2019). In the Croatian context, film tourism demonstrates how mediated cultural visibility can shape destination image more effectively than fragmented institutional communication alone. At the same time, these effects remain only partially integrated into broader destination branding strategies. Film-related visibility often functions as a localized or project-based success rather than as a systematically incorporated part of a national communication strategy.

5.5. Towards communication coherence

The analysis suggests that the main challenge of Croatian cultural tourism is not the creation of new resources, but the better communication and integration of existing ones. Cultural tourism, destination branding, and public relations are all present, but they still operate within overlapping and insufficiently coordinated frameworks.

A more coherent approach would require stronger coordination among cultural institutions, tourism bodies, and communication actors, along with clearer narrative frameworks and a more strategic use of digital communication tools. In this way, destination identity could be strengthened not as a fixed attribute, but as the result of consistent and credible communication. In such conditions, destination branding can no longer be understood as a centrally controlled communication activity, but rather as a distributed process shaped by the interactions among institutions, cultural actors, digital platforms, and audiences. This shift suggests the need to reconceptualize destination branding as a form of distributed communication, in which coherence is not imposed from a single center, but emerges through the alignment of multiple actors and communication flows. The Croatian case, therefore, shows that the long-term value of cultural tourism depends not only on cultural richness but on the ability to transform that richness into a recognizable and sustainable destination narrative. This suggests that the key analytical shift is not from promotion to branding, but from communication content to communication structure.

5.6. Festivals: Communication coherence and fragmentation in practice

The dynamics described in this paper can be illustrated through the communication positioning of major Croatian cultural events. Festivals such as the Dubrovnik Summer Festival and the Pula Film Festival demonstrate that Croatian cultural actors can achieve strong individual visibility and symbolic recognition. At the same time, they reveal the limits of their integration into a broader and coherent national destination narrative. The Dubrovnik Summer Festival is a particularly strong example of event-based cultural communication. Its long tradition, international reputation, and clearly defined artistic profile make it one of the most recognizable cultural events in Croatia. The festival successfully connects heritage space, artistic prestige, and city identity, presenting Dubrovnik as a place of high cultural value. However, this communication remains primarily tied to the festival itself and the city where it takes place. Its symbolic strength is not consistently translated into a wider representation of Croatia as a culturally distinctive destination. A similar pattern can be observed in the Pula Film Festival. The event possesses historical continuity, a strong association with film culture, and a distinctive visual identity shaped by its use of the Roman amphitheater as a screening venue. This creates a powerful link between cultural event, historical setting, and public visibility. Yet the festival's communication value remains predominantly event-centered. Rather than functioning as part of a coordinated national narrative of cultural tourism, it operates mainly as an autonomous cultural brand. Taken together, these examples show that the central problem is not the lack of cultural visibility but the lack of communication mechanisms that connect individual cultural actors into a unified destination narrative. Croatian cultural events can generate recognition, prestige, and audience engagement, but their symbolic value often remains localized or sector-specific. This confirms that the key challenge of cultural tourism in Croatia lies less in cultural production itself than in strategically integrating cultural communication into destination branding.

6. CONCLUSION

This paper examines the relationship among cultural tourism, public relations, and destination branding in Croatia from a communication perspective. The findings indicate that the key challenge is not the lack of cultural resources, but their insufficient integration into a coherent and recognizable destination narrative. The analysis shows that cultural visibility in Croatia is often achieved through individual initiatives, events, or externally generated media exposure. However, these elements remain only partially connected within a broader communication framework. As a result, destination identity emerges as fragmented rather than strategically articulated.

The role of public relations is therefore not limited to promotion, but lies in its potential to function as a coordinating mechanism between cultural production, institutional communication, and public perception. This role becomes increasingly important in digital environments, where destination image is shaped through the interaction of institutional messages and user-generated content. The Croatian case demonstrates that visibility alone does not ensure meaningful or coherent representation. Instead, the long-term development of cultural tourism depends on aligning diverse cultural actors within a consistent communication framework that preserves the complexity of local identity while enabling global recognition. Future research could further explore the role of digital platforms, artificial intelligence, and participatory communication in shaping destination narratives, particularly in relation to sustainability and cultural authenticity. In this sense, the challenge of cultural tourism is not only to increase visibility but also to maintain the integrity and complexity of place-based meanings within increasingly mediated and fragmented communication environments. The Croatian case illustrates that destination identity is not simply communicated, but continuously constructed, negotiated, and potentially reduced through communication processes.

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DIGITALIZATION AS A RESULT OF BANKING INNOVATION: A SYSTEMATIC LITERATURE REVIEW FOLLOWING PRISMA GUIDELINES

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ABSTRACT

This document provides a systematic literature review that examines empirical evidence exploring digitalization as an outcome of banking innovation. Using PRISMA guidelines, a comprehensive search has been performed on the predominant academic databases (Science Direct and Scopus) with structured criteria for inclusive and exclusion criteria for studies on digitalization in banking. The current study encompasses a narrative synthesis of findings emerging from a comprehensive set of peer-reviewed studies published between 2020 and 2025 totaling 57 studies. The result of this investigation indicates digitalization in banking to be a diverse outcome of technological and organizational advancements and banking sector innovations driven by market and technological forces. The findings of this investigation reveal fintech adoption, mobile banking, blockchain technology, and AI-powered banking to be among the prime drivers of innovation pressures leading to digitalization in banking. The heterogeneity inherent in the studies has therefore demanded a narrative approach to synthesis in addition to a meta-analysis approach.

Keywords: *banking innovation, digitalization, financial technology, PRISMA, systematic review*

1. INTRODUCTION

The banking sector has undergone an unprecedented level of transformative change within the last two decades, and technological innovation remains the central driver of this change within the sector. Digitalization, the adoption of digital technologies in business processes and services, remains a term virtually synonymous with banking in the modern age. However, the means by which banking innovation [1], [16], [42] translates to digitalization are still under synthesized in existing theory. Though case studies and industry analysts suggest the impact of digital transformation on the banking industry [2], [24], no systematic study on digitalization as an outcome of the innovation that occurs in the banking sector has as yet been undertaken. This has created problems for the involvement of the innovation and digitalization process by the concerned sectors. Research questions of the systematic review include the following:

1. What drives digitalization in the banking sector?
2. What are the measurable outcomes of innovation-driven digitalization?
3. What are the contextual factors that impact banking innovation and digitalization?
4. What are the existing gaps in the literature about this correlation?

2. METHODOLOGY

This literature review was performed as a systematic literature review (SLR). It was carried out based on the PRISMA methodology as explained in [30]. This increases the reliability of this evaluation since it makes use of strict methodology techniques in order to avoid bias and identify trends and challenges in searching for literature.

The search encompassed peer-reviewed journal articles that were empirical in their approach, using a quantitative, qualitative, or multiple-design method. Articles were constrained by their publication date, which had to be between January 2020 and December 2025, and for the language, which had to be English or French. There was also a focus on banking, encompassing commercial banks, investment banks, central banks, and/or fintech institutions. The studies explored the link between banking innovation and digitalization outcome metrics. Cases that involved gray literature sources, editorials, opinion articles, review articles that concentrated on technological aspects rather than from an organizational perspective, pre-2020 literature sources, non-English/French sources with English/French being the languages used for research on digitalization despite the lack of emphasis on the driving forces of innovation, were excluded from the review. Systematic searches were conducted across two major academic databases:

- ✓ Scopus
- ✓ Science direct

Literature search strategies included controlled vocabulary combined with keyword combinations: ("bank" OR "financial institution" OR "fintech") AND ("digital*" OR "e-banking" OR "mobile banking") AND ("innovation" OR "technological change" OR "digital transformation"). Database-specific search strings were adapted to protocols according to platform. The systematic search retrieved 340 records. While screening for title and abstract, 78 articles were selected for full-text screening. Fifty-seven studies fulfilled the final inclusion criteria and were analyzed for qualitative synthesis. The PRISMA flow diagram represents the article selection process. <Figure 1>

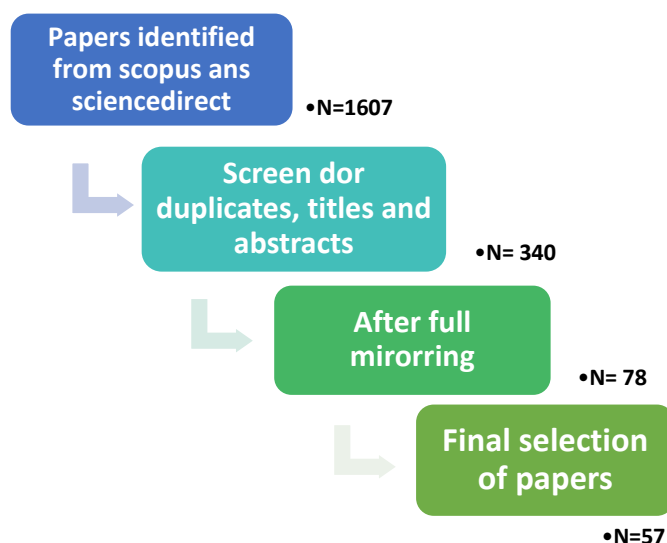


Figure 1 : SLR following PRISMA
Source: author's elaboration based on collected data

3. RESULTS

3.1. Types of Banking Innovation Identified

There were four categories of banking innovation leading to digitalization:

Starting by the technological innovation [54], which is the most widely researched typology in the existing studies on banking digitalization, encompassing a very wide range of digital technologies, that change the way financial organizations function and conduct business.

Technological innovation encompasses fintech [48], mobile banking solutions, artificial intelligence [46], blockchain technology [36] [47] and cloud computing. The dominant use of studies on technological innovation [24] is a result of the prominent position occupied by technology as a facilitator of digital transformations in organizations [29]. Studies show that there has been an evolution in the application of technology in payment solutions from basic payment processing functionality to the development of an ecosystem entailing real-time payments, international settlements and embedded financial services [18], [31]. Technological changes have thus entailed considerable investment in backend technology development and enhanced safety measures. Customer Relationship Management software applications have analogously developed from basic contact managers to intelligent solutions that utilize predictive analytics capabilities and the power of natural language processing for the purpose of personalized banking services [34],[45]. There is considerable number of literatures specifically focused on the role of mobile banking [27], being the principal enabler driver for digitalization. This concede that the development of the mobile platform can be understood not merely as the interface with the customer but as an organizational strategic. This strategy pushes the need for comprehensive investment in digital infrastructure. Banks that began with the development of the mobile app for serving customers [14] were set back by the realization that the usability of the mobile app for banking actually required radical changes in the organizational framework related to banking and the processing system. The second type is the organized innovation; it involves radical shifts in the way banks organize themselves and conduct business processes and service delivery processes in order to effectively cater to the customers [25]. Process re-engineering projects focus on reorganizing and restructuring the legacy processes that were typically designed and aligned for a branch model and transforming them according to online-centric models. This involves removing unnecessary steps in a process, automating manual processes, and aligning handoffs between online and offline processes [20]. The new service delivery models and processes involve a paradigm shift from product-oriented to a more customer-oriented business model [19] and process structure that revolves around customers and their service cycles and not organizational structures. Business model innovation [10] stood out as very important in the context of organizational innovation because it describes situations in which innovation itself becomes both output and enabler of digitalization. Digital-first organizational designs break down traditional hierarchical patterns with a focus on collaborative working in a networking manner with quick responsiveness [22]. Digital-first organizational designs also include smaller and self-contained teams that have the flexibility and freedom to make decisions without following a rigorous approval process. Based on this study, there is a clear result that organizations with digital-first designs have enhanced innovation speed and engagement of employees along with a better ability to recruit digital talents. The third type is Market-driven innovation, which corresponds to the innovation activities driven by external market. An important motivator, and the first one cited, corresponds to the competition from Fintech [7] and giant tech firms' entry into financial markets. New entrants are not constrained by existing systems and the culture of traditional banks and can rapidly implement innovation to reshape the speed and personalization of customer service [55], which traditional banks need to match by innovation and innovate new capabilities, respectively, according to research on banks' innovation activities and response to the competition threat through market-driven innovation [33]. As well as the adoption of Regtech technology [6] embodies a remarkable market-driven innovation area where the need to comply with the law. The Regtech technology utilizes automation and artificial intelligence to simplify the process of compliance and monitoring as well as minimize the risks involved in the regulation of money. Research shows [12], [28], [39] the way anti-money laundering technology, know-your-customer procedures, and regulatory reporting have benefited from Regtech technologies [5].

The study [51] makes it clear that the adoption of Regtech technology leads to system-wide digitalization, because this latter requires integration with other banking systems with the necessity of setting data formats and data governance. For the last type, represent Business Model Innovation of banks. The platform-based banks are the elemental of the shift away from the traditional pipeline business model [43]; where banks generate value through the provision of proprietary offerings using their own channels, towards the platform model; which generates value by enabling the interactions of multiple participants [4]. As platform banks, institutions orchestrate the financial ecosystem by linking users to third-party financial and non-financial service providers via open APIs and developer platforms [55]. Evidence confirms the ability of banks applying the platform-based approach to achieve scaled growth without corresponding growth in their own infrastructure and operational expenditures [41]. The best practices of successful platform adoption exist at every level, including platforms facilitating payment interactions for merchants and consumers and platforms facilitating lending by linking borrowers to various funding sources. The Open banking standards are business models that constitute significant changes to how banks think about their competitive boundaries [13] [41] [42]. Instead of fighting to maintain the secrecy associated with the customer base and their information, open banking models allow the bank to share the financial information provided by their customers with third-party service providers after the customers have granted the full permission for the action. It enables new participants within the market [21] to offer innovative services aimed at analyzing the financial services provided by the institution or push the payment services without the need for the customers to consult their banks. Studies have shown that for open banking models to be successful, banks must adopt new ways of thinking instead of fighting for market shares based on their analytical capabilities.

3.2. Digitalization outcomes

This part of the study shows the outcomes of digitalization, as dimensions, finding and results:

Outcome dimensions	Key findings	Quantitative Results	Authors
Operational Efficiency	Automation of routine processes, reduced manual interventions, streamlined workflows, and enhanced processing capabilities	• Cost reductions: 15-30% average • Processing time improvements: 20-60% across different <i>functions</i> • Automation rates: Significant reduction in manual tasks	- Bueno, L. C., Marques, A. C., & Fuinhas, J. A. (2024). - Alam, Y., Azizah, S. N., & Caroline, C. (2025). - Litvishko, O., et al. (2020). - Bapat, D. (2020).
Customer Experience Metrics	Enhanced digital accessibility, improved service quality, increased customer engagement, and higher satisfaction scores	• Digital adoption rates: 50-85% for digital banking services [32] • Net Promoter Score improvement: • Service availability: 24/7 access vs. limited branch hours	- Roy, S. K., Singh, G., Hope, M., Nguyen, B., & Harrigan, P. (2022). - Mbama, C. I., & Ezepeue, P. O. (2018). - Barjaktarović Rakočević, S., et al. (2025). - Chauhan, V., Yadav, R., & Choudhary, V. (2022). - Chan, R., Troshani, I., Rao Hill, S., & Hoffmann, A. (2022). - Ozili, P. K. (2021).

Financial Performance	Revenue diversification, improved cost-income ratios, enhanced profitability metrics, and sustainable competitive advantage	• Digital service annually revenue growth • Cost-income ratio improvements • ROA and ROE: Positive correlations with digital maturity • Profitability lag time: 18-36 months post-investment	- Nguyen-Thi-Huong, L., & Nguyen, T. L. A. (2023). - Abdurrahman, A., Gustomo, A., & Prasetio, E. A. (2024). - Bueno, L. C., Marques, A. C., & Fuinhas, J. A. (2024). - Setiawan, B., et al. (2024). - Arner, D. W., Buckley, R. P., Zetsche, D. A., & Veidt, R. (2020).
Risk management	Advanced fraud detection, real-time compliance monitoring, enhanced risk assessment capabilities, and reduced operational risk exposure	• Fraud detection accuracy improvement • False positive rate reductions • Real-time transaction monitoring by millisecond response times • Regulatory violation rate reductions • Multi-variable analysis: hundreds of parameters per transaction	- Alzoubi, H. M., et al. (2022). - Butler, T., & O'Brien, L. (2020). - Li, Y., et al. (2025). - Jindal, S., & Kumar, S. (2025). - Uddin, M. H., Mollah, S., Islam, N., & Ali, M. H. (2023).
Market Expansion	Geographic expansion through digital channels, enhanced market penetration, lower customer acquisition costs, and financial inclusion [38] advancement	• Digital customer acquisition costs: 40-60% lower than branch-based • National/international scope from inception for digital-only banks • Millions of previously unbanked populations now served • Market penetration in rural and dispersed geographies	- Ozili, P. K. (2021). - Lashitew, A. A., van Tulder, R., & Liasse, Y. (2019). - Chauhan, V., Yadav, R., & Choudhary, V. (2022). - Chan, R., Troshani, I., Rao Hill, S., & Hoffmann, A. (2022). - David-West, O., Iheanachor, N., & Kelikume, I. (2022).

Table 1 : Comprehensive Table about the outcomes of digitalization
Source: author's elaboration from various sources

4. CONCLUSION

This systematic review delivers strong evidence of the fact that digitalization is a profound banking innovation outcome in terms of technological, organizational, market-driven, and business model attributes. This relationship is multifaceted in nature, as innovations tend to lead the digitization process to operational, customer-focused, financial, and risk management [39] areas simultaneously. Nevertheless, this relationship is not absolute but highly influenced by the environment of regulation, capabilities, competitive markets, and quality of stakeholder interactions.

The results suggest that the problem of banking digitalization cannot be understood as a typical technology adoption issue but as a much more complex transformation involving simultaneous innovation in technology, organizational design, business models, and capacities. Future studies are needed to close the identified gaps in the literature related to equity issues, sustainability, and psychological variables and to examine new scenarios related to the organic consequences of innovation-driven banking digitalization.

ACKNOWLEDGEMENT: *We would like to express our sincere gratitude to the Varazdin Development & Entrepreneurship Agency and Faculty of Law, Economics and Social Sciences Sale for providing the institutional support and research environment that made this study possible. We are particularly grateful for the opportunities afforded to us throughout this research endeavor. This opportunity was supported by the cooperation research program between the Faculty of Management University of Warsaw, ENCGT - Ecole Nationale de Commerce et de Gestion de Tanger / Abdelmalek Essaadi University, Morocco, GOVCOPP, University of Aveiro, Portugal and Polytechnic of Medimurje in Cakovec. We acknowledge with appreciation the support and research framework provided by this partnership, which facilitates academic exchange and scientific cooperation between Morocco and the other countries. This international collaboration has been instrumental in enabling comprehensive research on inclusive green finance and its applications in emerging economies.*

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EVALUATING THE IMPACT OF AI-SUPPORTED AUTOMATION ON ONLINE GUEST REVIEW MANAGEMENT IN HOTELS

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ABSTRACT

Managing online guest reviews and responding to them in a timely and consistent manner has become one of the key operational and reputational processes in the hotel industry. With the continuous growth of online review platforms, hotels are faced with an increasing volume of guest feedback that requires prompt, appropriate, and brand-consistent responses. Traditional manual approaches to review management place a significant workload on employees, limit scalability, and often prevent systematic use of guest feedback as an input for managerial decision-making. This paper analyses the application of an AI-supported system designed to automate the management of online guest reviews in hotels, with the aim of assessing its contribution to business process efficiency and managerial decision-making support. The system enables automated generation of responses adapted to the rating and sentiment of guest reviews, autonomous decision-making regarding the publication of responses based on predefined tolerance thresholds, and the generation of structured analytical reports intended for hotel management. By integrating these functionalities, the system supports both operational activities and higher-level managerial processes related to online reputation management. The research is based on an applied evaluation of the implemented system in a real business environment. The analysis focuses on measuring employee time savings achieved through process automation and assessing their financial impact on hotel operations. In addition, the study examines the role of generated analytical reports in supporting managerial insight into guest feedback trends and operational issues. The results indicate a measurable increase in operational efficiency, a reduction in employee workload related to manual review handling, and improved availability of relevant information for managerial decision-making. These findings confirm that AI-supported automation of online guest review management represents an effective form of ICT support for business activities in hotels, contributing to both process optimization and enhanced managerial control.

Keywords: *Artificial intelligence, Business process automation, Online guest reviews, Hotel management, Managerial decision support*

1. INTRODUCTION

Online guest reviews have long become one of the most influential sources of information in the hotel industry, significantly shaping guests' perceptions, their booking decisions, and the overall reputation of hotels (Gabbard, 2023). Platforms such as Booking.com, Google Reviews, and TripAdvisor allow guests to publicly share their experiences, making guest feedback an important factor in determining a hotel's reputation.

For hotel management, reviews represent not only an indicator of service quality but also a valuable source of information that can contribute to the improvement of operational processes and support strategic decision-making. At the same time, the continuous growth of online review platforms has led to a significant increase in the volume of guest feedback that hotels must monitor and respond to. Timely and appropriate responses to guest reviews have become an important managerial practice because they demonstrate the hotel's willingness to communicate with guests, transparency in operations, and commitment to service quality. Previous research has shown that high-quality interaction with guest feedback positively influences user trust and the perception of hotel service quality (Salehi-Esfahani, Torres & Hua, 2023). However, managing this process manually often represents a significant operational burden for employees, especially in hotels that receive a large number of reviews daily across multiple online platforms. Traditional approaches to managing online reviews are most often based on the manual analysis of feedback and the individual preparation of responses by hotel employees. Such a process requires time, language adaptation, and careful formulation of the tone of each response to ensure it is appropriate to the content of the review. An additional challenge is that reviews are often written in different languages, which requires translation and additional language editing before responses can be published. Consequently, employees spend a considerable portion of their working time on repetitive and operational tasks (Kellogg, Valentine & Christin, 2021). This work process somewhat limits the possibility of systematically analysing guest feedback for managerial decision-making purposes. It also represents a certain financial cost for hotels when viewed from the perspective of employee working hours and labour costs. The development of artificial intelligence technologies in recent years has opened new opportunities for supporting such business processes (Kunz et al., 2025). AI-supported systems can assist in analysing large volumes of textual data (Feuerriegel et al., 2025), generating responses to reviews, and producing various analyses based on insights derived from guest feedback. In this context, the application of AI-supported automation represents a promising approach for improving the process of managing online guest reviews in hotels. By automating tasks such as response generation, review categorisation, and the creation of analytical reports, it is possible to reduce employee workload and enable faster and more consistent communication with guests. At the same time, the systematic analysis of reviews can provide hotel management with valuable insights into trends in guest satisfaction (Yang, Wu & Zhang, 2024), service quality, and potential operational issues. The aim of this paper is to analyse the application of an AI-supported system for automating the management of online guest reviews in hotels and to assess its contribution to the execution of business processes as well as its value for hotel management in making informed decisions based on generated analyses. The research is based on the evaluation of an implemented system in a real business environment, with particular emphasis on analysing employee time savings, assessing the financial effects of process automation, and examining the role of generated analytical reports in supporting managerial decision-making. In order to achieve the stated research objectives, the paper examines three key research questions related to the efficiency of review management processes, the role of AI-supported automation in managerial decision-making, and the types of managerial insights that can be obtained through the systematic analysis of online guest reviews. The rest of the paper is organized as follows; some related works on online guest reviews, reputation management in the hotel industry in Section 2. Section 3 presents the research methodology and the overall framework of the proposed system. Section 4 describes the structure of the AI-supported review management system and the technologies used. Section 5 presents the results of the system evaluation, with a focus on process efficiency, employee time savings, and the financial implications of automation. Finally, Section 6 concludes the paper and outlines recommendations for future research.

2. LITERATURE REVIEW

This section presents an overview of recent research related to the application of artificial intelligence in hospitality, the analysis of online hotel reviews, and decision support systems used in hotel management. Recent studies highlight broader implications of artificial intelligence adoption in the hospitality sector, particularly in relation to employment, sustainability, and strategic development of the industry. Martínez-Roget, Rodríguez and Pestana Mourão (2025) analyse how AI influences employment structures in hotels, showing that automation of routine tasks can increase operational efficiency while simultaneously affecting the demand for certain job roles. A comprehensive review conducted by Law et al. (2024) synthesizes existing research on artificial intelligence in hospitality and identifies key technological trends, including service automation, intelligent analytics, and personalized customer services. In addition, Filimonau et al. (2025) explore the potential of AI to support sustainability initiatives in hotels by optimizing resource usage and reducing environmental impact. Together, these studies demonstrate that artificial intelligence plays a significant role not only in improving operational performance but also in shaping future workforce structures and sustainable practices in the hospitality industry. It is an increasingly important component of modern hospitality management and service innovation. In the hospitality sector, online reviews of hotels serve as a crucial information source, profoundly shaping customer views and choices regarding reservations. For instance, Martín-Fuentes, Mellinas and Mateu (2024) explore shifts in Booking.com's hotel ratings, underscoring the impact of evolving review mechanisms and user assessments on platform-based hotel scores. Taking a customer-centric angle, Suwal and Neupane (2025) delve into how online reviews drive hotel booking choices, revealing that user-provided insights heavily sway levels of trust, service quality perceptions, and ultimate buying actions. Furthermore, Lunkes et al. (2025) examine the link between online feedback and hotels' digital accountability, illustrating how guest comments can foster advancements in ESG strategies and overall sustainability outcomes for hospitality entities. Collectively, these works underscore the escalating role of online reviews in guiding consumer behaviors as well as informing managerial tactics in the hotel field. Decision support systems play an increasingly important role in improving managerial decision-making and operational efficiency in the hospitality industry. Ćurlin and Jaković (2023) provide a systematic review and bibliometric analysis of decision support research in the hotel sector, highlighting the growing importance of data-driven approaches for strategic and operational management. Wang et al. (2024) propose a decision support system that incorporates online customer comments to improve hotel ranking models, demonstrating how user-generated content can enhance the accuracy and relevance of evaluation methods. Furthermore, Gultom, Mustofa and Tanaga (2026) analyse the role of artificial intelligence-based decision support systems in managerial decision-making, emphasizing their potential to support complex business decisions through advanced analytics and intelligent data processing. Together, these studies indicate that modern decision support systems are becoming a crucial technological tool for improving decision quality and competitiveness in the hospitality industry.

3. RESEARCH METHODOLOGY

This section presents the research approach, the data sources used, and the system evaluation criteria. Particular emphasis is placed on the empirical analysis of the system in a real-world business environment, enabling the assessment of its operational efficiency and applicability in the decision-making process.

3.1 Research Design and Approach

The study is structured as an applied evaluative case study, with the analysis conducted on a system implemented and actively used in a real-world business environment.

Such an approach enables the evaluation of system performance within the context of actual operational processes and business constraints. The evaluation is based on a quantitative analysis of operational efficiency and system applicability in the processing of customer reviews and support of business decision-making. For this purpose, a set of metrics is used to enable objective measurement of the system's impact. The evaluation is based on the following metrics:

- Response time (T_{response}) – average time required to generate a response to an individual review,
- Labor cost (C_{labor}) – calculated based on time expenditure and unit labor cost,
- Number of reviews processed per unit of time ($N_{\text{reviews/time}}$) – quantification of system productivity,
- Analysis time (T_{analysis}) – time required for data analysis and report generation.

All metrics are computed using automated system logging, supplemented by manual verification on a randomly selected sample of reviews to ensure measurement accuracy. Data are collected over a six-month period under normal operational conditions, with performance recorded before and after system implementation to enable comparative analysis.

3.2 Data Sources and Evaluation Criteria

The data used in this study were collected from a system implemented and actively used in a real-world business environment. The analysis was conducted on data generated during the system's daily operation, as well as on actual measurements of employees' work activities, ensuring the relevance and reliability of the results. The data sources used are categorized as follows:

- system logs, including records of user activities and measurements of the execution of specific system functionalities,
- time-based measurements of review processing, response generation, and automated responses based on rating levels,
- time-based measurements related to report generation (daily, weekly, and monthly).

All data were collected under normal operational conditions, without experimental interventions, thereby ensuring a realistic representation of system performance. The system evaluation was conducted based on previously defined metrics, with emphasis placed on the comparison of performance before and after system implementation. Such an approach enabled the quantification of the system's impact on operational efficiency and the optimization of business processes. Additionally, measurement accuracy was ensured through a combination of automated data collection via system logs and manual verification on a sample of selected records. For measurement purposes, the work of multiple hotel employees was monitored, with the time required for the complete review handling process being analyzed, including review reading, translation (where necessary), response generation, proofreading, approval procedures, and response publication on relevant platforms. The obtained measurement results were analytically mapped to multiple hotels with varying volumes of received guest reviews. Such an approach enabled the simulation of different operational scenarios, thereby providing additional insight into the economic effects of system implementation under diverse business conditions.

4. AI-SUPPORTED REVIEW MANAGEMENT SYSTEM

In contemporary hotel operations, managing online guest reviews presents a significant challenge due to the high volume of feedback and the need for timely and consistent responses.

An AI-supported review management system offers an innovative solution that automates the processes of collecting, analyzing, and responding to reviews, while simultaneously providing management with valuable insights for better business decision-making.

4.1 Overview of the Review Management System

The basic concept of the system development is based on the implementation of a service for automating business processes, with the aim of reducing managerial workload and improving work quality and operational efficiency. In the context of online review management, such an approach enables the optimization of time-consuming and repetitive activities related to the processing of user feedback. This creates the conditions for faster, more consistent, and higher-quality communication with guests, as well as for more effective utilization of available data in the business decision-making process. Figure 1. presents the architecture of the cloud-based Review Management System developed for hotel management. The system enables systematic collection and analysis of online guest reviews, automated generation of appropriate responses, and the creation of various analytical business reports. Designed as a scalable cloud solution, it provides easy access to multiple hotels irrespective of their geographical location. Business profiles from globally recognized online platforms, such as Google Business, Booking.com, and TripAdvisor, are integrated into the system. To support scalable and structured review management, an unlimited number of business units can be created and managed within the platform. Each business unit is configured to operate autonomously according to a defined hotel policy, which includes predefined parameters governing the monitoring, analysis, and management of review data. The system architecture is composed of multiple independent modules powered by artificial intelligence technologies, with particular emphasis placed on multi-agent approaches (Ning and Xie, 2024) and various large language models (Minaee et al., 2025). A multi-agent represents a set of interconnected and specialized agents designed to perform specific tasks within a complex process, where each agent has a clearly defined role and responsibility. Such an approach is typically based on the use of various LLMs, which enable agents to process natural language, make decisions, and collaborate with each other to efficiently solve tasks. The collection of data from hotel profiles is managed by the Communication agent. Hotel business profiles are accessed autonomously, and guest review data is recorded in the central database. Data collection is performed periodically, whereby, after each predefined time interval, connections to integrated hotel portals are systematically established.

Continuous operation is ensured, with the system monitoring for new guest reviews 24 hours a day. Data from newly published reviews are collected, processed, and adapted to meet user requirements. The processed data are subsequently stored in the central database. Through authorised access to the portals, the latest guest reviews are retrieved and processed to ensure that the data are appropriately formatted for further use. The system utilises two central databases. The first is a relational SQL database in which guest review data are stored together with all associated information about the object or hotel to which each review belongs. The second database is a vector database that is utilised by the system to support the Review multi-agent. This agent is responsible for generating responses to guest reviews and for adapting the tone and style of the responses to match the specific hotel policy. In addition to data collection, the Communication agent is tasked with sending replies to individual guest reviews through standard communication channels. It is also responsible for delivering information and notifications to hotel management regarding their duties or newly received reviews. For this purpose, a variety of communication channels are employed, ranging from email to push notifications on mobile devices.

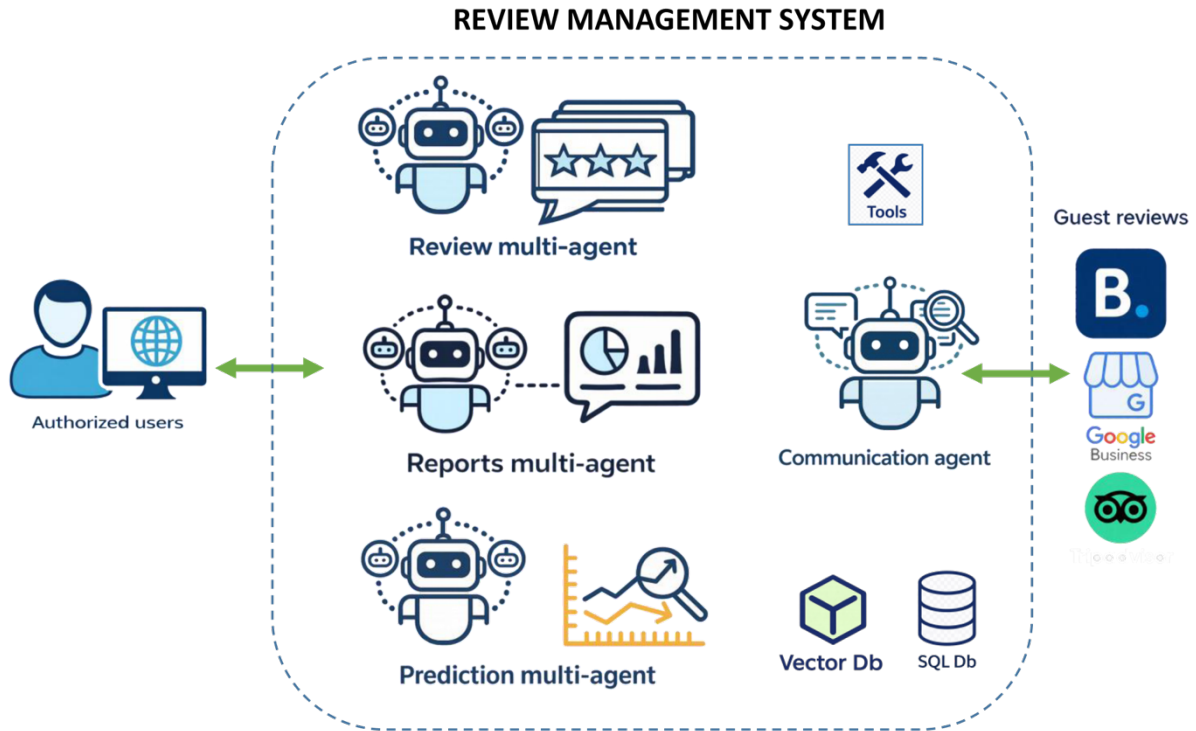


*Figure 1: The structure of the Review management system
(Source: Authors)*

The operation and efficiency of the Review Management System are based on the utilisation of various specialised multi-agents. The primary multi-agent in terms of importance is the Review multi-agent. The Review multi-agent is responsible for processing guest reviews and for generating a response to each individual review in a manner that fully complies with the hotel and object policy applicable to the specific review. Each guest review is analysed by the multi-agent, based on which a response is generated in the appropriate language, using the tone and style defined by the hotel and its official communication policy.

The second multi-agent utilised by the system is the Report multi-agent. Automatic generation of various types of reports for hotel management is performed by this agent. The generated reports may include different file formats and various attributes, depending on the nature and purpose of each report. These reports are based on the output of the Review multi-agent and its analysis of the received data. The third multi-agent utilised by the system is the Prediction multi-agent. This multi-agent is equally important within the overall system. The prediction of operational trends in hotels, as well as the forecasting of increases or decreases in the quality of a hotel or its individual objects, is performed by the Prediction multi-agent. The highest security measures are implemented throughout the entire Review Management System, which grants access exclusively to authorised users with different profiles. The level of data access and the possibility of editing hotel policies are determined by the user profile. In addition, communication and the transmission of data and information to authorised users are provided by the system through a specialised mobile application.

4.2 Review Multi-Agent Based Process Automation

The use of AI agents is aimed at automating specific business processes in order to accelerate and simplify daily operational tasks. By reducing the time required for manual activities, a more efficient allocation of employee working time can be achieved. Additionally, the automation of text generation minimizes the likelihood of human errors, while enabling the presentation of information across multiple interrelated dimensions. This contributes to providing hotel management with a more comprehensive and accurate understanding of the performance of individual business segments.

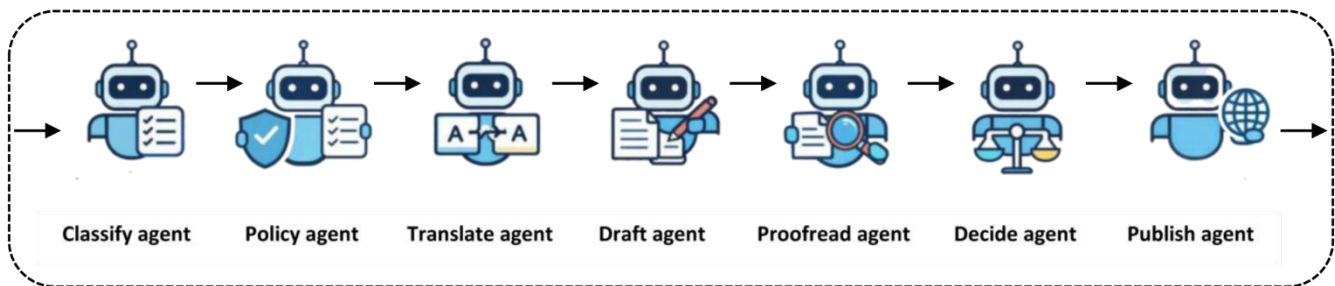


*Figure 2: The structure of the Review multi-agent
(Source: Authors)*

The automation of the review management process is implemented through a Review multi-agent approach, where multiple specialized agents collaboratively perform distinct tasks within the workflow. Each agent is responsible for a specific function, such as classification, translation, response generation, or decision-making, enabling a modular and scalable system design. Through coordinated interaction, these agents ensure efficient processing of guest reviews while maintaining consistency and quality of generated responses. This approach allows for a significant reduction in manual workload and improve the speed and reliability of review handling processes. Fig. 2 presents the architecture of the Review multi-agent and the internal sequence of specialised sub-agents together with their assigned tasks. The Review multi-agent is structured as a sequential workflow consisting of a series of specialised agents, each performing a clearly defined role in the review processing workflow. The first agent in the sequence is the Classify agent, which categorises incoming guest reviews according to predefined criteria such as satisfaction level, sentiment, and comment type. This classification enables subsequent processing steps to be adapted to the specific characteristics of each review. The next stage is performed by the Policy agent. This agent determines the appropriate handling rules for each review based on the hotel's predefined policy, including the required response style, level of formality, and specific communication guidelines. In addition, the language of the guest review is identified, and the most suitable large language models (LLMs) for response generation are selected in accordance with the hotel policy. The next agent in the sequential workflow is the Translate agent. Guest reviews are translated by this agent into the language preferred by the hotel, thereby ensuring complete understanding of the content regardless of the original language used by the guest. The translated text is additionally aligned with the hotel's specific rules and communication standards. Subsequently, the Draft agent generates an initial draft response, taking into account the previously defined hotel policy and the context of the review. A personalised greeting and the official hotel signature are automatically added to the generated response. The format and style of the signature are predefined in the object/hotel policy settings. Once the draft has been created, the Proofread Agent is activated. This agent performs a final review and linguistic refinement of the text to ensure grammatical correctness, stylistic consistency, and a fully professional level of communication.

In the final stages of the process, the Decide agent is utilized, by which a decision is made regarding the further handling of the generated response, specifically whether the response will be published automatically or forwarded for additional review by hotel management. This decision on automatic publication is determined based on the rating provided by the guest who submitted the review. Within the system, predefined automation thresholds are established, and if the normalized review rating falls within a specified range, the agent proceeds according to the defined rule. Finally, the Publish agent is responsible for publishing the response through the appropriate online platforms, thereby completing the entire review management process. Such an organization enables efficient process automation while maintaining a high level of control and communication quality.

5. SYSTEM EVALUATION AND RESULTS

The evaluation of the proposed artificial intelligence-based review management system was conducted in a real-world business environment of the hotel chain. The primary objective of this evaluation was to assess the system's impact on operational efficiency, response time, and overall process optimisation. The evaluation was based on a comparative analysis of system performance before and after implementation. Key performance indicators included the time required for review processing, response generation, and report creation, as well as the level of automation achieved in handling guest feedback.

5.1 Evaluation of review response time

For the purposes of this study, the time spent by hotel employees responsible for writing and publishing responses to guest reviews was measured. Manual response handling constitutes a multi-step process that includes reading the guest review, translating the text when written in a foreign language, analysing the rating and character of the review, drafting the response, reviewing the draft, submitting the text for approval, translating the final response in accordance with hotel policy, and recording the review for subsequent analysis. The system enables hotel management to independently define threshold values for automatic or manual publication of responses. Each guest review rating is normalised by the system to a unified scale ranging from 0 to 100. When the threshold for automatic publication is set close to 100, responses are generated and published automatically only for excellently rated reviews. All remaining, lower-rated reviews require manual processing. The experimental study was conducted in a hotel located in northern Croatia. During 2025, the hotel received a total of 1,369 guest reviews. When the normalised rating range is divided into five categories, the distribution of reviews is as follows: 20.19% of reviews received a rating of 5, 17.07% a rating of 4, 15.71% a rating of 3, 20.00% a rating of 2, and 24.44% a rating of 1.

For the purposes of the study, a manual measurement of the time spent by hotel employees on responding to guest reviews was conducted. The results showed that the average time required to publish a response to a single guest review is 9.4 minutes. Given the total number of reviews received, the employee responsible for publishing responses spent 12,868.6 minutes per year on this activity. When converted into hours, this amounts to 214.47 hours. Assuming an average number of monthly working hours for employees in similar positions, this corresponds to more than one full month of work dedicated exclusively to writing and publishing responses to guest reviews. In the hotel, the employee tasked with responding to guest reviews and coordinating the publication of responses had a net hourly rate of 8.5 €. The total net cost of this activity amounts to 1,823.11 €. Based on the application log records of the system's operation and response publication, a significant reduction in the time spent was recorded. The hotel's policy settings were configured to enable automatic responses for reviews rated 5 and 4. As a result, the number of reviews requiring manual response writing was reduced by 37.26 %.

Since the system prepared each response in a fully proofread form and in the appropriate language, hotel management was only required to perform final verification and minor corrections of the prepared response text. The employee spent an average of 4.3 minutes per response for sending the final reply. According to simple mathematical calculations, when the reduction in the number of reviews requiring manual responses and the automatic preparation of response texts are taken into account, the same employee spent 3,693.7 minutes on this task, which corresponds to 61.56 working hours. This represents a time reduction of 71.3 %, which constitutes an exceptionally large saving. When the financial component of labour costs is added, the overall savings for the hotel are substantial. It should be noted that these figures do not take into account additional benefits such as faster response times, improved timeliness of replies to guests, grammatical accuracy, appropriate tone of responses, and the possibility of automated report generation.

5.2 Evaluation of Management Efficiency and Analytical Reporting

The Review Management System enables the automatic generation of various analytical reports that provide hotel management with valuable insights into service quality trends and overall guest satisfaction. Through systematic analysis of guest reviews, key areas of business processes that require improvement can be clearly identified, particularly those related to recurring guest complaints and rating patterns. For the purposes of this study, the time required to manually prepare a weekly report — compiled by hotel management and submitted to higher-level decision-makers — was measured. The manual preparation of such a report involves a detailed analysis of all available review data, including the grouping and classification of reviews, numerical processing, and the final structuring of results into a coherent textual document. Interviews with hotel managers revealed that the preparation of a single weekly report requires approximately three hours. On an annual basis, this amounts to around 156 working hours. When compared to a standard eight-hour working day, this workload equates to nearly one full month of dedicated managerial time, clearly demonstrating a substantial allocation of managerial resources. In addition to weekly reports, the system supports the automatic generation of quarterly, semi-annual, and annual reports. When the time required for these additional reporting activities is taken into account, the overall workload becomes even more significant. This level of manual effort clearly underscores the need for process optimisation through automation and the application of modern technologies, which can substantially reduce time consumption while simultaneously improving the quality and accessibility of analytical insights.

6. CONCLUSION

In this study, the application of an AI-supported review management system in the hotel industry was examined, with the primary objective of evaluating its impact on operational efficiency and managerial decision-making. The results clearly demonstrate that the set objectives were successfully achieved through the implementation of the system. Significant reductions were recorded in the time required for review processing and response generation, as well as in the overall workload of employees. Repetitive tasks were effectively automated, which enabled a more efficient allocation of human resources and higher productivity. Furthermore, managerial performance was substantially enhanced by the provision of automated analytical reports. These reports allow systematic monitoring of guest satisfaction trends and early identification of operational issues. Consequently, a stronger information base for strategic decision-making is provided, which contributes to improved service quality and the hotel's competitive position. In addition to measurable time and cost savings, the speed and consistency of communication with guests were improved, while control over the hotel's online reputation was strengthened.

Although the study was conducted in a real business environment and therefore offers high practical relevance, its findings are limited to a single hotel chain. Future research should extend the evaluation to a broader range of hotel categories and sizes and should further develop advanced features such as sentiment analysis and adaptive learning. The integration of AI multi-agent technologies in online review management represents a significant step toward the digital transformation of hotel operations, delivering substantial improvements in efficiency, service quality, and managerial decision-making.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS: The authors used generative AI (ChatGPT) exclusively for language refinement, grammar correction, and improvement of readability and clarity of the manuscript. These tools were not used for generating scientific content, data analysis, interpretation of results, or forming research conclusions. The authors take full responsibility for the integrity of the research, the accuracy of all data and findings, and the overall scientific contribution of this work.

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AGILE PROJECT MANAGEMENT AS A DRIVER OF ORGANIZATIONAL RESILIENCE: A SYSTEMATIC LITERATURE REVIEW

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ABSTRACT

In a time marked by instability, uncertainty, complexity, and ambiguity, organizational resilience has become essential for businesses to survive and thrive. This systematic literature review looks at how Agile Project Management (APM) practices relate to organizational resilience. It combines findings from 67 peer-reviewed studies published between 2001 and 2025. Following PRISMA guidelines, the review identifies four main ways that APM helps build resilience: anticipatory capacity through ongoing environmental scanning and feedback loops; adaptive capacity through iterative planning and quick response skills; learning capacity through regular retrospectives and sharing knowledge; and collaborative capacity through teamwork and engaging stakeholders. The review shows that APM practices are especially effective in enhancing resilience when there is strong organizational culture, committed leadership, and the right technological support. However, factors like organizational size, industry context, and level of implementation also influence this relationship. This review adds to the literature on APM and organizational resilience by offering a framework that connects specific agile practices to resilience aspects. It also points out areas for future research, such as the need for long-term studies and exploring APM's role in ecological and sustainability changes.

Keywords: *Agile project management, Organizational resilience, adaptive capacity, Systematic literature review*

1. INTRODUCTION

The current business environment is marked by fast technological changes, global connections, and major disruptions that challenge traditional management methods (Bennett & Lemoine, 2014). The COVID-19 pandemic, supply chain issues, geopolitical conflicts, and escalating climate change have highlighted the need for organizational resilience, which includes the ability to anticipate, prepare for, respond to, and adjust to both gradual changes and sudden disruptions (International Organization for Standardization, 2017). In this volatile setting, organizations are looking for management methods that allow for flexibility, quick responses, and ongoing adjustments. Agile Project Management (APM) has become a leading approach that focuses on iterative development, collaboration with customers, and responsive planning (Beck, et al., 2001). Initially created for the software industry, agile methods have increasingly spread to various sectors, including manufacturing, healthcare, finance, and government (Rigby, et al., 2016). Supporters claim that agile practices naturally promote adaptability and resilience by allowing for quick changes, encouraging learning, and ensuring stakeholder alignment through regular feedback.

Although APM principles and resilience needs seem to fit well together, the actual relationship between these concepts is still unclear across different fields. The APM literature has typically concentrated on project-related results like delivery speed, quality, and customer satisfaction (Serrador & Pinto, 2015). In contrast, research on organizational resilience has looked at wider enterprise capabilities that often do not connect with specific management methods (Duchek, 2020). This lack of connection makes it difficult to understand theoretically and to provide practical guidance for organizations wanting to use agile methods for building resilience. This systematic literature review aims to bridge the gap between APM and organizational resilience literature by synthesizing existing evidence on how agile practices contribute to building resilient organizations. The review is guided by four research questions:

RQ1: What dimensions of organizational resilience are addressed by Agile Project Management practices?

RQ2: What are the mechanisms through which APM contributes to organizational resilience?

RQ3: What contextual factors moderate the relationship between APM adoption and organizational resilience?

RQ4: What gaps exist in current research and what future directions emerge?

2. THEORETICAL BACKGROUND

2.1. Organizational Resilience

The idea of resilience has changed a lot since it started in materials science and ecology. In organizations, resilience means both an outcome, the ability to recover from disruptions, and a process, the ongoing development of capabilities that help with adaptation (Linnenluecke, 2017). The International Organization for Standardization (International Organization for Standardization, 2017) defines organizational resilience as the ability to absorb and adjust in a changing environment, allowing the organization to meet its goals and continue to thrive. Duchek (2020) reviewed resilience literature and identified three main capabilities: anticipation, which is the ability to spot potential threats and opportunities before they become obvious; coping, the capacity to respond effectively during a crisis; and adaptation, the ability to learn from experiences and change organizational practices. Lengnick-Hall et al. (2011) expanded this framework by focusing on cognitive, behavioral, and contextual aspects of resilience. They argued that resilient organizations build unique knowledge structures, behavioral habits, and resource networks. Williams et al. (2017) differentiated between operational resilience, which is maintaining functionality during disruptions, and strategic resilience, which is the ability to change and succeed amid major environmental shifts. This distinction is especially important for understanding how APM contributes, as agile practices may impact these types of resilience differently. Recent studies have also highlighted the timing aspect of resilience, breaking it down into phases: preparation before disruptions, response during disruptions, and learning after disruptions (Hillmann & Guenther, 2021).

2.2. Agile Project Management

Agile Project Management came from the Agile Manifesto (Beck, et al., 2001). It outlined four main values: prioritizing individuals and interactions over processes and tools, focusing on working software instead of extensive documentation, encouraging customer collaboration rather than contract negotiation, and responding to change instead of sticking to a plan. These values were put into practice through twelve principles that stress iterative delivery, continuous improvement, and self-organizing teams. Agile includes various frameworks, such as Scrum, Kanban, Extreme Programming (XP), and newer methods like SAFe (Scaled Agile Framework), LeSS (Large-Scale Scrum), and Disciplined Agile (Conboy, 2009).

Although these frameworks have different practices, they share key features: short iterative cycles (sprints), regular feedback from stakeholders, empowered teams, and a process based on transparency, inspection, and adaptation (Schwaber & Sutherland, 2020). The use of Agile Project Management has grown significantly beyond its roots in software development (Nechouani & Machrafi, 2025). The 16th Annual State of Agile Report (Digital.ai, 2022) shows that 94% of organizations use agile in some form, with increasing implementation in marketing, human resources, finance, and operations. This growth raises questions about how agile principles apply in different contexts and their effects on resilience across organizations rather than just specific projects.

2.3. Theoretical Integration

Several theoretical perspectives inform the relationship between APM and resilience. Dynamic capabilities theory (Teece, Pisano, & Shuen, 1997) suggests that a competitive edge comes from an organization's ability to sense environmental changes, seize opportunities, and adjust resources. APM practices can be seen as operational routines that build and use these dynamic capabilities (Conforto, et al., 2016). The iterative nature of agile allows for continuous sensing through customer feedback. Sprint planning helps in seizing opportunities, while retrospectives support organizational change. Organizational learning theory provides another view, distinguishing between single-loop learning (correcting errors within existing frameworks) and double-loop learning (questioning and changing underlying assumptions) (Argyris & Schön, 1978). Agile retrospectives create reflection processes that can encourage both types of learning. However, the degree to which organizations achieve double-loop learning through agile practices varies greatly (Dingsøyr, et al., 2012). Complex adaptive systems theory offers a third perspective, seeing organizations as dynamic entities that evolve with their environments through emergent processes (Stacey, 1996). This view emphasizes how agile's focus on self-organizing teams and emergent planning aligns with adaptability in complex systems. Instead of trying to predict and control outcomes, agile methods welcome uncertainty and allow for flexible responses to changing conditions.

3. METHODOLOGY

This systematic literature review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page, et al., 2021) to ensure methodological rigor and transparency. The review protocol was developed prior to conducting searches and documented to enable replication.

3.1. Search Strategy

A detailed search was conducted across five academic databases: Scopus, Web of Science, Business Source Complete (EBSCO), IEEE Xplore, and ProQuest Dissertations & Theses. These databases were chosen to gather literature from management, information systems, and engineering fields where APM and resilience research is mostly published. The search strategy used Boolean operators to combine terms related to agile project management and organizational resilience. The main search string was: ("agile project management" OR "agile methodology" OR "scrum" OR "agile practices" OR "iterative development" OR "agile transformation") AND ("organizational resilience" OR "business resilience" OR "enterprise resilience" OR "adaptive capacity" OR "organizational agility" OR "crisis response" OR "business continuity" OR "turbulent environment" OR "VUCA"). The search was limited to peer-reviewed publications in English from 2001, the year of the Agile Manifesto, through December 2025.

3.2. Inclusion and Exclusion Criteria

Studies were included if they: (a) looked at Agile Project Management practices, frameworks, or principles; (b) focused on organizational-level results related to resilience, adaptability, or crisis response; (c) used empirical methods (quantitative, qualitative, or mixed); and (d) appeared in peer-reviewed journals or conference proceedings. Studies were excluded if they: (a) concentrated solely on project-level outcomes with no organizational implications; (b) studied resilience in non-organizational settings (like individual psychological resilience); or (c) were not available in English.

3.3. Selection Process and Quality Assessment

The selection process proceeded in three stages. First, titles and abstracts of 1,847 initially identified records were screened, resulting in 312 potentially relevant studies. Second, full-text assessment was conducted on these studies, with 67 meeting all inclusion criteria (Figure 1).

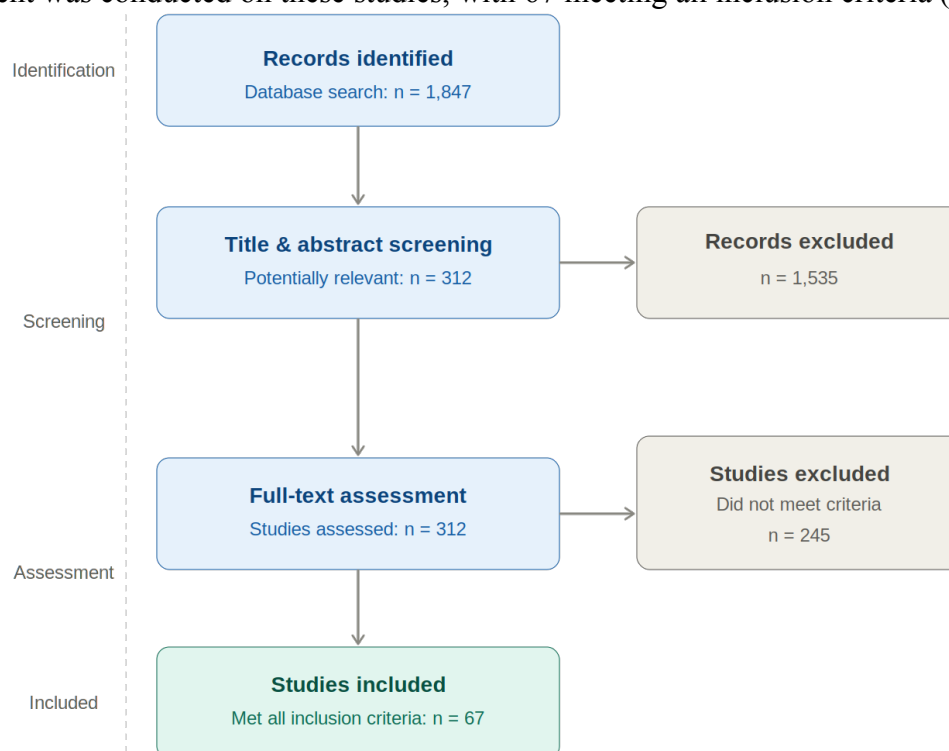


*Figure 1: PRISMA flow diagram
(Source: Author's own work)*

3.4. Data Extraction and Synthesis

Data were collected using a standard template that included bibliographic information, research methods, sample characteristics, APM practices examined, resilience dimensions or outcomes assessed, key findings, and study limitations. Due to the variety of research designs and outcomes, a narrative synthesis approach was used instead of meta-analysis (Popay, et al., 2006). Thematic analysis uncovered recurring patterns across studies, with themes continuously refined through constant comparison.

4. RESULTS

4.1. Overview of Included Studies

The final sample included 67 studies published between 2003 and 2025. There was a significant rise in publications after 2015, with 78% of the studies appearing in that period. The growth continued rapidly after 2020, with 41% of the studies published then (Figure 2). This trend shows an increasing interest in organizational resilience after the pandemic.

Most of the studies came from Europe (37%), North America (28%), Asia (21%), and other regions (14%) (Figure 3).

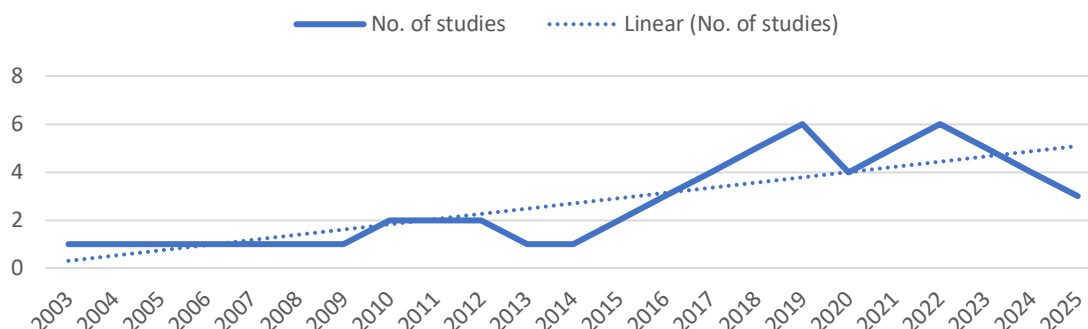


Figure 2: Publications' evolution from 2003 to 2025
(Source: Author's own work)

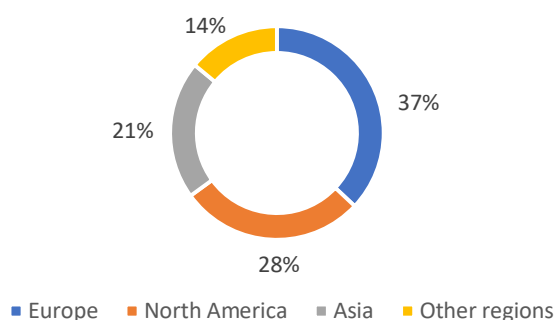


Figure 3: Publications' geographical distribution
(Source: Author's own work)

Methodologically, 34 studies used qualitative approaches, mostly case studies and interviews. Nineteen studies used quantitative methods, such as surveys and secondary data analysis. Fourteen studies applied mixed methods designs. The industry contexts varied widely: 31 studies focused on software and IT services, 12 on manufacturing, 8 on financial services, 6 on healthcare, and 10 on cross-industry samples. The sizes of organizations ranged from small and medium enterprises to large multinational corporations, with 23 studies specifically looking at SME contexts. Table 1 summarizes the distribution of studies across key dimensions.

Characteristic	Category	Number of Studies	Percentage
Methodology	Qualitative	34	50.7%
	Quantitative	19	28.4%
	Mixed Methods	14	20.9%
Discipline	Software/IT	31	46.3%
	Manufacturing	12	17.9%
	Financial Services	8	11.9%
	Healthcare	6	9.0%
	Cross-industry	10	14.9%
Organization Size	SME	23	34.3%
	Large Enterprise	28	41.8%
	Mixed/Not Specified	16	23.9%

Table 1: Publications' distribution per methodology discipline and organization size.
(Source: Author's own work)

The analysis of the 67 studies revealed four main themes related to different resilience dimensions influenced by APM practices: anticipatory capacity, adaptive capacity, learning capacity, and collaborative capacity. Additionally, a theme emerged about the contextual factors that affect the APM-resilience relationship.

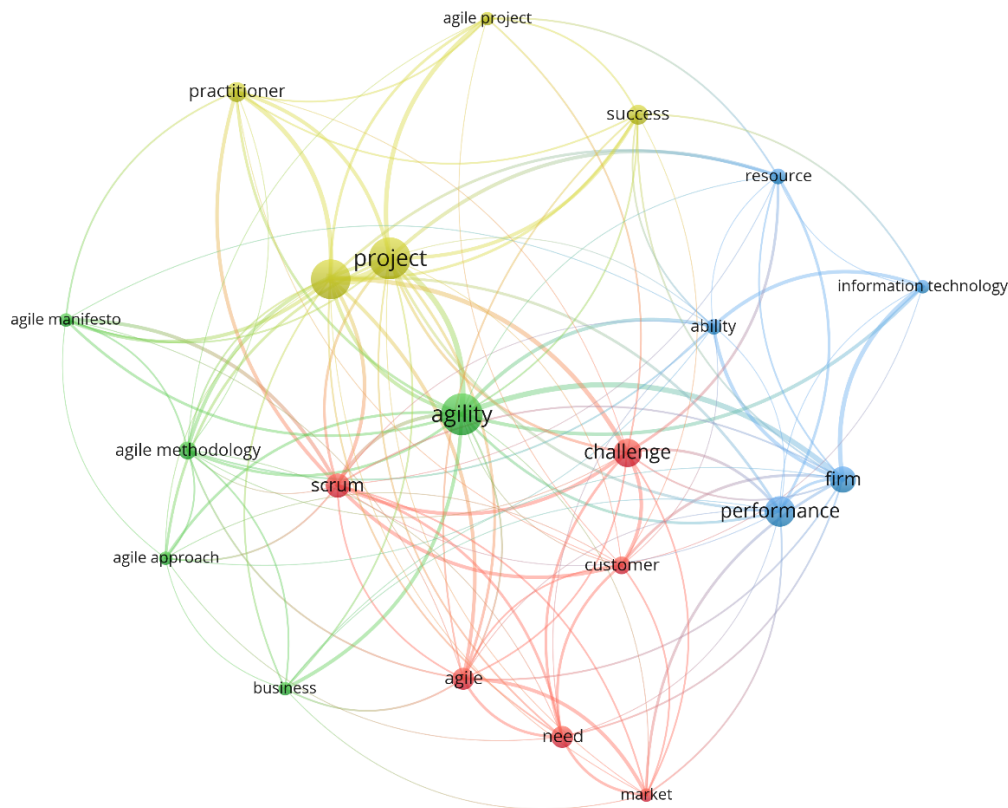


*Figure 4: VOSviewer keyword co-occurrence
(Source: Author's own work)*

A keyword co-occurrence analysis using VOSviewer identified four distinct thematic clusters among the 67 studies (Figure 4). The first cluster includes foundational project management terms (project, practitioner, agile manifesto). The second focuses on key methodological concepts (agility, scrum, agile methodology). The third cluster addresses organizational adoption and contextual challenges (agile, challenge, customer, market), while the fourth reflects firm-level strategic outcomes (performance, firm, resource, information technology). This last cluster is the most directly tied to the resilience outcomes discussed in this review. The positions of agility and project across clusters highlight their role in linking APM practice with organizational results.

4.2. APM and Anticipatory Capacity

Twenty-three studies looked at how APM practices improve an organization's ability to spot potential threats and opportunities before they fully develop. Three main mechanisms emerged from this research. First, the continuous feedback loops that come with agile practices, like sprint reviews, daily stand-ups, and regular customer interactions, create several channels for sensing the environment (Overby, et al., 2006). Kettunen (2009) found that organizations using Scrum detected market changes an average of 4.2 months earlier than similar organizations that relied on traditional project management. This early detection is due to the frequency and diversity of stakeholder interactions. Second, agile practices encourage a wider distribution of attention to environmental signals.

In contrast to traditional hierarchical structures that concentrate environmental scanning among senior leaders, agile teams engage directly with customers, spreading sensing abilities throughout the organization (Mikalsen, et al., 2018). Lee and Xia (2010) showed that this distributed attention significantly improved threat detection in unstable markets. Third, the transparency highlighted in agile, through tools like information radiators, burndown charts, and open communication, allows rapid sharing of signals across organizational boundaries (Stettina & Hörz, 2015). However, some studies pointed out that the benefits of being anticipatory rely on team members having enough contextual knowledge to correctly interpret signals. This suggests that agile sensing works best when paired with the development of domain expertise.

4.3. APM and Adaptive Capacity

The largest collection of evidence, consisting of 41 studies, focused on APM's role in adaptive capacity. This is the ability to change strategies, processes, and resources in response to shifting conditions. The iterative and time-limited nature of agile sprints became the main way to adapt. Nerur et al. (2005) argued that short cycles lower commitment to outdated plans. Frequent reprioritization of backlogs allows resource reallocation without the sunk-cost pressure found in traditional projects. There is considerable empirical support for this mechanism. Conforto et al. (2016) surveyed 471 organizations and discovered that adopting agile significantly predicted adaptive performance during industry disruptions. Qualitative studies illustrated this relationship well, for example, Bianchi et al. (2021) documented how a European manufacturing firm used sprint-based planning to shift production from automotive parts to ventilator components within three weeks of the pandemic's start. This transformation would have taken months using traditional planning methods. Studies also emphasized the importance of minimum viable products (MVPs) and incremental delivery in cutting adaptation costs. By delivering functionality in increments, agile organizations reduce the investment at stake at any time. This lowers the switching costs linked to strategic changes (Fitzgerald, et al., 2014). Rigby et al. (2020) estimated that organizations with strong agile practices made pivots at about 40% lower costs than comparison organizations.

4.4. APM and Learning Capacity

Thirty-one studies examined APM's role in learning capacity, which is the ability to gain insights from experience and incorporate them into organizational routines. The sprint retrospective emerged as the main practice that supports organizational learning. Retrospectives create dedicated time for teams to reflect on what worked well, what could be better, and what actions will be taken (Derby & Larsen, 2006). Dingsøyr et al. (2012) conducted longitudinal case studies of five organizations. They found that consistent retrospective practice led to measurable improvements in problem-solving speed. Teams became 28% faster on average and had 43% fewer repeated errors. However, the quality of learning varied greatly across different contexts. Organizations achieved deeper learning when retrospectives went beyond surface-level process improvements and questioned underlying assumptions. This deeper learning is what Argyris and Schön (1978) called double-loop learning. The diverse nature of agile teams also boosted learning capacity by allowing knowledge transfer across different areas of expertise (Bjørnson & Dingsøyr, 2008). When team members with various skills work closely together, tacit knowledge becomes easier to access, and new combinations of knowledge are more likely to surface. Still, studies pointed out potential downsides. Intense team focus could create knowledge silos, limiting organization-wide learning if there were no clear ways to share knowledge between teams. The fail-fast mentality encouraged by agile practices is another way to promote learning.

By supporting quick experiments and seeing failures as chances to learn rather than setbacks, agile cultures can speed up the organization's learning process (Edmondson, 2019). Thomke (2020) found that organizations with mature agile practices ran 2.3 times more experiments each year compared to traditional organizations. They traced 71% of successful innovations back to insights gained from failed experiments.

4.5. APM and Collaborative Capacity

Twenty-seven studies addressed collaborative capacity, which is the ability to coordinate well with internal and external stakeholders. Agile practices build this capacity through several means. The product owner role creates a clear link between development teams and customers. This ensures ongoing alignment between what the organization can do and what stakeholders need (Schwaber & Sutherland, 2020). Studies found that when this role is carried out effectively, it greatly improves stakeholder satisfaction and reduces rework due to misalignment (Sverrisdottir, et al., 2014). Self-organizing teams develop collaborative skills through daily coordination practices. The daily stand-up, although simple, fosters routine interaction that builds trust, establishes shared mental models, and allows for quick coordination (Stray, et al., 2016). Moe et al. (2010) showed that teams doing daily stand-ups achieved coordination efficiency similar to co-located teams, even when members were spread out geographically. At the organizational level, agile transformations often dismantle functional silos by reorganizing around cross-functional product teams. This restructuring can improve coordination across the organization, though studies pointed out significant change management challenges. Dikert et al. (2016) found that large-scale agile transformations took an average of 2.5 years to achieve stable cross-functional collaboration. Success depended on ongoing leadership commitment and investment in cultural change.

4.6. Contextual Moderators

The relationship between APM and resilience varies by context. Analysis identified several factors that influence this relationship. Organizational size was important. Small and medium-sized enterprises (SMEs) seemed to gain resilience benefits from APM faster than large companies. This is likely due to lower coordination costs and fewer legacy constraints (Lindvall, et al., 2004). However, larger organizations saw greater overall resilience gains when they effectively scaled agile practices. This suggests that there are advantages to increasing the scope of agile resilience-building (Paasivaara, et al., 2018). The industry context also played a role. Organizations in fast-paced industries such as technology, media, and professional services showed stronger APM-resilience links than those in more stable fields like utilities and government. This is consistent with contingency theory, which suggests that organic management approaches work better in uncertain situations (Burns & Stalker, 1961). Recent disruptions have increased uncertainty even in traditionally stable sectors, potentially broadening the relevance of agile resilience benefits. Leadership support was a key factor in success across different contexts.

Research consistently showed that the benefits of agile resilience decreased when leadership commitment was weak or inconsistent (Nerur, et al., 2005). Successful agile transformation required leaders to embody agile values, shield teams from bureaucratic hurdles, and invest in skill development instead of just enforcing the framework (Denning, 2018). Cultural factors also influenced the relationship. Organizations that fostered psychological safety, tolerated ambiguity, and encouraged collaboration achieved resilience benefits more quickly (Edmondson, 2019).

5. DISCUSSION

This systematic review examined evidence from 67 studies on the relationship between Agile Project Management and organizational resilience. The findings strongly support APM's role in enhancing resilience across various dimensions while highlighting important nuances and limitations. By combining different themes, this review offers a framework that connects APM practices to resilience outcomes through specific mechanisms. At its core, essential agile practices, iterative cycles, feedback loops, cross-functional teams, and empowered decision-making, trigger mechanisms such as distributed sensing, quick resource reallocation, regular reflection, and teamwork. These mechanisms foster four resilience capacities: anticipatory, adaptive, learning, and collaborative. Together, these capacities help organizations absorb disruptions and adjust to changes in their environment. The framework also acknowledges that these relationships vary based on factors like organizational size, industry trends, leadership commitment, and cultural fit. In addition, resilience capacities interact effectively: anticipatory capacity leads to quicker adaptive responses, learning capacity enhances future anticipation and adaptation, and collaborative capacity speeds up all other processes through effective stakeholder coordination.

6. CONCLUSION

This systematic literature review provides solid evidence that Agile Project Management practices significantly contribute to organizational resilience. By using distributed sensing, iterative adaptation, institutionalized learning, and improved collaboration, agile organizations build the ability to anticipate disruptions, respond effectively, learn from experiences, and work well with stakeholders. These findings are especially important as organizations face a more turbulent global environment, marked by technological disruption, pandemic aftershocks, and the need for ecological transition. However, the link between APM and resilience is not automatic or universal. To gain resilience benefits, organizations must genuinely commit to agile principles, have supportive leadership, a compatible culture, and be aware of the tensions between agile flexibility and strategic stability. They should view agile adoption as a complete transformation, not just as a specific project management method. Resilience grows from the interaction of practices, culture, and continuous learning. As the business environment changes in unpredictable ways, the ability to build and maintain organizational resilience will be crucial. This review suggests that when implemented thoughtfully, Agile Project Management can be an effective way to develop this essential capability, allowing organizations not just to survive disruptions but to thrive through adaptive evolution.

7. LIMITATIONS

This review has several limitations that should guide interpretation. First, publication bias may inflate positive findings because studies showing APM-resilience relationships are more likely to be published than those with null results. Including gray literature and unpublished studies might uncover less favorable evidence. Second, the dominance of software and IT industry studies (46%) limits how applicable these findings are to other sectors. More research in manufacturing, healthcare, and public sector contexts is needed. Third, the variety in methods, while providing rich perspectives, made it impossible to perform a meta-analysis. Effect sizes could not be reliably compared across studies that used different definitions of APM and resilience constructs. Fourth, causality remains unclear in correlational studies; organizations that already have resilience may be more likely to adopt and succeed with agile practices, rather than agile practices causing resilience improvements.

8. FUTURE RESEARCH DIRECTIONS

This review highlights several promising areas for future research. First, longitudinal studies that track how resilience develops during agile transformation journeys would improve our understanding of causal links and show how capabilities grow over time. How long does it take for resilience benefits to show up? Do these benefits last if agile practices stop? Second, comparative studies that look at resilience outcomes across agile, traditional, and hybrid project management methods in controlled settings would clarify the advantages of different approaches. Natural experiments from organizational changes or industry disruptions can provide chances for quasi-experimental designs. Third, research should create and test measurement tools specifically for assessing APM-related resilience. Current studies often use general resilience measures or proxy indicators that might not reflect agile-specific factors. Valid tools would support more rigorous quantitative research and comparisons among organizations. Fourth, studying APM's role in tackling ecological and sustainability issues presents a new area of research connected to the urgent need for ecological transition. How can agile practices help organizations adapt to climate change? Can iterative methods speed up sustainable innovation? Research linking APM to sustainability transitions would broaden its relevance to important societal challenges. Finally, cross-cultural studies that explore how national and organizational culture affects the APM-resilience relationship would improve the global applicability of findings. Most current evidence comes from Western organizational contexts. Researching agile resilience in different cultural environments would uncover boundary conditions and possible adjustments.

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INDUSTRY 4.0 COMPETENCIES: A PROPOSED TOOL FOR EVALUATION OF ENGINEERING FORMATION

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ABSTRACT

Industry 4.0 requires professionals prepared to operate in multidisciplinary environments that are innovative and constantly evolving. Hard skills and soft skills have been identified as equally decisive for employability and organizational sustainability. In developing countries such as Brazil, challenges related to technological infrastructure and curricular updating may generate gaps in engineering education, making it essential to systematically assess which competencies are being addressed and which remain neglected. This study aims to propose an evaluation tool for competencies related to Industry 4.0, designed to support the improvement of teaching processes and contribute to a training more aligned with contemporary demands. The construction of the tool was based on checklist developed by academic staff from the Engineering courses at the Federal Technological University of Paraná (UTFPR), Brazil, and an integrative review of studies found on Scielo and Google Scholar databases. The analysis allowed the identification of the most relevant competencies and their organization into a consensual new evaluation checklist. Then, each competency is scored from 1 to 5 according to the Likert Scale. The tool can be applied before and after educational programs or engineering courses, enabling comparison between the level of importance attributed by students to the competencies and the degree to which they are addressed during training, using the same 5-point scale. Comparative results are represented in a radar chart, highlighting gaps or formative advances between the two evaluation moments. Thus, the proposal is configured as a practical and replicable tool to measure the effectiveness of education in developing competencies for Industry 4.0. Furthermore, it provides relevant input for the restructuring of curricular content, helping to bring students formation closer to the current demands of the labor market.

Keywords: Competencies, Engineering, Evaluation, Industry 4.0, Students

1. INTRODUCTION

Industry 4.0 represents an important transformation in contemporary production systems, characterized by the integration of technologies such as cyber-physical systems (CPS), artificial intelligence (AI), the Internet of Things (IoT), big data and additive manufacturing.

This technological revolution redefines industrial processes but also the professional profiles required, demanding engineers capable of operating in complex, interdisciplinary and constantly evolving environments (Jorge et al., 2022). In this context, traditional engineering education, centered primarily on technical-scientific content, proves insufficient in meeting new demands. Technical and cognitive competencies, or hard skills, must be articulated with personal and social competencies, or soft skills, to ensure employability and organizational sustainability (Lima, Maduro & Lima, 2024; Miranda, 2022). Research revealed that the lack of soft skills such as communication, critical thinking, empathy and resilience tends to hinder the professional development of students and engineers, underscoring the urgency of implementing training programs and enhancing teaching practices (Kovaleski, 2019; Silva et al., 2020). Nevertheless, structural limitations, curricular fragmentation and pedagogical resistance may persist in academic environments, compromising the formation of engineers equipped with communication and negotiation skills, holistic perspectives and the ability to innovate, solve problems, adapt to technological advances and make decisions with confidence (Silva et al., 2020). Given these challenges, the aim of this study was to propose an accessible tool to evaluate the competencies essential to Industry 4.0. The proposed approach is to represent competency gaps by comparing the level of importance attributed by students with their perceived performance, thereby facilitating the identification of skills that require further development in engineering formation. Ultimately, this contributes to the continuous improvement of the teaching-learning process and the preparation of professionals aligned with labor market demands.

2. MATERIALS AND METHODS

The development of the assessment tool was conducted in four stages. The first one involved compiling the competencies required for professional practice in Industry 4.0, based on a competency checklist developed by the Human Resources Research Group at the Federal University of Technology - Paraná (UTFPR), Brazil, in collaboration with Brazilian and international universities, including Fundação Oswaldo Cruz (Fiocruz) Bio-Manguinhos, Brazil; Universidade Estadual de Ponta Grossa (UEPG), Brazil; Universidade Federal do Paraná (UFPR), Brazil; Universidade de Aveiro, Portugal; Universidad Nacional Arturo Jauretche (UNAJ), Argentina; Fachhochschule Dresden (FHD) – University of Applied Sciences, Germany; and Université de Technologie de Compiègne (UTC), France. This joint effort sought to integrate diverse academic and cultural perspectives in order to create a robust competency assessment instrument applicable to both academic and professional contexts (Fischer, 2024; Maruyama & Ito, 2025). The second stage consisted of an integrative review of Brazilian academic studies retrieved from Scielo and Google Scholar. The inclusion criteria were: (i) Period: 2016 to 2026; (ii) Type of study: research or case study and systematic review; (iii) Language: Portuguese or English; (iv) Target audience: engineering students; and (v) Description of competencies considered relevant in the context of Industry 4.0. The search query adopted was: ("Industry 4.0" OR "smart industry") AND (student OR graduation OR university OR education) AND engineering AND (competency OR skill). The third stage involved the cross-referencing of the most frequently cited competencies in the mapped studies with those described in the UTFPR checklist, in order to filter them into a preliminary matrix (new checklist). Similar competencies were clustered and categorized following the common terms adopted in the literature. Finally, the fourth stage consisted of constructing the competencies assessment tool, which functions as a visual map designed to facilitate the understanding of the breadth of essential competencies for Industry 4.0.

3. RESULTS AND DISCUSSION

3.1. Results of the mapping studies

Considering the methodological criteria established, nine Brazilian empirical studies were analyzed, one of which employed a mixed methodology (systematic review and empirical research) (Kovaleski, 2019), in addition to two systematic review studies with broad national and international coverage (Costa et al., 2024; Sousa, 2022). Tables 2 and 3 present the hard and soft skills cited and considered relevant.

	Hard skills	N	Authors
Technical	Digital literacy/ Specific software/ IT for operational routines	8	Costa et al. (2024); Kovaleski (2019); Sallati, Bertazzi & Schützer (2019); Silva & Olave (2020); Silva & Teixeira (2023); Silva, Viana & Vilela Jr. (2020); Soliani et al. (2025); Sousa (2022)
	Enabling technologies (IoT, AI, CPS, Robotics, Automation, Data analysis/ Big Data)	7	Costa et al. (2024); Kovaleski (2019); Sallati, Bertazzi & Schützer (2019); Silva & Teixeira (2022); Silva, Viana & Vilela Jr. (2020); Soliani et al. (2025); Sousa (2022)
	Basic notions of IT security	3	Costa et al. (2024); Kovaleski (2019); Sousa (2022)
	Human-machine interaction	2	Costa et al. (2024); Kovaleski (2019)
	Knowledge in mathematics, finance and accounting	2	Costa et al. (2024); Sallati, Bertazzi & Schützer (2019)
	Geometric design/ additive manufacturing	1	Silva & Teixeira (2022)
	Environmental management/ geoprocessing	1	Silva & Teixeira (2023)
	Technical writing	1	Kovaleski (2019)
	Knowledge of English	1	Costa et al. (2024)
	High qualification	1	Costa et al. (2024)
	Previous professional experience	1	Costa et al. (2024)
	Project management	1	Costa et al. (2024)
Methodological/ Cognitive	Problem-solving	5	Costa et al. (2024); Sallati, Bertazzi & Schützer (2019); Silva & Olave (2020); Silva & Teixeira (2023); Sousa (2022)
	Systemic/ holistic thinking	4	Kovaleski (2019); Silva & Olave (2020); Silva & Teixeira (2022); Soliani et al. (2025)
	Creativity	4	Costa et al. (2024); Sallati, Bertazzi & Schützer (2019); Silva, Viana & Vilela Jr. (2020); Sousa (2022)
	Interdisciplinarity	4	Costa et al. (2024); Kovaleski (2019); Silva & Teixeira (2022, 2023)
	Project-based learning (PBL)	3	Silva & Teixeira (2022); Silva, Viana & Vilela Jr. (2020); Soliani et al. (2025)
	Critical thinking	3	Costa et al. (2024); Kovaleski (2019); Sousa (2022)
	Logical reasoning	3	Costa et al. (2024); Kovaleski (2019); Sallati, Bertazzi & Schützer (2019)
	Applied research	1	Sallati, Bertazzi & Schützer (2019)
	Sustainable thinking	1	Sallati, Bertazzi & Schützer (2019)
	Flipped classroom/ STEAM/ Culture Maker	1	Silva, Viana & Vilela Jr. (2020)

*Table 2: Hard skills cited in the literature.
(Source: Authors, 2026)*

	Soft skills	N	Authors
Social	Communication	9	Costa et al. (2024); Fernandes, Rodrigues & Antunes (2023); Gruber et al. (2022); Kovaleski (2019); Sallati, Bertazzi & Schützer (2019); Silva & Olave (2020); Silva & Teixeira (2023); Soliani et al. (2025); Sousa (2022)
	Responsibility	8	Costa et al. (2024); Fernandes, Rodrigues & Antunes (2023); Gruber et al. (2022); Kovaleski (2019); Sallati, Bertazzi & Schützer (2019); Silva & Olave (2020); Silva & Teixeira (2022); Soliani et al. (2025)
	Teamwork	7	Costa et al. (2024); Fernandes, Rodrigues & Antunes (2023); Kovaleski (2019); Silva & Teixeira (2022); Silva, Viana & Vilela Jr. (2020); Soliani et al. (2025); Sousa (2022)
	Empathy	4	Fernandes, Rodrigues & Antunes (2023); Gruber et al. (2022); Silva & Teixeira (2023); Silva, Viana & Vilela Jr. (2020)
	Leadership	4	Costa et al. (2024); Kovaleski (2019); Sallati, Bertazzi & Schützer (2019); Sousa (2022)
	Active listening / Respect for opinions and differences	3	Costa et al. (2024); Fernandes, Rodrigues & Antunes (2023); Gruber et al. (2022)
	Intercultural skills	3	Costa et al. (2024); Kovaleski (2019); Sallati, Bertazzi & Schützer (2019)
	Interprofessional collaboration	2	Silva & Olave (2020); Silva & Teixeira (2023)
	Cooperation	1	Sallati, Bertazzi & Schützer (2019)
	People management	1	Costa et al. (2024)
	Professionalism	1	Costa et al. (2024)
	Integrity and work ethics	1	Costa et al. (2024)

Personal	Adaptability, flexibility and resilience	9	Costa et al. (2024); Fernandes, Rodrigues & Antunes (2023); Gruber et al. (2022); Kovalski (2019); Silva & Olave (2020); Silva & Teixeira (2022, 2023); Silva, Viana & Vilela Jr. (2020); Soliani et al. (2025)
	Autonomy	6	Sallati, Bertazzi & Schützer (2019); Silva & Olave (2020); Silva & Teixeira (2022, 2023); Silva, Viana & Vilela Jr. (2020); Soliani et al. (2025);
	Initiative	5	Fernandes, Rodrigues & Antunes (2023); Silva & Olave (2020); Silva & Teixeira (2022, 2023); Silva, Viana & Vilela Jr. (2020); Soliani et al. (2025)
	Self-confidence	4	Gruber et al. (2022); Silva & Teixeira (2022, 2023); Silva, Viana & Vilela Jr. (2020)
	Motivation	4	Costa et al. (2024); Sallati, Bertazzi & Schützer (2019); Silva, Viana & Vilela Jr. (2020); Soliani et al. (2025); Sousa (2022)
	Proactivity	3	Costa et al. (2024); Gruber et al. (2022); Soliani et al. (2025)
	Openness to change/innovation	3	Silva & Olave (2020); Silva & Teixeira (2022, 2023)
	Emotional control	3	Fernandes, Rodrigues & Antunes (2023); Gruber et al. (2022); Soliani et al. (2025)
	Organization / Commitment	2	Costa et al. (2024); Fernandes, Rodrigues & Antunes (2023)
	Self-awareness	2	Costa et al. (2024); Fernandes, Rodrigues & Antunes (2023)
	Curiosity	2	Costa et al. (2024); Silva & Teixeira (2023)
	Result-oriented focus	1	Costa et al. (2024)
	Continuous learning	1	Costa et al. (2024)
	Digital mindset	1	Costa et al. (2024)
	Positive attitude	1	Costa et al. (2024)
	Dealing with frustrations	1	Gruber et al. (2022)
	Reliability	1	Sallati, Bertazzi & Schützer (2019)
	Working under pressure	1	Sallati, Bertazzi & Schützer (2019)

Table 3: Soft skills cited in the literature.

(Source: Authors, 2026)

3.3. Data cross-referencing

In tables 2 and 3, competencies cited in up to two studies (shaded cells) were considered less relevant and therefore excluded from the cross-referencing with the UTFPR checklist. This selection criteria was adopted by Kovalski (2019) in the triangulation of data from a systematic review and research conducted with experts from five Brazilian universities (UTFPR, UFPR, UEPG, PUCPR and UP) as well as industry representatives (DAF Trucks, O Boticário, Klabin and Tetra Pak). Redundant, generic and non-cited competencies were also eliminated. No soft skills were excluded (Table 4).

Technical competencies
Knowledge in predictive and proactive maintenance
Knowledge of national and international standards and legislation
Knowledge in organization, planning and/or management
Knowledge of quality processes
General knowledge in economics and trade
Know-how related to specific work or processes
Professional qualification to work in Industry 4.0
Professional experience, curriculum and continuing education
Logical and mathematical knowledge
Methodological/ cognitive competencies
Cognitive ability

Table 4: Competencies excluded from the checklist after comparison with the literature.

(Source: Authors, 2026)

Subsequently, the competencies were clustered by similarity and aligned with the descriptions found in several studies (Araújo, Silva & Basante, 2022; Hecklau et al., 2016; Jorge et al., 2022; Sousa, 2022), serving as a matrix or new competency checklist (Table 5).

	Criteria (terms of reference)	Alignment with UTFPR checklist
	Hard skills	
Technical	Digital literacy/ Basic and specific softwares/ IT for operational routines	Basic literacy knowledge (IT) Knowledge in computer science and computational skills (software, hardware, programming)
	Enabling technologies (IoT, AI, CPS, Robotics, Automation, Data analysis / Big Data)	Ability to work with data storage, analysis, integration and modeling Comprehension and ability to develop tools to optimize stages of the production process Ability to model and calibrate human-machine interaction
	Basic notions of IT security	Risk and resource management
Methodological/ Cognitive	Holistic thinking	Holistic vision of knowledge integration and strategy Ability to understand, monitor and analyze multifactorial processes
	Logical reasoning	Rational and logical thinking
	Critical thinking	Holistic vision of knowledge integration and strategy Ability to understand, monitor and analyze multifactorial processes Rational and logical thinking
	Project-based learning (PBL)	Analytical ability Interdisciplinary skills* Research skills and investigative mindset
	Problem-solving	Analytical ability Interdisciplinary skills* Research skills and investigative mindset Creativity and innovation Creativity for solving uncommon problems Ability to solve complex problems
	Soft skills	
Social	Communication	Communication and interpersonal relationship skills Communication skills in another language Mediation skills in problem-solving processes Skills to reestablish commercial, political and/or entrepreneurial partnerships
	Responsibility	Ability to fulfill tasks and decisions from senior management
	Teamwork	Leadership and teamwork skills Ability to teach peers
	Empathy	Emotional intelligence
	Active listening and respect for differences	Professional ethics, tolerance for diversity and reliability
	Leadership	Leadership and teamwork skills Ability to teach peers
	Intercultural skills	Professional ethics, tolerance for diversity and reliability
Personal	Adaptability, flexibility and resilience	Adaptability in functions and work environments Ability to work with dynamic functions, tasks and emerging problems Ability to work under pressure* and in stressful conditions
	Autonomy	Self-management, self-organization and recovery from failures
	Proactivity	Proactivity, autonomy and initiative*
	Self-confidence	Self-management, self-organization and recovery from failures Proactivity, autonomy and initiative*
	Motivation	Motivation and positive attitudes for decision-making and problem-solving Openness* and motivation to learn and/or self-learning Spirit of perfection and pursuit of efficiency

Table 5: Cross-reference between competencies from the literature and the UTFPR checklist.
(Source: Authors, 2026)

Some soft skills appeared more than once due to their hybrid or transverse nature. The marked competencies (*) of UTFPR checklist (table 5) are among the most cited ones (Table 2 and 3), avoiding repetitions. Thus, the evaluation criteria (terms of reference) were defined.

3.4. Competency assessment tool for Industry 4.0

The assessment tool consists of a “mandala”, divided into hard and soft skills, which facilitates the organization of criteria (terms) and the visual interpretation of results. Each competency is evaluated in terms of importance for professional practice and the performance, considering what has been trained in the formation program. A score must be assigned according to a five-level Likert scale (Table 6).

Likert Scale	Importance	Performance
1	Not important	Very poor
2	Slightly important	Poor
3	Important	Fair
4	Very important	Good
5	Extremely important	Excellent

*Table 6: Levels of importance and performance of competencies.
(Source: Authors, 2026)*

The mandala was inspired by the studies of Hecklau et al. (2016) and Martschin et al. (2025), in which the closer the score is to the center, the better the competency rating in terms of importance or performance. Thus, the distances between both evaluations determine the gaps, facilitating the identification of competencies that require further development. Student scores can be collected through an online checklist based on table 6, with scoring levels organized in columns for marking. Microsoft Excel may be used to tabulate the collected data and generate an overall class overview, as well as its visual representation in the mandala.

This enables communication among students and faculty members or academic staff to plan improvement actions. For overall score of each competency, it is recommended to calculate the mean and standard deviation, as well as the median and mode values, in order to reduce bias because of the ordinal nature of the Likert scale. To ensure continuous improvement in student performance, it is suggested to adopt the lowest score, especially for deviation values higher than ± 0.8 (moderate or high dispersion) according to the maximum variability of ± 2.0 on this Likert scale (Table 7).

Personal Competencies / Performance (N = 120 students)				
	Adaptability, flexibility and resilience	Autonomy and self-organization	Self-confidence and initiative	Motivation (performance and learning)
Mode	3	5	2	4
Median	3.0	4.5	2.0	4.0
Mean $\pm$ SD	2.70 $\pm$ 0.45	4.30 $\pm$ 0.87	2.50 $\pm$ 0.45	3.90 $\pm$ 0.67
Final score	3	4	2	4

*Table 7: Simulated values of descriptive statistics and definition of the final score.
(Source: Authors, 2026)*

Once the final scores of importance and performance evaluations for all competencies are tabulated, the mandala is generated as a radar chart (Figures 1 and 2). To designate the competencies of the mandala, the same terms of table 5 were adopted, with some modifications in accordance with the UTFPR checklist. For example, *problem-solving* was supplemented with the term *creativity*, as it was repeatedly mentioned in the matrix (Table 6) and literature (Costa et al., 2024; Sallati, Bertazzi & Schützer, 2019; Sousa, 2022). Big data is an enabling technology, but it is analyzed separately in the mandala because it involves knowledge of statistics and data analysis for decision-making (Kovaleski, 2019).

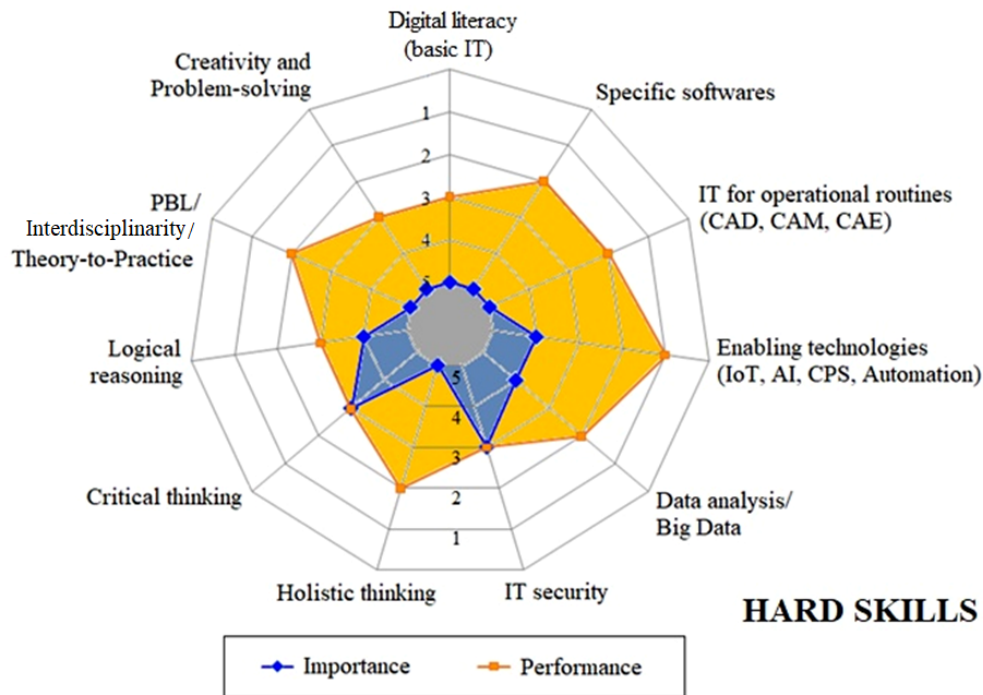


Figure 1: Hard skills mandala with simulated evaluations of importance and performance.
(Source: Authors, 2026)

The simulated results of the hard skills mandala (Figure 1) reveal considerable formative gaps in *enabling technologies*, the use of *specific software* and the application of *IT for operational routines*. The discrepancy between the high relevance attributed (scores 4 and 5) and the low perceived performance (scores 1 and 2) reinforces the need for greater curricular integration of these dimensions. Among cognitive competencies, *holistic thinking* emerges as highly valued in the simulation but insufficiently consolidated in practice, suggesting the need for teaching practices that foster the integration of knowledge. Silva et al. (2025) noted that although engineering students reported familiarity with technologies such as CAD, CAM, CAE, AI and automation, the formation of Industry 4.0 content remained fragmented and poorly integrated with market realities. Silva et al. (2020), in turn, identified incongruence between the Brazilian National Curriculum Guidelines (DCNs) and the demands of Industry 4.0, particularly regarding programming languages, data security and business knowledge for assertive decision-making. The gaps in *creativity and problem-solving* and *PBL/ interdisciplinarity/ theory-to-practice* further highlight the relevance of active methodologies, workshops and industrial simulations, as demonstrated by several studies that confirmed positive results in students performance when executing tasks (Lang et al., 2025; Sallati, Bertazzi & Schützer, 2019; Silva & Olave, 2020; Silva & Teixeira, 2022, 2023; Silva, Viana & Vilela Jr, 2020; Soliani et al., 2025).

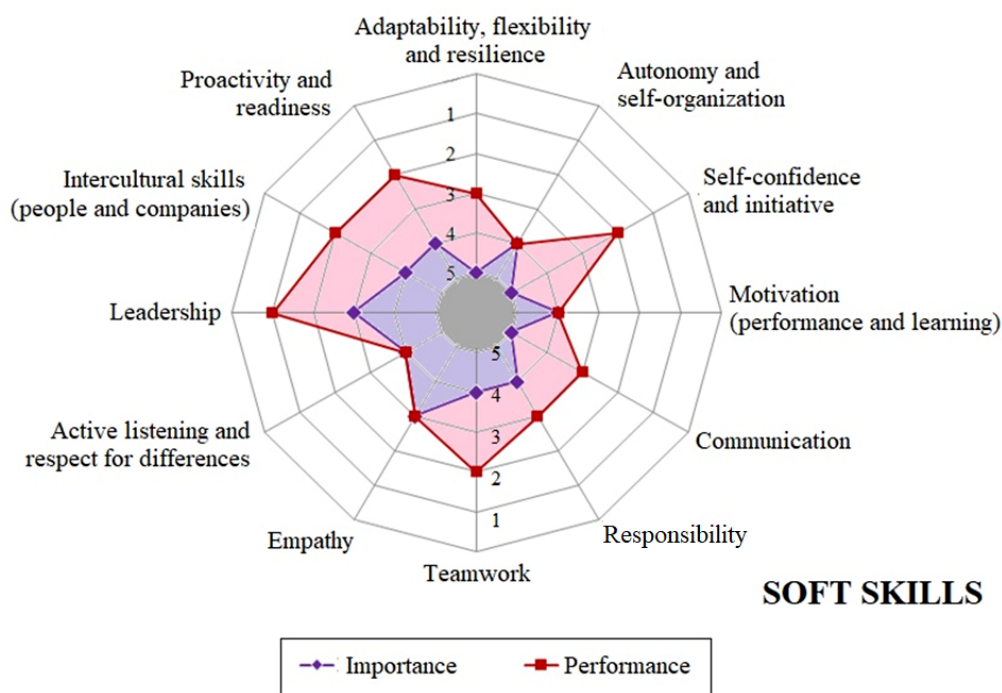


Figure 2: Soft skills mandala with simulated evaluations of importance and performance.
(Source: Authors, 2026)

Among the soft skills, *self-confidence and initiative* presented the largest gap in the simulation (Figure 2). *Adaptability, flexibility and resilience*, as well as *communication*, also warrant further exploration, as they are among the most frequently cited competencies in the literature (Table 3). Furthermore, Silva et al. (2020) emphasized the need for explicit inclusion of soft skills in the Brazilian National Curriculum Guidelines (DCNs), such as *flexibility and adaptability*, *emotional intelligence* and *critical thinking* to support decision-making and negotiation skills. The simulated findings also align with the literature highlighting the importance of soft skills for effective professional performance in contexts of constant transformation, which permeate Industry 4.0 (Costa et al., 2024; Sousa, 2022). Finally, it is important to acknowledge the interfering factors that compromise the consolidation of the analyzed competencies. These include the lack of materials and equipment for applied practice (Silva, Viana & Vilela Jr, 2020; Soliani et al., 2025), methodological gaps related to faculty members resistance to pedagogical innovation and student interaction (Fernandes, Rodrigues & Antunes, 2021; Silva & Olave, 2020), as well as curricular fragmentation and limited integration with the business and production sectors (Silva & Teixeira, 2022, 2023). In this regard, and based on the gaps identified in this simulated assessment, the tool proposed may also contribute indirectly to the identification of such structural, pedagogical and curricular fragilities, as well as to discuss possible improvement strategies to prepare engineers more effectively for labor market demands.

4. CONCLUSION

The developed mandala represents a practical and accessible instrument for evaluating essential competencies for Industry 4.0, at both individual and collective levels. Its construction resulted from the cross-referencing of a validated checklist from a Brazilian university with the scientific literature, thereby confirming its relevance and applicability. The graphical representation of competency gaps enables the immediate visual identification of areas requiring greater attention, creating conditions for dialogue among students and academic staff.

This process fosters reflection on the curricular content that needs to be revised or updated, the pedagogical approaches that should be adopted by faculty members and the strengthening of extracurricular activities and workshops. As practical recommendations for future studies, it is suggested the application of this tool at different stages of academic training, in order to optimize the alignment and interdisciplinarity of curricular content throughout the formation program. Furthermore, professors may use it as a self-assessment instrument, comparing their scores with those assigned by students and promoting open dialogue on possible adjustments to the teaching and learning process. The tool also demonstrates potential for application in companies, with the possibility of adaptations according to the specificities of different engineering subfields. This flexible character, particularly with regard to technical competencies, enables lifelong learning and the continuous improvement of work teams across diverse organizational contexts.

ACKNOWLEDGEMENT: *To professors of the UTFPR, Paraná, Brazil, for the support during the final review stage. To professor and researcher Fabíola Conceição Martins (ORCID: 0009-0008-2711-731X) for her collaboration in collecting articles, developing simulated graphs and translating this manuscript into English.*

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TRAPPED BY GREEN CLAIMS: PERCEPTIONS, TRUST, AND BEHAVIOURAL GAPS IN SUSTAINABLE CONSUMPTION - EVIDENCE FROM CROATIA

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ABSTRACT

This paper explores consumers' awareness of and reactions to greenwashing in the context of sustainable consumption. Using an online questionnaire as the primary research instrument, distributed via Facebook marketplace groups, data were collected from 54 respondents. The questions were formulated to capture familiarity with greenwashing, perceptions of misleading green claims, trust drivers, and responsibility attribution among stakeholders. Descriptive statistics and thematic analysis were applied to examine attitudes, perceived ability to detect greenwashing, and specific examples from everyday consumer experiences. The findings demonstrate that greenwashing is seen as a serious business ethics issue and emphasize the need for stricter institutional regulation. They also point out that individual engagement in checking green labels is relatively low and that self-assessed ability to recognize greenwashing is only moderate. Respondents place the greatest trust in eco-certificates, transparent production information, and company reputation, while expressing skepticism toward influencer marketing. The results highlight a persistent attitude-behaviour gap and underline the importance of education and multi-stakeholder collaboration in strengthening consumers' capacity to identify greenwashing and fostering a more authentic market for sustainable products.

Keywords: *greenwashing, sustainable consumption, consumer awareness, business ethics, environmental claims*

1. INTRODUCTION

The growing emphasis on corporate social responsibility and environmental accountability has driven an increase in green claims in marketing, leading to concerns about greenwashing-the practice of making misleading or deceptive environmental claims. The concept of greenwashing is relatively new. It was coined in 1986 by environmentalist Jay Westervelt and gained popularity only after the term “greenwashing” was introduced in a 1996 book on environmental marketing (Yang et al., 2020). Over the past three decades, interest in greenwashing has continuously risen, in both academia and the public arena (Persakis et al., 2025). Greenwashing is a marketing message that aims to create a positive, environmentally friendly image of a company and its products or services among recipients, while claiming they meet stakeholders' sustainability needs without taking specific actions (Zioło et al., 2024). The definitional scope of the concept is broad, encompassing various approaches to greenwashing. Lyon and Maxwell (2011, p. 9) considered greenwashing as a “selective disclosure of positive information about a company's environmental or social performance without full disclosure of negative information on these dimensions, so as to create an overly positive corporate image”. Parguel et al. (2011, p. 15) defined it as “the act of misleading consumers regarding the environmental practices of a company or the environmental benefits of a product or service”. Delmas and Burbano (2011, p. 65) described greenwashing as a “poor environmental performance and positive communication about environmental performance.” Other definitions highlight the distinction between “symbolic” and “substantive”.

For example, Walker and Wan (2012, p. 231) define greenwashing as “symbolic information emanating from within an organization without substantive actions,” whereas Bowen and Aragon-Correa (2014, p. 3) describe it as “a specific subset of symbolic corporate environmentalism in which the changes are both ‘merely symbolic’ and deliberately so”. These superficial actions allow companies to project a green image, such as by using eco-friendly packaging, while continuing to engage in environmentally harmful behavior (Andreoli et al., 2017). Clearly, earlier definitions emphasized aspects such as information disclosure, where information was selective and deliberately misleading, presented in a way that benefited companies at the expense of customers and other stakeholders. To this day, conceptualizing greenwashing as misleading information or disinformation created to shape the public perception of a company’s environmental performance remains the dominant definitional approach (Persakis et al., 2025). De Freitas Netto et al. (2020) define greenwashing as misleading consumers about an organization’s environmental practices or a product’s (service’s) environmental benefits. Aronczyk et al. (2024) analyze greenwashing as the strategic use of deceptive information, where companies often spread selective or exaggerated claims to influence consumer perceptions. Bingaman et al. (2022) highlight that greenwashing is a systematic strategy used by companies to mislead consumers about their sustainability initiatives, which may breach ethical standards of corporate transparency. According to these definitions, greenwashing isn't just harmless exaggeration; it's a deliberate strategy to influence public trust, raising major ethical questions about how companies present their environmental initiatives. Greenwashing is a complex phenomenon that can occur either at the corporate level (i.e., when an organization is misleading or deceptive about its environmental practices) or at the product/service level (i.e., when it is misleading or deceptive about the environmental benefits of a product or service) (Santos et al., 2022). Therefore, greenwashing can affect various stakeholders differently (Torelli et al., 2020). The most directly affected stakeholders are the customers. Greenwashing influences consumer perceptions and purchase intentions (Chen et al., 2020; Guerreiro & Pacheco, 2021; Nguyen et al., 2019; Wang et al., 2020). Additionally, greenwashing prevents consumers from making informed purchase decisions by creating confusion and reducing their willingness to pay for greenwashed products, thereby contributing to skepticism and the erosion of green trust (Santos et al., 2022). Greenwashing, defined as the deceptive practice of conveying an exaggerated or false impression of environmental responsibility, undermines genuine sustainability efforts and creates distrust among consumers and stakeholders (Persakis et al., 2025, p. 958). Greenwashing has been extensively studied in developed countries (Wang et al., 2023), but in the transition context, its manifestations and effects remain poorly investigated. This is especially important because cultural and regional factors may significantly influence how consumers react to greenwashing (Zhang et al., 2022). Therefore, this paper aims to answer a single research question: How do consumers perceive greenwashing, what are the safeguards of green trust, and how do consumers react to greenwashing practices in Croatia?

2. RESEARCH METHODOLOGY

To address the research question on consumers’ familiarity with and attitudes toward greenwashing, an empirical study was conducted using an online questionnaire. The research instrument was designed to capture the perception of green advertising, which is often used as a deceptive tactic to influence consumer beliefs. The questionnaire consisted of 17 questions: 16 closed-ended and one open-ended, divided into two sections. The first section collected general information about participants, while the second section explored different aspects of greenwashing. For the items used in this research, a 5-point Likert scale was applied.

The convenience sampling method was used, and the questionnaire was distributed via Facebook shopping (marketplace) groups. In total, 54 participants fulfilled the online questionnaire from July to August 2025. The descriptive analysis of the collected quantitative data was performed using SPSS, while the thematic analysis of qualitative data was conducted using NVivo software. A descriptive analysis of the sample shows that 56% of respondents were female and 44% were male. Based on age, 11% of the sample are young adults (18-25 years old), and the largest proportion of the sample consists of respondents aged 26-34 (72%). Only 9% of the sample is over 50 years old, and an additional 8% accounts for those aged 35-49. Over half of respondents (54%) hold a university graduate diploma, while 28% hold a university undergraduate/college diploma. 17% of the respondents have a secondary education level, and only 1 respondent (2%) has a primary education level. Regarding familiarity with greenwashing, nearly half of the respondents (48%) are unfamiliar with the concept, while 41% are well informed. However, 11% of respondents are unsure if they understand what greenwashing is. The respondents were asked to rate their understanding of greenwashing on a scale from 1 to 5, where 1 means "I don't understand it at all" and 5 means "I understand it completely." The largest proportion of respondents (39%) reported moderate understanding (3). 20% of the sample self-assessed their understanding as very good (4), and an additional 11% rated it excellent. 15% of the sample rated their understanding as insufficient (1), and an equal proportion (15%) rated it as barely sufficient (2).

3. RESEARCH RESULTS

The perceptions of different aspects of greenwashing were examined, as shown in Table 1. For the items, a Likert scale was used, ranging from 1 - strongly disagree to 5 - strongly agree. The results show that over half of the sample (51,85%) agrees or strongly agrees that many brands advertise their products as green, ecological, or eco-friendly in a misleading way. The mean value (3.52) suggests that, in the sample, there is a moderately high level of skepticism regarding advertising practices. The respondents found it very difficult to distinguish authentic sustainable products from those merely advertised as such (79,63% agree or strongly agree). The mean value (3.96) indicates a high level of confusion about authentic green and sustainable products, highlighting a lack of clarity and transparency needed to make clear distinctions. The results show that nearly two-thirds of the sample (70,38%) perceive greenwashing as a serious business ethics issue. The mean value (3.96) indicates that respondents are highly critical of greenwashing practices and recognize their harmful potential not only in misleading customers but also within a broader social and ecological context. A smaller proportion of respondents are either ambivalent or skeptical about the issue, but the overall distribution of results indicates that greenwashing demands serious attention and regulation. In the research sample, there is a strong belief that institutional regulation of green advertising should be more stringent (Mean=4.30) to prevent manipulation and the deceptive and misleading practices associated with green marketing. Consumers expect a proactive role for public institutions in setting the "rules of the game": clear regulations, criteria, and sanctions for false advertising. Although 17% of respondents are neutral on this issue, the near-complete lack of disagreement points to consensus on the importance of a systemic institutional approach: a regulatory approach to consumer rights protection and the promotion of sustainable practices. Paying attention to green and ecological claims is an important aspect of sustainable consumption. The results suggest that respondents are not sufficiently engaged in this regard (Mean=2.87), indicating somewhat weaker active evaluation of green claims in everyday consumer decisions. This is especially relevant in the context of the results presented above, where respondents recognized problems related to greenwashing and the need for stricter institutional oversight. The discrepancy between awareness of greenwashing and actual consumer behavior is evident.

This gap might be due to several factors: lack of time or interest in research, distrust of green labels, confusing terminology, or feeling incompetent when handling complex information. This emphasizes the need not only for education and regulation but also for clear, easily recognizable labels to simplify decision-making.

Item	Level of agreement	Frequency	Percent	Mean
Many brands make false green claims	1	0	0,00	3,52
	2	4	7,41	
	3	22	40,74	
	4	24	44,44	
	5	4	7,41	
	Total	54	100,00	
It is difficult to distinguish authentic sustainable products from those only advertised as such	1	0	0,00	3,96
	2	4	7,41	
	3	7	12,96	
	4	30	55,56	
	5	13	24,07	
	Total	54	100,00	
Greenwashing is a serious business ethics issue	1	1	1,85	3,96
	2	3	5,56	
	3	12	22,22	
	4	19	35,19	
	5	19	35,19	
	Total	54	100,00	
Governmental regulation of green advertising should be more strict	1	1	1,85	4,30
	2	0	0,00	
	3	9	16,67	
	4	16	29,63	
	5	28	51,85	
	Total	54	100,00	
I pay attention to green claims/labels when shopping	1	3	5,56	2,87
	2	20	37,04	
	3	17	31,48	
	4	9	16,67	
	5	5	9,26	
	Total	54	100,00	

*Table 1: Perceptions of greenwashing aspects
(Source: Research, N=57)*

Next, the prior experience with possibly false green claims was examined. As shown in Chart 1, 57% of respondents have purchased at least one green product whose authenticity was doubted. On the other hand, 19% of respondents say they're unsure about this specific experience, which could indicate an unconscious greenwashing effect. These results suggest that greenwashing as a strategy could be very effective, but unfortunately, it comes at the expense of the customers. More than half of respondents have already experienced doubts about green advertising, underscoring the need for stronger regulation and transparency.

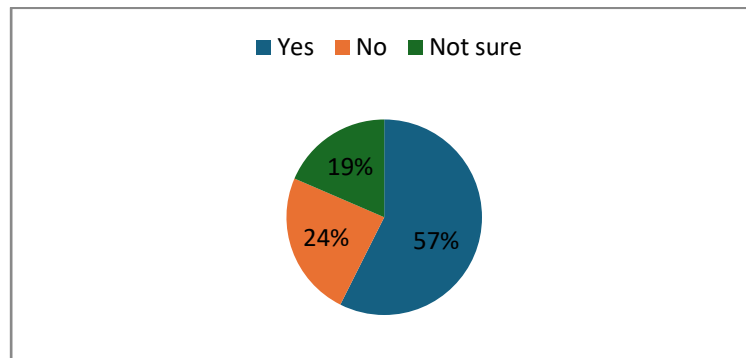


*Chart 1: Previous experience with possibly false green claims
(Source: Research, N=57)*

Most respondents (69%) are willing to pay a premium for sustainable and green products, indicating a positive trend in customer perceptions of sustainability. This suggests that most participants view sustainability as a genuine value rather than a marketing ploy. These findings demonstrate a strong level of ecological awareness, pointing to real potential for building a market rooted in transparency and accountability.

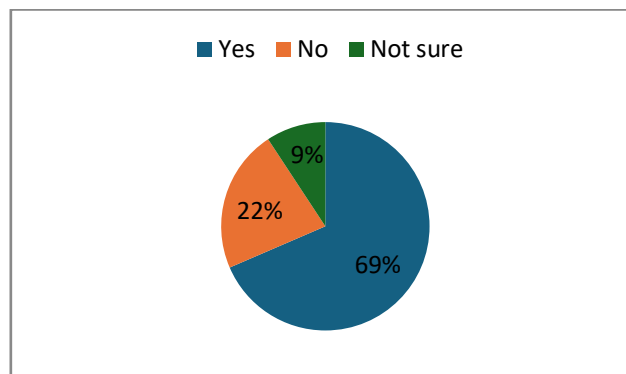


*Chart 2: Willingness to pay a premium for authentic green/sustainable products
(Source: Research, N=57)*

As the number of products with green labels grows, understanding the drivers of trust building becomes essential. The factors customers consider when evaluating the trustworthiness of green and ecological claims are shown in Chart 3. From the participants' point of view, the most important factors are eco certificates and labels, followed by clear information about the production process and the company's reputation.

Recommendations from influencers and celebrities are the least important factor, indicating a strong skepticism toward social media advertising content. Interestingly, price and availability are considered somewhat unimportant, suggesting that ecologically engaged customers prioritize quality and trustworthiness over commercial considerations.

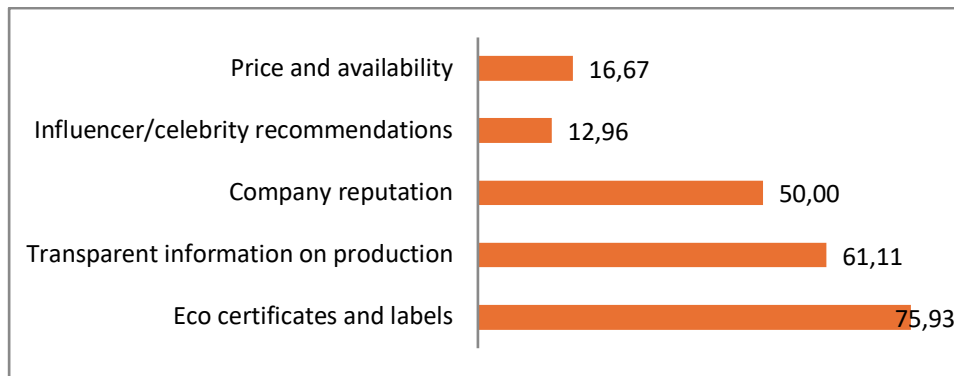


*Chart 3: Factors that foster trust in sustainable and green products
(Source: Research, N=57)*

These results suggest that participants are largely focused on measurable, verifiable factors, making them empowered customers who don't fall for marketing tricks and demand concrete evidence of sustainability.

The growing prevalence of greenwashing practices demands a clear answer to whether customers can reliably recognize it. The results are given in Table 2.

	Level of agreement	Frequency	Percent	Average
I can without doubt detect greenwashing	1	3	5,56	Mean=3,24
	2	17	31,48	
	3	19	35,19	
	4	14	25,93	
	5	5	9,26	
	Total	54	100,00	

*Table 2: Ability to detect greenwashing
(Source: Research, N=57)*

37,04% of the respondents expressed serious doubts about their ability to detect greenwashing. Along with 35,19% of respondents who are neutral (neither agree nor disagree) towards the issue, this indicates a need for education to improve their ability to detect greenwashing.

Greenwashing practices create major barriers to sustainable consumption by misleading consumers about a product's or brand's actual ecological worth. In this context, educating customers is a crucial tool for recognizing and addressing these practices. Respondents are aware of this, as shown in Chart 4: 74% view education as a crucial tool for combating greenwashing.

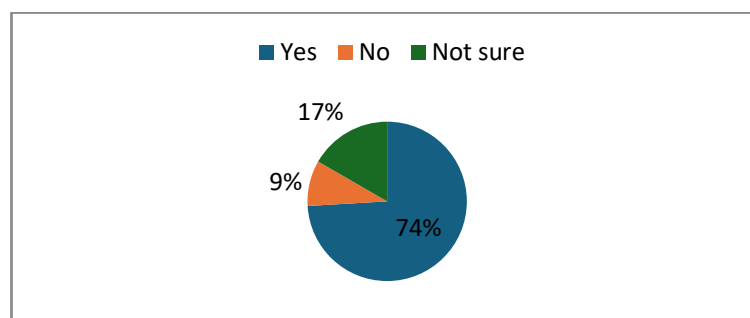


*Chart 4: Perceptions of the importance of education in eliminating greenwashing
(Source: Research, N=57)*

Combating greenwashing requires a systemic approach and cooperation among various stakeholders. Still, the role of different stakeholders remains unclear. The results shown in Chart 5 clearly indicate that the main belief is that fighting greenwashing requires collective responsibility from all stakeholders – the government, companies, consumers, and NGOs (41%). Although the roles of customers and organizations (companies and NGOs) are recognized, they are insufficient to effectively eliminate greenwashing, in respondents' view, without institutional support.

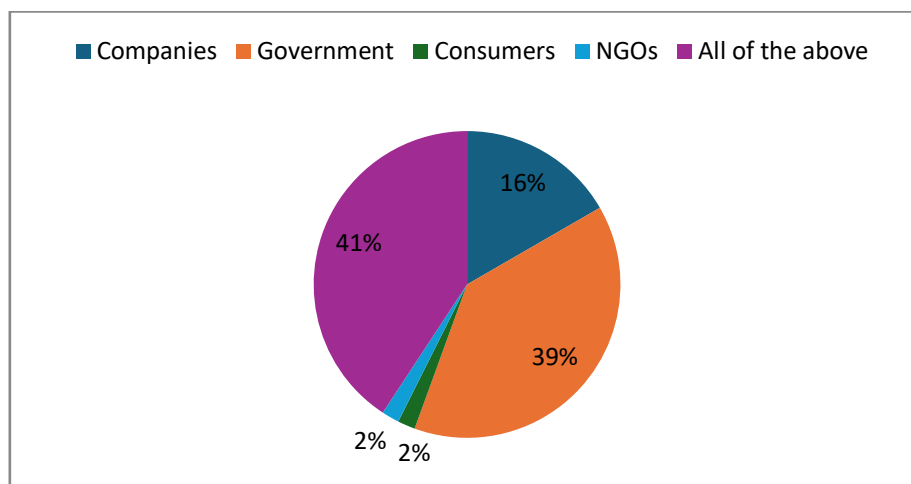


*Chart 5: Perceptions of responsibility/accountability allocation between the stakeholders
(Source: Research, N=57)*

Finally, the last, open-ended question allowed respondents to share personal experiences and views about greenwashing. Different examples from everyday life were shared that can be classified into several themes:

1. Products with false green/ecological claims
 - Bioplastics and biodegradable bags-respondents are expressing doubts about whether these products are truly eco-friendly.
 - Detergents, shampoos, and cosmetics-“green packaging” often lack solid certification support.
 - Persil, Coca-Cola, and Nestlé-these brands were seen as impostors: seemingly strong supporters of green initiatives but frequently criticized for polluting and greenwashing in practice.
2. Fashion
 - Clothing - respondents questioned the “eco-collections” offered by fast fashion brands.
3. Energy and the automobile industry
 - Higher energy use than claimed – respondents doubted the credibility of energy performance certificates (EPC).
 - VW and diesel engines – “Dieselgate” has been referenced as a corporate scandal linked to greenwashing.
4. Food buying habits
 - Food in supermarkets vs. local markets – many respondents doubted the green labels on supermarket food; they preferred to buy food at local markets, even without green labels.

4. CONCLUSION

The research results indicate a high level of awareness of greenwashing but also point to a level of incongruency between attitudes and actual behaviors. An interesting finding was that 48% of the participants weren't familiar with greenwashing, and another 41% were unsure if they knew what greenwashing meant. Despite this, 75% see greenwashing as a serious issue in business ethics, indicating a hidden awareness of manipulative tactics even among those unfamiliar with greenwashing. Even though the level of scepticism towards green claims is high in the research sample, engagement at the individual level is relatively low (in paying attention to green claims/labels). This gap between the attitude and the actual behaviour could be interpreted in the context of information overload, lack of transparency, and overall consumer scepticism. The research results revealed that most respondents have a low or moderate ability to detect greenwashing, highlighting the need for educational programs and targeted awareness raising campaigns. This is reinforced by the fact that 74% of respondents view education as a key factor in eliminating greenwashing. The qualitative part of the research highlighted examples such as Nestlé, Coca-Cola, and fast-fashion brands that advertise green values while also being (in)famous for unsustainable practices. These findings demonstrate a critical awareness and the ability to cross-check green claims against actual social and ecological impacts, indicating a deeper understanding of greenwashing even without formal knowledge of the phenomenon. With 57% of respondents reporting they purchased at least one product with potentially false green claims, and 69% indicating a willingness to pay a premium for genuinely sustainable products, the market potential for authentic sustainable products becomes clear, along with the control mechanisms needed to ensure the credibility of green claims. The research results support the trend towards rational, well-informed consumer behavior, with respondents reporting that eco-labels, certificates, and transparency are key factors in assessing the trustworthiness of green claims. Combating greenwashing requires collaboration among all stakeholders: the companies, the government, the academic community, consumers, and civil society institutions. It is vital to establish clear guidelines, sanctions for manipulative practices, and encourage companies to integrate sustainability into the core of their business strategies. Finally, fighting greenwashing is not just a matter of ethics but also a strategic focus on long-term competitiveness and social responsibility. In an era where transparency and authenticity are essential values, greenwashing is not just an obstacle but a test of genuine commitment to sustainable development. Future research should expand on this paper by using larger, more diverse samples, longitudinal studies, and cross-country comparisons to better understand greenwashing-related attitudes, scepticism, and behaviour. Examining the effectiveness of different educational interventions: formal education, online campaigns, and eco-label literacy training in improving consumers' recognition of greenwashing is another valuable research path. Finally, analysing the roles and interactions of key stakeholders (governments, companies, NGOs, consumer organisations) in multi-level governance frameworks, including how new regulations and enforcement mechanisms influence corporate green communication strategies, should deepen our understanding of this complex phenomenon.

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PATTERNS OF DIGITAL TECHNOLOGY USE IN CONTEMPORARY SOCIETY AND THE CONSEQUENCES OF USERS' DIGITAL HABITS

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ABSTRACT

Digital technologies play a key role in shaping communication, social and cultural practices in contemporary society. Their widespread presence has led to changes in patterns of technology use and the development of new digital habits that may have various effects on individuals' everyday functioning. In this context, the intensity and modes of digital technology use have become an important research topic within contemporary social studies. The aim of this paper is to analyse patterns of digital technology use and to examine their possible consequences in contemporary digital society, with particular emphasis on indicators associated with digital addiction. The study has a theoretical-empirical character. The theoretical section discusses relevant concepts related to digital technologies, digital habits, digital addiction, and their social effects. The empirical part is based on a pilot survey conducted on a convenience sample of 75 respondents from different age groups. The results indicate a high level of everyday use of digital technologies and suggest a connection between more intensive use of digital devices and certain difficulties in everyday functioning, such as increased stress levels, problems with concentration and sleep disturbances. The findings highlight the importance of further research on digital habits and their effects within the context of contemporary digital society. At the same time, the results contribute to a better understanding of the social implications of digital transformation in the context of ongoing global technological changes.

Keywords: *digital technologies, digital habits, patterns of technology use, digital society, social effects of digital technologies*

1. INTRODUCTION

In contemporary society, marked by accelerated digitalisation, patterns of digital technology use have become one of the key factors shaping individuals' everyday lives. Digital devices, particularly smartphones and online platforms, are no longer merely tools for communication and access to information; rather, they structure modes of work, social interactions, leisure time, and users' identity practices. Alongside the positive effects of digital transformation – such as increased access to information, global connectivity, and new forms of creative expression – the negative consequences of intensive and uncontrolled use of digital technologies are becoming increasingly evident.

In this context, the concept of digital addiction has emerged as an important analytical framework for understanding changes in user behaviour, particularly in relation to habits, time spent using devices, and the psychosocial effects of such practices. Previous research indicates a correlation between intensive use of digital technologies and various negative outcomes, including increased stress levels, reduced life satisfaction, sleep disturbances, and impaired social relationships. Younger age groups are particularly vulnerable, as they grow up in digitally saturated environments and develop specific patterns of interaction with technology. Based on the above, this paper aims to analyse patterns of digital technology use in contemporary society and to examine their effects on users' psychological, social, and physical functioning. Special emphasis is placed on the relationship between digital habits and indicators of digital addiction. The paper is structured as a theoretical-empirical study. The theoretical section provides an overview of relevant concepts related to digital addiction and patterns of technology use, while the empirical section is based on a pilot survey conducted on a sample of 75 respondents. Through the analysis of the collected data, the study seeks to determine whether there are statistically and interpretatively significant relationships between the intensity of digital technology use and its negative consequences on individuals' everyday functioning.

2. PATTERNS OF DIGITAL TECHNOLOGY USE AND BEHAVIOURAL ADDICTIONS

Understanding digital addiction requires a theoretical approach that integrates classical concepts of addiction, contemporary perspectives on behavioural addictions, and an analysis of the specific characteristics of the digital environment. In this sense, digital addiction cannot be viewed solely as an individual problem, but rather as a phenomenon arising from the interaction between an individual's psychological dispositions and the structural features of digital technologies. Starting from general definitions, addiction can be understood as a state of impaired self-regulation in which an individual loses control over a particular behaviour or substance. Pavlinović (2019) emphasises that this is a condition in which a person cannot function normally without a specific stimulus, accompanied by symptoms such as tension, loss of control, and social withdrawal. Such a definition implies an important methodological dimension of addiction – its measurability through behavioural patterns and functional consequences in everyday life. From a medical perspective, addiction is considered a chronic and relapsing disorder, highlighting its long-term nature and tendency toward recurrence (Goodman, 1990). This definition is significant as it points to the necessity of a longitudinal approach in studying addictive patterns. At the same time, addiction can also be interpreted as a loss of personal freedom, as noted by Ivančić (2000), while Rosenberg and Curtiss Feder (2014) emphasise the importance of learned behavioural patterns and their internalisation. This confirms that addiction is not exclusively a biological phenomenon, but rather the result of a complex process of learning, repetition, and social interaction. The contemporary theoretical framework further expands the concept of addiction by including behavioural forms. In this context, it is emphasised that addiction can develop in relation to any stimulus that produces a sense of pleasure (Dodig Hundrić et al., 2018), thereby opening space for the analysis of digital technologies as potentially addictive systems. Griffiths (2005) further operationalises behavioural addictions through six key components: the dominance of behaviour over emotions and thoughts, mood modification, reduced self-control, social isolation in cases of abstinence, impairment of cognitive and interpersonal functioning, and a strong urge to return to the behaviour after abstinence. This framework enables more precise empirical investigation of such phenomena. Within such a theoretical framework, the concept of digital addiction emerges, which can be defined as the compulsive and uncontrolled use of digital technologies that disrupts everyday functioning (Young, 2004).

This definition encompasses two key dimensions – intensity of use and its consequences – thereby enabling the operationalisation of this phenomenon in a research context. Contemporary studies increasingly emphasise that digital addiction represents a growing problem, particularly among younger populations, with the most pronounced consequences including anxiety, depression, and social isolation (Mavar, 2022). In this way, digital addiction is clearly positioned as an interdisciplinary phenomenon that requires the integration of multiple scientific perspectives. It is important to note that digital addiction develops within a specific technological environment, which further shapes this phenomenon. Katunarić (2012) highlights the risks of excessive dependence on technological systems, while contemporary authors emphasise that digital media transform communication patterns through interactivity, global accessibility, and content personalisation (Zgrabljić Rotar, 2020; Kunić, 2024). These changes have significant methodological implications, as digital behaviour becomes continuous, fragmented, and context-dependent. Under such conditions, the analysis of digital addiction should be grounded in the concept of usage patterns, which includes both quantitative and qualitative dimensions. As Kokorić (2020) points out, digital technologies reshape the structure of everyday life and interpersonal relationships, thereby creating conditions for the development of new forms of addictive behaviour. Different forms of digital addiction can be understood as manifestations of these patterns. Social media addiction is associated with the need for social validation and constant interaction, while mobile device addiction is based on their availability and integration into daily activities. Quantitative insights into this phenomenon are provided by studies documenting an increase in time spent using digital devices (Goode et al., 2020); however, time alone is not sufficient for its full understanding. It must be linked to functional consequences such as reduced concentration, sleep disturbances, and increased stress levels. Internet addiction represents the broadest form of digital addiction, as it encompasses a variety of activities and usage patterns. In the literature, it is defined as compulsive behaviour that disrupts everyday functioning (Carević et al., 2014), with additional diagnostic criteria including loss of control and social withdrawal (Kušanić et al., 2019). The particular vulnerability of younger users is explained by their developmental characteristics and modes of engaging with digital content (Kunić et al., 2017). Although it is less frequently analysed today within the context of digital technologies, television represents an important precursor to contemporary addictive patterns. Its role in shaping passive and repetitive behaviours has long been recognised (Trstenjak, 2006; Pavić et al., 2017), along with its influence on the perception of reality (Gui & Stanca, 2009).

A deeper understanding of digital addiction is provided by the neuropsychological approach. At the centre of these analyses is the dopaminergic reward system, which reinforces behavioural repetition (Volkow et al., 2013). Repeated exposure to digital stimuli is associated with changes in the prefrontal cortex and reduced self-control (Brand et al., 2014), while additional studies confirm alterations in cognitive functions related to attention and inhibition (Kuss et al., 2014). The comparison between behavioural and substance addictions further clarifies the nature of digital addiction. Both types of addiction are shown to share similar mechanisms and consequences (Grant et al., 2010), while different stimuli may activate the same neurobiological systems (Potenza, 2014). At the same time, a key methodological challenge lies in the fact that behavioural addictions are often socially accepted, which complicates their recognition and study (Miliša et al., 2009). Thus, digital addiction can be defined as a multidimensional phenomenon encompassing behavioural patterns, neurobiological processes, and social contexts. Its study requires the integration of quantitative and qualitative approaches, as well as consideration of the specific characteristics of the digital environment.

3. CONSEQUENCES OF DIGITAL ADDICTION AND APPROACHES TO PREVENTION

Digital addiction, as a form of behavioural addiction, has multidimensional consequences that manifest at psychological, social, and physical levels, as well as within the broader societal context. The analysis of these consequences requires an integrated approach that connects individual effects with social structures and behavioural patterns, while also identifying at-risk groups and potential preventive and intervention strategies. At the psychological level, digital addiction is increasingly associated with a range of negative emotional and cognitive outcomes. Twenge et al. (2018) highlight that intensive use of digital media correlates with higher levels of anxiety, depression, emotional instability, and reduced self-esteem. One of the key mechanisms contributing to this is continuous exposure to idealised representations of other users' lives, which encourages negative social comparisons and a sense of dissatisfaction with one's own life. The particular vulnerability of adolescents stems from their developmental stage, as further emphasised by Andreassen et al. (2017), who warn of the association between digital addiction and impaired emotional regulation, as well as feelings of emptiness. In this context, Keles et al. (2020) additionally point to the development of negative thought patterns resulting from continuous exposure to digital stimuli, thereby reducing individuals' capacity to cope with stress. Consequently, a vicious cycle is created in which psychological distress leads to withdrawal into the digital environment, while such behaviour further deepens existing difficulties. At the social level, the consequences of digital addiction are reflected in the transformation of interpersonal relationships and communication patterns. Excessive time spent in digital environments reduces the quality of face-to-face communication and leads to the weakening of social ties (Kircaburun et al., 2020). Coyne et al. (2019) particularly emphasise that children and adolescents experience difficulties in the development of social skills, including communication and conflict resolution. Digital interaction increasingly replaces real-life contact, resulting in reduced emotional connectedness and an increased sense of isolation. Among adults, this issue manifests through the deterioration of family and partner relationships, accompanied by decreased attention and emotional presence. Nesi et al. (2018) highlight the paradox of digital communication: despite constant connectivity, there is a decline in the authenticity of relationships and an increase in loneliness. The physical consequences of digital addiction are often less visible, yet they have a significant long-term impact on health. Chang et al. (2015) emphasise that exposure to blue light disrupts melatonin secretion and interferes with sleep. The consequences of such disturbances include chronic fatigue, irritability, and reduced concentration. In addition, a sedentary lifestyle associated with prolonged use of digital devices increases the risk of metabolic disorders, as highlighted by Stiglic and Viner (2019). Negative effects are also evident at the level of the visual system, where Xie et al. (2016) point to the occurrence of dry eye and eye strain. The examination of the consequences of digital addiction necessarily includes the identification of at-risk groups. Loladze (2020) points out that adolescents and university students are particularly vulnerable, especially in the presence of impulsivity or low self-regulation. In addition to individual factors, social conditions – such as family conflicts and a lack of supervision – also play a significant role. In this context, Elhai et al. (2017) emphasise the tendency to escape from reality and seek immediate gratification as key mechanisms that increase the risk of developing addiction. Given the complexity of the phenomenon, the prevention of digital addiction requires a multi-level approach. King et al. (2012) emphasise that effective strategies must encompass the individual, family, educational, and societal levels. Particularly important is the development of digital literacy, which enables a critical understanding of digital content and one's own usage habits. Education on the responsible use of technology should begin at an early age, as highlighted by Livingstone and Helsper (2007), with an emphasis on time management and the ability to distinguish between beneficial and harmful content.

The family and the educational system play a key role in shaping healthy digital habits. The importance of parental monitoring and clear rules is emphasised by Lauricella et al. (2015), while educational institutions can integrate topics related to digital well-being into the curriculum. Such an approach enables the creation of an environment that promotes responsible and balanced use of technology. In the context of treating digital addiction, it is important to take into account its specific characteristics. Stanić (2010) points to the growing prevalence of problems related to digital technologies, particularly among young people. The increasingly early exposure of children to digital content further complicates the situation, as noted by Ivakić and Mandarić Vukušić (2023). At the same time, Jurman et al. (2017) emphasise that therapeutic approaches are still not fully standardised, but that prevention and the development of self-regulation remain central. Unlike traditional forms of addiction, the goal of intervention is not complete abstinence, but rather the establishment of a balanced use of technology. In this regard, Newport (2022) proposes the concept of digital minimalism, which is based on the conscious and selective use of technology in accordance with personal values. Such an approach enables sustainable management of digital habits in contemporary society. Digital addiction has complex and interconnected consequences that extend from the individual to the societal level. Its understanding requires the integration of diverse theoretical and methodological approaches, while effective prevention and intervention depend on the collaboration of various social actors and the development of new models of responsible technology use.

4. EMPIRICAL STUDY

4.1. Research Subject, Objectives, and Hypotheses

The subject of this study is the phenomenon of digital addiction, with a particular focus on its impact on individuals' psychological, social, and physical functioning in contemporary digital society. The research is aimed at analysing patterns of digital technology use and examining the relationship between the intensity of their use and potential negative consequences in everyday life. The main objective of the study was to assess the level of presence of digital addiction symptoms and to determine the relationship between the intensity of digital device use and psychosocial consequences, particularly perceived stress, difficulties with concentration, and sleep disturbances. Special emphasis was placed on younger age groups, which are identified in the theoretical part of the paper as particularly at risk in the context of developing addictive behavioural patterns.

In line with the stated objective, the following research tasks were defined:

1. to analyse patterns of digital technology use among respondents from different age groups
2. to examine the relationship between digital addiction and users' psychological condition
3. to determine the impact of digital addiction on physical health, with a focus on sleep quality

The survey consisted of a total of 15 questions organised into four thematic categories: demographic data, patterns of digital technology use, symptoms of digital addiction, and the psychological and physical condition of respondents. Based on the collected data, behavioural patterns and potential consequences of excessive use of digital devices were analysed.

Based on the research objectives, the following hypotheses were formulated:

H1: Increased time spent on digital devices is associated with higher levels of perceived stress, difficulties with concentration, and more frequent distraction from daily obligations.

H2: Younger individuals (aged 15–30) exhibit higher levels of digital addiction symptoms compared to older age groups.

H3: The use of digital devices immediately before sleep is associated with a higher frequency of sleep-related difficulties.

4.2. Research Methodology

The study has a theoretical-empirical character and is based on a quantitative research approach. Given the sample size, the use of convenience sampling, and the preliminary research objective, the empirical part of the study can be defined as a pilot study aimed at the initial examination of patterns of digital technology use and the identification of potential relationships between the intensity of their use and negative consequences in everyday functioning. A structured survey questionnaire was used as the primary research instrument, and data collection was conducted during 2025 in an online environment via the Google Forms platform. This approach enabled the easy distribution of the questionnaire and access to respondents with diverse sociodemographic characteristics.

4.2.1. Sample

The study included 75 respondents selected using a convenience sampling method. The sample comprises participants of different age groups, genders, and employment or educational statuses, with a particular emphasis on younger generations as the key research group. Respondents completed the questionnaire anonymously, with prior informed consent and ensured protection of personal data. Although such a sample does not allow for full generalisation of the results, it provides relevant insight into patterns of digital technology use and the perception of digital addiction within the observed population. In this sense, the results obtained in this pilot study should be considered as preliminary indicators that may serve as a basis for future, more extensive and methodologically complex research.

4.2.2. Instruments

The questionnaire consisted of a total of 15 items organised into four sections:

1. demographic data (age, gender, status)
2. patterns of digital technology use (duration of use, purpose, use before sleep)
3. symptoms of digital addiction (loss of control, discomfort without devices, prolonged use)
4. psychological and physical condition (stress, concentration, sleep, subjective assessment of addiction)

Nominal scales and Likert-type scales were used to assess attitudes and the frequency of behaviours. The questionnaire was pre-tested on a smaller group of respondents in order to ensure clarity of the questions and the reliability of responses.

4.2.3. Data Analysis

The collected data were analysed using methods of descriptive and inferential statistics with the support of Microsoft Excel and SPSS software. The analysis included basic distribution indicators, as well as correlation analysis and tests of statistical significance in order to examine the proposed hypotheses.

4.3. Research Results

The analysis of the collected data was conducted on a sample of 75 respondents, and the results are presented according to the thematic sections of the questionnaire.

Demographic Characteristics of Respondents

The first three questions referred to the demographic characteristics of the respondents. Regarding the first question, which concerned the gender of the respondents, it was found that 58.7% of respondents (N = 44) were female, while 41.3% (N = 31) were male.

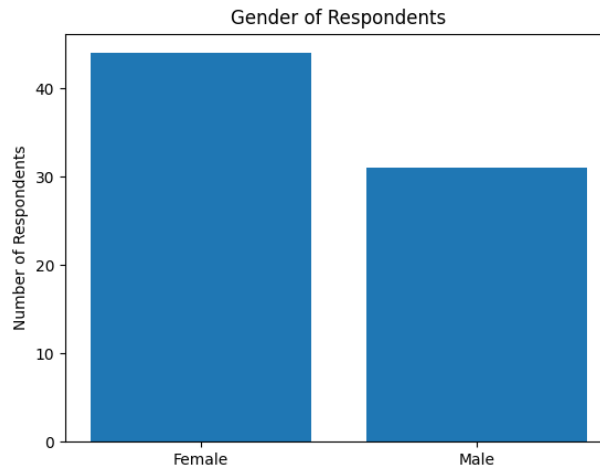


Figure 1: Respondents by Gender (Source: Author's Own Work)

The second demographic question referred to the age of the respondents. The results show that 1.3% (N = 1) of respondents are under the age of 15, 6.7% (N = 5) belong to the 15–20 age group, 44% (N = 33) to the 21–30 age group, 37.3% (N = 28) to the 31–45 age group, while 10.7% (N = 8) of respondents are over 45 years of age.

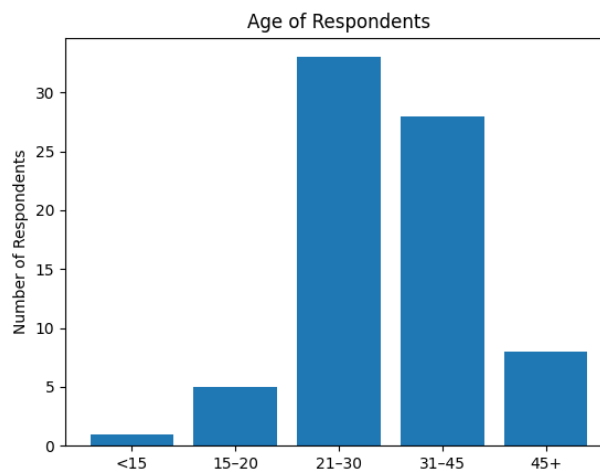


Figure 2: Respondents by Age (Source: Author's Own Work)

The third question referred to the respondents' status. The results show that 58.7% (N = 44) of respondents are employed, 28% (N = 21) are students, 6.7% (N = 5) are pupils, 4% (N = 3) are unemployed, and 2.7% (N = 2) are retired.

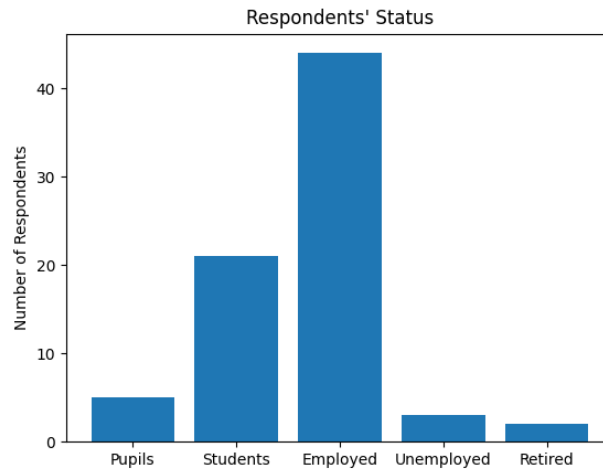


Figure 3: Respondents' Status (Source: Author's Own Work)

Digital Technology Use Patterns

The analysis of the collected data indicates a pronounced presence of digital technologies in the everyday lives of respondents, with clear patterns of intensive and frequent use of digital devices. The majority of respondents spend a significant portion of their day in a digital environment: 45.3% of respondents (N = 34) use digital devices between 5 and 7 hours per day, while an additional 30.7% (N = 23) spend between 8 and 10 hours per day. A smaller proportion of respondents use devices between 2 and 4 hours per day (14.7%, N = 11), while a very small number use them for less than 2 hours (1.3%, N = 1) or more than 10 hours per day (8%, N = 6).

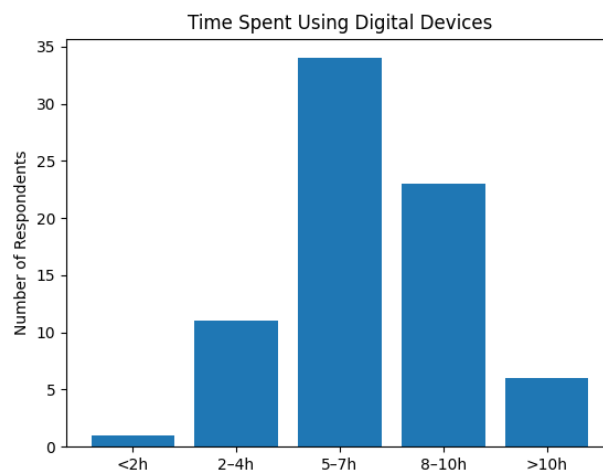


Figure 4: Daily Time Spent Using Digital Devices (Source: Author's Own Work)

With regard to the purpose of using digital devices, the results indicate the dominance of social media (85.3%, N = 64), followed by tracking news and information (68%, N = 51), professional use (53.3%, N = 44), and the consumption of entertainment content such as films and series (45.3%, N = 34). Digital devices are used for educational purposes and video games by 34.7% of respondents (N = 26) each. These findings point to the multifunctionality of digital technologies, as well as their deep integration into users' everyday activities.

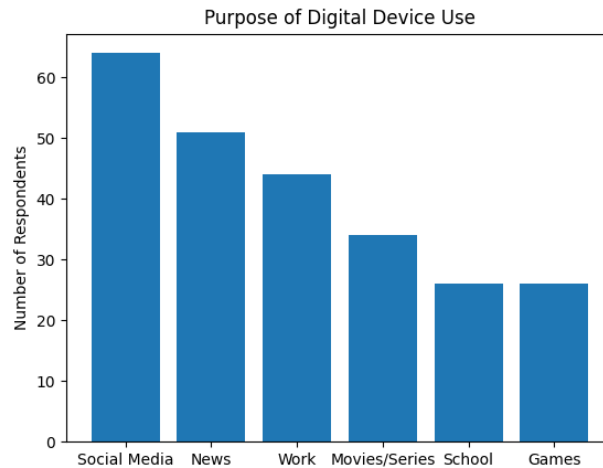


Figure 5: Purpose of Digital Device Use (Source: Author's Own Work)

A particularly indicative finding is that as many as 96% of respondents ($N = 72$) use digital devices immediately before sleep, while only 4% ($N = 3$) report that they do not. Such a practice suggests continuous exposure to digital stimuli without a temporal break before sleep, which may have significant implications for sleep quality and overall psychophysical well-being.

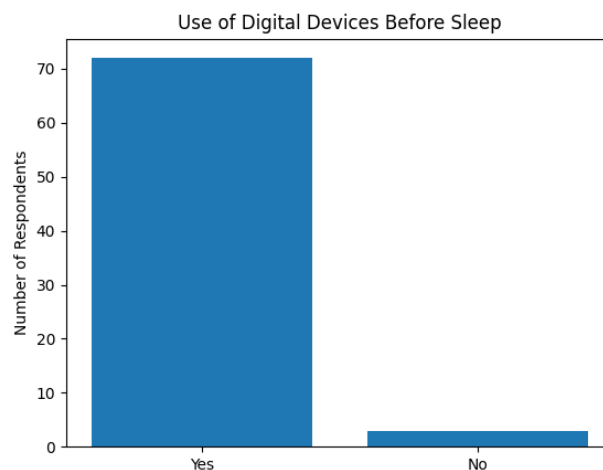


Figure 6: Use of Digital Devices Before Sleep (Source: Author's Own Work)

Symptoms of Digital Addiction

The results related to the symptoms of digital addiction indicate the presence of several key elements of behavioural addiction. More than half of the respondents report a certain degree of discomfort when separated from their mobile devices or the internet: 21.3% ($N = 16$) fully agree that it is difficult for them to be without access to technology, while 34.7% ($N = 26$) report partial discomfort. A smaller proportion of respondents state that they do not experience such discomfort or experience it only rarely.

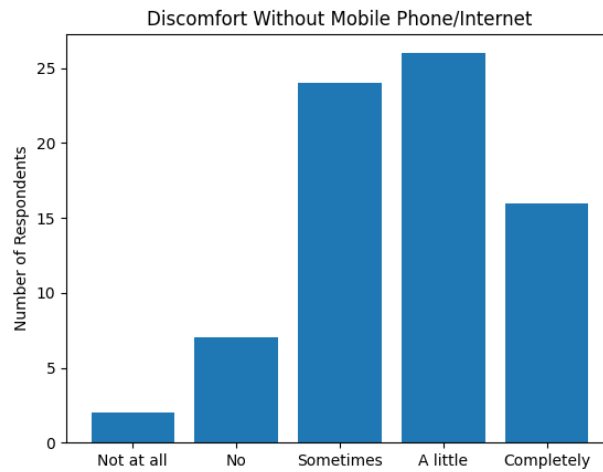


*Figure 7: Perceived Discomfort Without Mobile Phone/Internet
(Source: Author's Own Work)*

As many as 62.6% of respondents (N = 47) report that they at least occasionally use digital devices longer than intended, while a smaller proportion state that they do so rarely or never.

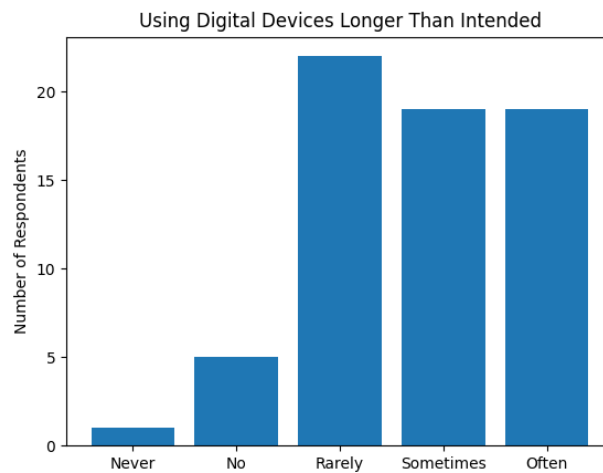


*Figure 8: Use of Digital Devices Longer Than Intended
(Source: Author's Own Work)*

A sense of anxiety or discomfort without access to the internet is present among the majority of respondents: 40% (N = 30) report experiencing it occasionally, while 36% (N = 27) report experiencing it often or always.

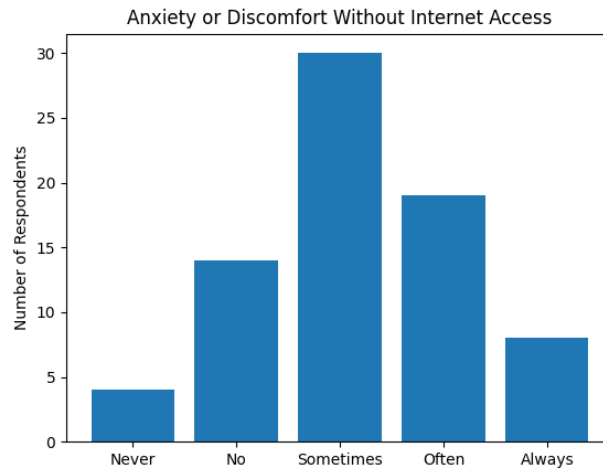


*Figure 9: Perceived Anxiety or Discomfort Without Internet Access
(Source: Author's Own Work)*

Additionally, 76% of respondents (N = 57) acknowledge that digital content at least occasionally distracts them from their everyday obligations, while a smaller number of respondents report that this does not occur.

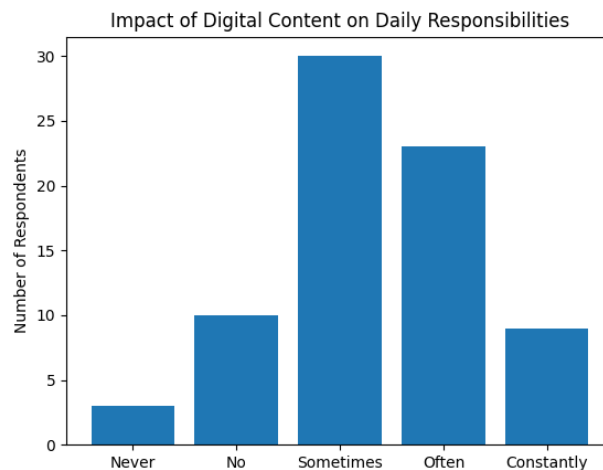


Figure 10: Impact of Digital Content on Daily Responsibilities (Source: Author's Own Work)

Psychological and Physical Condition

In the domain of psychological condition, the results show that 66.6% of respondents (N = 50) at least occasionally experience stress or anxiety after prolonged use of digital devices.

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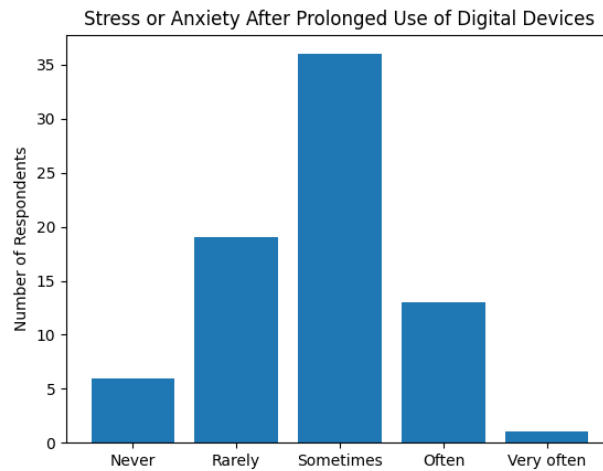


*Figure 11: Levels of Stress and Anxiety
(Source: Author's Own Work)*

Difficulties with concentration are present among a significant proportion of respondents: 32% (N = 24) report experiencing them, while 44% (N = 33) indicate that they occur occasionally. Only 24% of respondents (N = 18) report no such difficulties. These findings suggest a potential relationship between intensive digital activity and the impairment of cognitive functions.

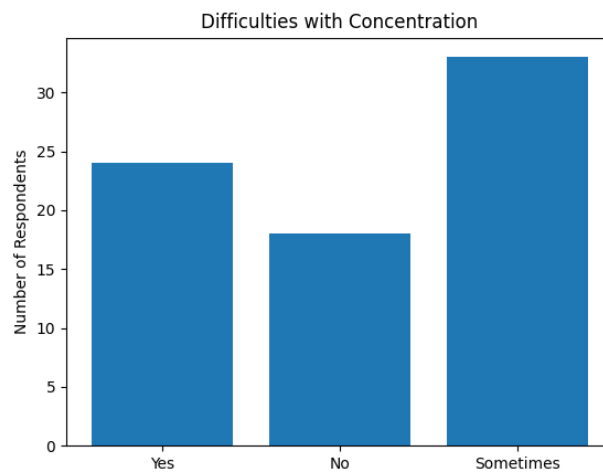


*Figure 12: Reported Difficulties with Concentration
(Source: Author's Own Work)*

With regard to sleep, 37.3% of respondents (N = 28) report experiencing sleep difficulties, while 42.7% (N = 32) indicate that they experience them occasionally. A smaller proportion of respondents report no sleep difficulties (20%, N = 15).

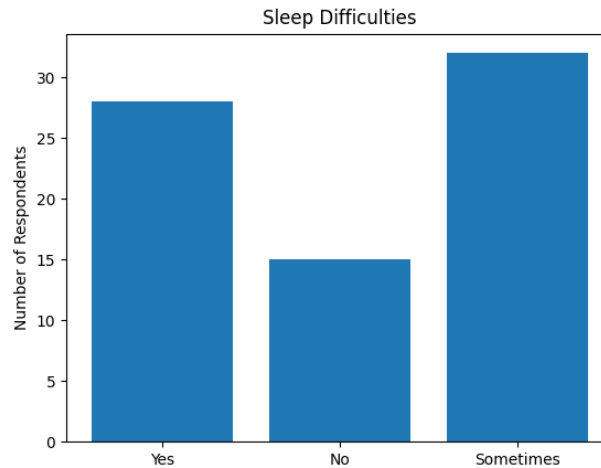


Figure 13: Sleep Difficulties (Source: Author's Own Work)

Only 18.7% of respondents (N = 14) directly associate the use of digital devices with sleep difficulties, while 54.7% (N = 41) are unsure whether such a relationship exists, indicating a lack of awareness regarding the impact of digital habits on health.

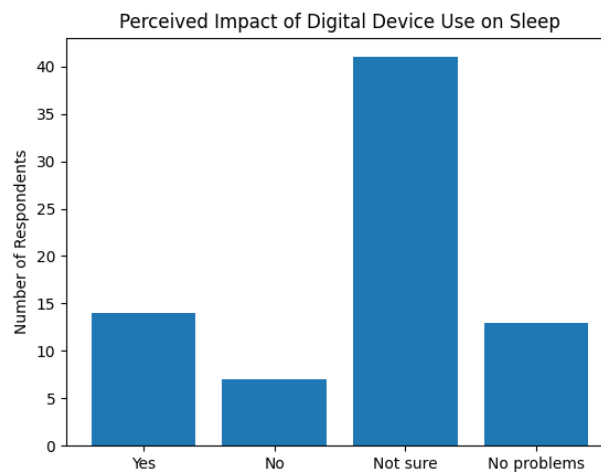


Figure 14: Perceived Impact of Digital Device Use on Sleep (Source: Author's Own Work)

Interestingly, 41.3% of respondents (N = 31) consider themselves to be digitally addicted, while 48% (N = 36) are uncertain in their self-assessment, and 10.7% (N = 8) believe they are not addicted. This result indicates an ambivalence in the perception of one's own behaviour and a difficulty in distinguishing between intensive use and addiction.

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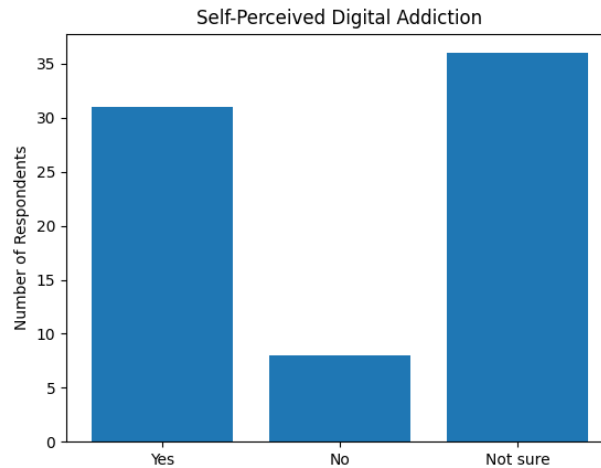


Figure 15: Self-Perceived Digital Addiction (Source: Author's Own Work)

4.4. Discussion

The obtained results confirm the basic assumption of the study regarding the high level of presence of digital technologies in everyday life and indicate the existence of behavioural patterns that are compatible with the concept of digital addiction. The intensity of digital device use, expressed through several hours of daily usage, has proven to be a key indicator of potentially risky behaviours. The results of the pilot study suggest that hypothesis H1 is empirically supported, as a higher intensity of digital device use is accompanied by higher levels of perceived stress and more pronounced difficulties in everyday functioning. These findings indicate the existence of a relationship between intensive digital activity and the impairment of psychological well-being and daily functionality of users. The findings also support hypothesis H2, according to which younger age groups exhibit more pronounced symptoms of digital addiction compared to older respondents. This result further confirms theoretical assumptions regarding the greater vulnerability of younger users in the context of developing addictive behavioural patterns. Furthermore, the results of the pilot study also support hypothesis H3, as they indicate a relationship between the use of digital devices immediately before sleep and the presence of sleep difficulties. Although not all respondents recognise a direct connection between these two phenomena, their simultaneous high prevalence suggests the existence of a latent relationship that requires further investigation. The obtained results confirm that digital addiction cannot be reduced solely to the amount of time spent using digital devices, but also involves qualitative dimensions of use, such as feelings of discomfort without internet access, prolonged use of devices beyond planned time, and interference with everyday obligations. In this way, the empirical findings of this study are consistent with theoretical approaches that interpret digital addiction as a form of behavioural addiction characterised by loss of control, emotional attachment, and impaired self-regulation. This multidimensionality demonstrates that digital addiction is a phenomenon that affects not only users' digital habits, but also their broader psychological and social functioning. The results also point to an important phenomenon of subjective uncertainty in the assessment of digital addiction. The fact that nearly half of the respondents are unsure whether they consider themselves addicted suggests that the boundary between "normal" and problematic use of digital technologies is not clearly defined in users' perceptions. Such uncertainty indicates a low level of awareness regarding the symptoms and consequences of problematic digital device use. In practical terms, this implies that preventive activities should not be focused solely on reducing the time spent using digital devices, but also on developing the ability for self-assessment, self-regulation, and critical understanding of one's own digital habits.

Despite the significant findings, the study has certain methodological limitations. The use of a convenience sample and a relatively small number of respondents limits the generalisability of the results. Additionally, the use of self-report measures may lead to subjective biases in responses. Future research should include larger and more representative samples, as well as a combination of quantitative and qualitative methods in order to gain a deeper understanding of patterns of digital behaviour and their effects. In conclusion, the results of the study indicate that digital addiction represents a relevant and complex issue in contemporary society, with pronounced psychological, social, and physical consequences. The findings highlight the need to develop preventive strategies aimed at raising user awareness, particularly among younger populations, and promoting balanced and mindful use of digital technologies.

5. CONCLUSION

Digital addiction is increasingly emerging as a complex psychological and social phenomenon arising from the pervasive presence of digital technologies in individuals' everyday lives. This paper has analysed the causes, mechanisms, and consequences of digital addiction, with particular emphasis on its impact on users' psychological, physical, and social functioning. The theoretical framework highlighted the key role of neuropsychological processes, particularly the activation of the dopaminergic reward system, which promotes the development of repetitive and compulsive behavioural patterns. This confirms a clear connection between digital addiction and other forms of behavioural addictions, as well as its partial analogy with substance addictions. The analysis of the available literature and the conducted research indicates that digital addiction does not represent an isolated problem, but rather a multidimensional phenomenon affecting various aspects of an individual's life. Particularly notable are psychological consequences such as increased levels of stress, anxiety, and emotional instability, as well as cognitive difficulties such as reduced concentration, and physical consequences, especially sleep disturbances. At the same time, the social dimension of the problem is reflected in the deterioration of interpersonal relationships and a decline in the quality of communication in real-life settings. The results of the empirical research further confirmed the theoretical assumptions. The analysis of data collected from a sample of 75 respondents revealed a high level of engagement in the digital environment, with a significant proportion of respondents spending several hours per day using digital devices. The findings support all three proposed hypotheses. It was established that longer time spent on digital devices is associated with increased levels of perceived stress, difficulties with concentration, and more pronounced challenges in everyday functioning, indicating a negative impact of excessive digital activity on individuals' psychological well-being. Furthermore, younger age groups exhibited more pronounced symptoms of digital addiction, confirming their greater vulnerability in the context of developing addictive behavioural patterns. A relationship between digital addiction and sleep disturbances was also confirmed, particularly among respondents who use digital devices immediately before going to sleep. A particularly significant finding relates to the subjective perception of addiction, as a large number of respondents are uncertain whether they consider themselves digitally addicted. This ambivalence indicates a low level of awareness of the symptoms and consequences of digital addiction, as well as the fact that the boundary between intensive use and addictive behaviour is often not clearly defined in everyday practice. The obtained results point to the need for a systematic approach to the issue of digital addiction, encompassing preventive, educational, and intervention measures. Given that digital technologies play an indispensable role in contemporary society, the goal is not their complete elimination, but rather the development of balanced and mindful use. In this context, the concept of digital minimalism can be considered as one of the potentially effective approaches, as it emphasises the selective and purposeful use of technology in accordance with personal values and priorities.

Despite the significant findings, the study has certain methodological limitations, primarily related to the size and structure of the sample and the use of self-report measures. Accordingly, the results of this study have the characteristics of a pilot study and represent a starting point for future research on larger and more representative samples. Future research should include larger and more representative samples, as well as a combination of quantitative and qualitative methods, in order to gain a deeper understanding of patterns of digital behaviour and their effects. In conclusion, digital addiction represents a serious challenge of contemporary society, particularly in the context of younger generations. Its consequences extend beyond the individual level and carry broader societal implications, which necessitates the development of interdisciplinary approaches involving the educational, healthcare, and social systems. Only through coordinated action is it possible to effectively address the challenges that digital transformation brings in the domain of mental health and overall quality of life.

ACKNOWLEDGEMENT: *This article is derived from the undergraduate thesis Digital Addiction – Mechanisms and Consequences by Ante Grabić, a student of the university undergraduate programme Culture, Media and Management, prepared under the supervision of Associate Professor Hrvoje Mesić, PhD, and co-supervision of Iris Tomić, PhD, at the Academy of Arts and Culture, Josip Juraj Strossmayer University of Osijek. The scientific contribution of this article is reflected in the integration of theoretical concepts of digital addiction with an empirical analysis of patterns of digital technology use, thereby contributing to a better understanding of their psychological, social, and physical effects in contemporary digital society.*

The authors acknowledge the use of an artificial intelligence-based language tool to assist in the translation process during manuscript preparation. The authors reviewed and confirmed the accuracy of the translation and its consistency with the original text.

This work was created within the project ZusU – Science in the Service of Art: Innovative Approaches to Art Education, funded by the European Union – NextGenerationEU (project code: 581-UNIOS-07).

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CULTURAL TOURISM AS A STRATEGIC TOOL FOR REGIONAL DEVELOPMENT: THE CASE OF THE RABAT–SALÉ–KÉNITRA REGION

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ABSTRACT

Cultural tourism plays a strategic role in regional development in the Rabat–Salé–Kénitra region, located at the center of Morocco’s economic and social transformations. With a rich intangible heritage derived from Arabo-Andalusian traditions, local craftsmanship, and a distinctive cultural identity, the region possesses key assets capable of enhancing its territorial and tourist appeal. The study focuses on the analysis of heritage resources and tourism potential while addressing the challenges of promoting them in an increasingly competitive interregional environment. It examines how cultural tourism can generate sustainable economic and social value while strengthening the region’s image. The methodology combines documentary and statistical analysis of tourism and cultural indicators with a comparative review of internationally recognized cultural destinations. This approach identifies best practices in destination management and territorial marketing that can be adapted to the local context. Expected outcomes aim to provide actionable recommendations for public and private stakeholders to improve the region’s cultural and tourism positioning. The study highlights the importance of cultural tourism as a lever for regional development and emphasizes the strategic role of territorial marketing in a globalized economic environment.

Keywords: *Cultural tourism, Regional development, Territorial attractiveness, Territorial marketing*

1. INTRODUCTION

In a globalized economy, regions increasingly compete to attract tourists, investment, and human capital, making tourism a strategic driver of regional development. Within this context, cultural tourism has gained particular importance because it combines economic value creation with heritage preservation, identity promotion, and social cohesion (Richards, 2018; UNWTO, 2022). Unlike standardized mass tourism models, cultural tourism enables territories to differentiate themselves through distinctive and non-transferable assets, thereby reinforcing long-term development trajectories. At the national level, Morocco has recorded a strong recovery in tourism activity, reaching approximately 17.4 million international arrivals in 2024 and tourism revenues exceeding MAD 112 billion (Ministry of Tourism, 2024). However, this performance remains spatially concentrated in a limited number of destinations, notably Marrakech and Agadir. By contrast, the Rabat–Salé–Kénitra region, despite its political centrality, modern infrastructure, and significant cultural heritage, continues to capture only a modest share of tourism flows. To situate this imbalance within the national context, the evolution of tourism activity in Morocco is presented in Table 1.

YEAR	TOURIST ARRIVALS (MILLIONS)	TOURISM RECEIPTS (USD BN)	NIGHTS SPENT (MILLIONS)
2018	12.3	9.52	24.3
2019	13.1	9.95	25.2
2020	2.8	4.51	10.3
2021	3.7	3.77	12.0
2022	10.9	8.63	27.0
2023	14.5	10.5	28.7
2024	17.4	11.3	30.0

Table 1: International tourist arrivals, tourism receipts, and nights spent in Morocco (2018–2024)

(Source: UNWTO (2023); World Bank (2024); Moroccan Ministry of Tourism (2024); author's compilation)

These data show strong national tourism recovery, but they do not indicate balanced territorial distribution of tourism benefits. This reveals a central paradox: despite significant cultural and institutional assets, the Rabat–Salé–Kénitra region remains underperforming in tourism competitiveness. While the literature addresses destination competitiveness, cultural tourism, and territorial attractiveness, their integration remains limited, particularly in emerging destinations. This paper analyzes how cultural tourism can enhance regional competitiveness in the Rabat–Salé–Kénitra region. It adopts a qualitative approach based on secondary data and comparative analysis. The paper is structured into four sections: theoretical framework, methodology, empirical analysis, and discussion.

2. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

The literature review is structured around the main conceptual pillars of the study, namely cultural tourism, territorial positioning, and regional competitiveness. It aims to connect these dimensions within a unified analytical perspective adapted to the Rabat–Salé–Kénitra case. The following subsection first examines the relationship between cultural tourism and regional development before moving to issues of destination attractiveness and competitiveness.

2.1 Cultural tourism and regional development

The developmental role of tourism in Morocco is empirically evident through its strong post-pandemic recovery and increasing macroeconomic contribution. For analytical clarity, it is relevant to situate cultural tourism within national tourism dynamics before focusing on regional disparities. The table below summarizes recent trends using official data.

Year	Tourist arrivals (millions)	Tourism contribution / receipts	Additional indicator
2020	2.8	3.2% of GDP	Severe contraction
2021	3.7	2.7% of GDP	Partial recovery
2022	10.9	7.1% of GDP	Strong rebound
2023	14.5	MAD 104.7 billion	Pre-peak performance
2024*	17.4	MAD 112 billion	28.7 million overnight stays

Table 2: Tourism performance in Morocco (2020–2024)

(Source: World Bank (2024); Moroccan Ministry of Tourism (2024); Observatoire du Tourisme (2023–2024); author's compilation.)

These figures confirm strong tourism growth but do not ensure balanced regional development, highlighting the need for differentiated territorial strategies. Tourism also plays a significant role in employment, this reinforces its importance as a structural development sector. Nevertheless, aggregate indicators tend to mask territorial disparities, particularly in regions where governance, branding, and heritage valorization remain uneven. This highlights a key research gap: how cultural tourism can be integrated into territorial strategies to convert cultural capital into measurable competitiveness.

2.2 Territorial marketing and destination attractiveness

In a context of intensified global competition, territories increasingly adopt marketing strategies to enhance their attractiveness and differentiation (Kotler et al., 2019; Kavaratzis and Ashworth, 2018). A central component of this process is destination branding, which requires alignment between territorial identity, perceived image, and visitor experience (Anholt, 2020; Zenker and Braun, 2017)..

Destination	Overnight stays (millions)	Share (%)
Marrakech	9.2	31.5
Agadir	6.1	20.9
Casablanca	2.3	7.9
Tangier	1.5	5.1
Rabat	0.82	2.8
Fès	1.3	4.4
Other regions	8.5	27.4
Total	29.7	100

*Table 3: Overnight stays in classified accommodation establishments in Morocco (2023)
(Source: Observatoire du Tourisme (2023))*

The data reveal a strong concentration of tourism activity in a few destinations. Rabat's limited share is not due to a lack of cultural assets but rather to weaker territorial positioning. While cities like Marrakech have developed a strong experiential and cultural brand, Rabat remains primarily associated with administrative functions.

Indicator	2019	2021	2023
Tourist arrivals (millions)	12.9	3.7	14.5
Global competitiveness ranking	66th	—	62nd
Cultural resources score (/7)	2.8	—	3.2
Tourism contribution to GDP (%)	7.3	2.7	7.1

*Table 4: Tourism competitiveness indicators in Morocco (2019–2023)
(Source: World Economic Forum (2019; 2023); World Bank (2024); Moroccan Ministry of Tourism (2024); author's compilation.)*

Although Morocco has improved its global positioning, cultural resources remain underexploited as a competitive advantage. This highlights the need for a systemic approach to territorial marketing that integrates resource management, stakeholder coordination, and experience design. The absence of such integration in Rabat–Salé–Kénitra limits its ability to develop a coherent and competitive territorial identity.

2.3 Regional competitiveness in a globalized context

Regional competitiveness is a multidimensional concept encompassing economic performance, governance, innovation, and attractiveness (Porter, 1990; Crouch, 2019). In tourism, competitiveness depends not only on infrastructure but also on intangible factors such as destination image and visitor experience. The performance of Moroccan regions highlights structural disparities.

Region	Overnight stays (millions)	Beds	Average stay (days)
Marrakech-Safi	9.2	78,000	3.4
Souss-Massa	6.1	72,000	4.1
Casablanca-Settat	2.3	32,000	2.1
Tangier-Tetouan-Al Hoceima	1.5	28,000	2.5
Rabat-Salé-Kénitra	0.82	18,000	1.9

Table 5: Comparative tourism indicators by region in Morocco (2023)
(Source: Observatoire du Tourisme (2023))

The Rabat–Salé–Kénitra region shows lower tourism volumes and shorter stays, reflecting limited visitor engagement. Despite adequate infrastructure, its performance suggests weaknesses in positioning and experience design rather than resource availability.

3. METHODOLOGY

3.1 Research design

This study adopts a qualitative case study approach grounded in abductive reasoning. The Rabat–Salé–Kénitra region was selected because it combines significant cultural resources with relatively limited tourism competitiveness, making it a relevant case for analyzing the link between cultural tourism and regional development. The analysis combines literature review, secondary statistical data, and comparative benchmarking. This triangulation strengthens the analytical robustness of the study.

3.2.1 Data sources and analytical approach

The empirical analysis relies on secondary data obtained from institutional sources, including the Moroccan Ministry of Tourism, the Observatoire du Tourisme, the Haut-Commissariat au Plan (HCP), the World Bank, and UN Tourism. To contextualize the position of the Rabat–Salé–Kénitra region, tourism infrastructure is considered as a key indicator of competitiveness.

Site	Location	Year	Type
Medina of Fez	Fès	1981	Cultural
Medina of Marrakech	Marrakech	1985	Cultural
Medina of Tetouan	Tetouan	1997	Cultural
Volubilis	Meknès region	1997	Cultural
Historic City of Meknes	Meknès	1996	Cultural
Medina of Essaouira	Essaouira	2001	Cultural
Mazagan	El Jadida	2004	Cultural
Rabat, Historic City	Rabat	2012	Cultural

Table 6: UNESCO World Heritage Sites in Morocco (2024)
(Source: UNESCO World Heritage Centre (2024))

While Rabat benefits from international recognition, this status remains insufficiently translated into tourism performance, highlighting a gap between cultural assets and their effective valorization. In addition, the study employs comparative benchmarking to identify best practices in culturally driven destination development and assess their relevance for the Moroccan context. This table is used as an indicator of international cultural recognition rather than direct tourism performance.

3.3.2 Limitations

This study is limited by its reliance on secondary data, which restricts access to visitor perceptions and stakeholder interactions. In addition, the lack of disaggregated cultural tourism data complicates precise impact assessment. Benchmarking results must also be interpreted cautiously due to contextual differences between destinations.

4. EMPIRICAL ANALYSIS: RABAT–SALÉ–KÉNITRA REGION

4.1 Cultural and heritage resources

The Rabat–Salé–Kénitra region is characterized by a diversified cultural endowment combining historical heritage, institutional significance, and intangible cultural practices.

Category	Examples	Tourism potential
Tangible heritage	Oudayas, Chellah, Hassan Tower	High
Intangible heritage	Andalusian music, craftsmanship	Strong
Cultural events	Mawazine Festival	High visibility
Institutional heritage	Museums, administrative sites	Symbolic

*Table 7 : Cultural tourism assets in Rabat–Salé–Kénitra
(Source: Moroccan Ministry of Culture (2023–2024);
regional reports; author’s compilation)*

Rabat holds a comparable level of recognized heritage but, unlike Marrakech or Fès, has not fully integrated these assets into tourism consumption patterns. This indicates that the limitation lies less in resource availability than in their strategic valorization. At the regional scale, cultural assets extend beyond Rabat to include Salé’s medina and craftsmanship, as well as cultural events and institutional sites. These elements form a diversified but fragmented ecosystem.

Year	Overnight stays (thousands)	Growth (%)
2019	950	—
2020	420	-55.8
2021	510	+21.4
2022	665	+30.4
2023	820	+23.3
2024*	855	+4.3

*Table 8 : Evolution of overnight stays in Rabat (2019–2024)
(Source: Observatoire du Tourisme (2023–2024); author’s compilation)*

The evolution indicates recovery after the pandemic, but not a structural shift in Rabat’s tourism positioning. Moroccan Ministry of Culture (2023–2024); regional reports; author’s compilation
Despite this diversity, cultural resources remain weakly integrated into a structured tourism offer.

4.2 Tourism performance and dynamics

Tourism performance provides a quantitative assessment of the region’s attractiveness. Despite post-pandemic recovery, the Rabat–Salé–Kénitra region remains a secondary destination within the national tourism system.

The structure of demand further highlights this positioning.

Type of tourists	Share (%)
Domestic	58
International	42

Table 9 : Structure of tourism demand in Rabat (2023)
(Source: Observatoire du Tourisme (2023))

The predominance of domestic tourism reflects limited international positioning.

4.3 Structural challenges

The region faces two main constraints: fragmented governance and weak positioning. Rabat remains primarily associated with administrative functions rather than cultural tourism, limiting its competitiveness compared to destinations with strong experiential branding.

Destination	Brand positioning	Visibility	Cultural integration
Marrakech	Lifestyle & heritage	Very high	Strong
Fès	Spiritual heritage	High	Strong
Essaouira	Artistic culture	Medium	Integrated
Rabat	Institutional	Moderate	Limited

Table 10 : Comparative positioning of Moroccan destinations (2023)
(Source: ONMT (2023); tourism strategy reports; author’s compilation)

Rabat’s positioning remains largely institutional, limiting its ability to compete with destinations that have successfully integrated culture into a compelling tourism narrative. Overall, the analysis highlights a central issue: the Rabat–Salé–Kénitra region possesses significant cultural capital but lacks the strategic integration necessary to convert it into sustained tourism competitiveness. This underscores the need to strengthen territorial marketing and experience design as key drivers of regional development.

5. DISCUSSION: TERRITORIAL MARKETING STRATEGIES AND COMPETITIVENESS

5.1 Branding and positioning strategies

Building on the empirical findings, the discussion now examines the strategic implications of Rabat–Salé–Kénitra’s current positioning. The empirical findings indicate that the Rabat–Salé–Kénitra region’s limitations stem less from a lack of cultural resources than from insufficient strategic positioning.

Within territorial marketing, branding plays a central role in shaping destination identity, differentiation, and perception (Kavaratzis and Ashworth, 2018; Anholt, 2020).

Destination	2022	2023	2024*
Marrakech	4.5	5.8	6.5
Agadir	2.1	2.8	3.2
Casablanca	1.4	1.9	2.2
Tangier	1.2	1.6	1.9
Rabat	0.6	0.8	0.9

Table 11 : International tourist arrivals by destination (2022–2024)
(Source: Observatoire du Tourisme (2023–2024); Moroccan Ministry of Tourism (2024);
author’s compilation)

The gap between Rabat and leading destinations reflects differences in branding rather than resources. From a strategic perspective, Rabat’s combination of historical heritage and modern capital status represents a distinctive positioning opportunity. However, this potential remains underexploited due to the absence of a coherent territorial narrative. This highlights a key implication of territorial marketing theory: competitiveness depends on the symbolic construction and communication of territorial identity, not solely on the presence of assets.

5.2 Governance and stakeholder coordination

The effectiveness of territorial marketing strategies depends on governance structures and stakeholder coordination. Territorial attractiveness results from the interaction of multiple actors, including public authorities, cultural institutions, and private operators (Zenker and Braun, 2017).

Stakeholder	Role	Level
Ministry of Tourism	Policy and strategy	National
ONMT	Promotion	National/International
Regional councils	Planning	Regional
Local authorities	Infrastructure	Local
Cultural institutions	Heritage management	Local/Regional
Private sector	Service provision	Local

Table 12 : Key stakeholders in tourism governance in Morocco
(Source: Moroccan Ministry of Tourism (2023–2024);
institutional reports; author’s compilation)

This multi-level structure often leads to fragmented initiatives. In the Rabat–Salé–Kénitra region, cultural programming, tourism promotion, and urban development are insufficiently integrated, limiting the coherence of the tourism offer. From a theoretical perspective, this reflects a governance gap, where the absence of coordination mechanisms reduces the effectiveness of collective action (Crouch, 2019). Cultural events such as Mawazine generate visibility but remain weakly connected to broader tourism experiences, reducing their long-term impact.

5.3 Benchmarking and strategic implications

Comparative benchmarking helps identify the strategic mechanisms through which cultural resources are transformed into tourism performance.

Indicator	Marrakech	Rabat
Overnight stays (millions)	9.2	0.82
Average stay (days)	3.4	1.9
International tourism share (%)	~70	~42
Brand recognition	High	Moderate

Table 13 : Comparative tourism performance (Marrakech vs Rabat, 2023)
(Source: Observatoire du Tourisme (2023); international tourism reports; author's compilation)

The comparison highlights significant gaps in both performance and positioning. Marrakech benefits from a mature tourism ecosystem combining branding, product development, and stakeholder coordination. In contrast, Rabat remains at an earlier stage of development. These findings suggest that improving competitiveness in the Rabat–Salé–Kénitra region requires a shift from fragmented initiatives to an integrated territorial strategy. Cultural tourism should be embedded within a broader framework combining branding, governance, and experience design. This leads to a key analytical implication: the transformation of cultural resources into competitive advantage depends on their strategic integration rather than their mere existence. Addressing this issue is essential for intermediate destinations seeking to strengthen their position within increasingly competitive tourism systems.

6. CONCLUSION

This study shows that the Rabat–Salé–Kénitra region possesses significant cultural assets but remains limited by weak positioning, fragmented governance, and insufficient experience design. Improving competitiveness requires an integrated territorial marketing approach combining branding, coordination, and cultural tourism development. While the study is based on secondary data, it highlights the need for further research incorporating qualitative insights. Upcoming international events offer an opportunity to reposition the region, provided they are supported by coherent long-term strategies. To synthesize these dynamics, the following table presents the region's position within the national tourism system. To synthesize the main findings, Table 14 situates the region within the broader Moroccan tourism system.

Indicator	Rabat–Salé–Kénitra	Morocco
Overnight stays (millions)	0.82	29.7
Share (%)	2.8	100
Average stay (days)	1.9	3.2
International tourism (%)	42	~60
Tourism receipts growth	Moderate	High

Table 14 : Key tourism indicators – Rabat–Salé–Kénitra vs Morocco (2023–2024)
(Source: Observatoire du Tourisme (2023); Moroccan Ministry of Tourism (2024); World Bank (2024); author's compilation)

The analysis highlights that improving regional competitiveness requires a systemic approach to territorial marketing. This involves three key conditions: the construction of a coherent and differentiated territorial brand, effective stakeholder coordination, and the development of immersive cultural tourism experiences. The absence of these elements explains the current underperformance of the Rabat–Salé–Kénitra region. From a managerial perspective, strategies should move beyond fragmented promotional actions toward integrated territorial development. This includes articulating a unified regional identity combining cultural heritage and modern urban functions, while strengthening coordination between public and private actors. At the academic level, this study contributes to the literature by integrating cultural tourism and territorial marketing within a unified analytical framework, particularly in the context of intermediate destinations. It highlights the need to move beyond isolated approaches and to consider the dynamic interaction between resources, governance, and positioning. However, the study has limitations, notably its reliance on secondary data and the lack of detailed information on cultural tourism flows. Future research should incorporate qualitative fieldwork, including stakeholder interviews and visitor surveys, to better capture experiential and governance dimensions. Finally, upcoming international events such as the Africa Cup of Nations and the 2030 FIFA World Cup offer strategic opportunities to reposition the Rabat–Salé–Kénitra region. Leveraging these events through coherent territorial marketing and legacy planning could enable cultural tourism to become a key driver of sustainable regional development.

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FROM THE LIPSTICK INDEX TO THE LABUBU EFFECT: UNUSUAL INDICATORS AND METAPHORS AS SIGNALS OF ECONOMIC CRISES

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ABSTRACT

When economic crises occur, a number of unusual and often metaphorical expressions emerge that are both entertaining and memorable. These include the hemline index, the lipstick index, the men's underwear index, the champagne index, the cardboard box index, the R-word index, the Sports Illustrated Swimsuit Issue indicator, and the guns-to-caviar index. Less widely known but similarly expressive labels include the haircut indicator, the diaper index, and the garbage indicator. More recently, Labubu plush figures have appeared as a new type of crisis indicator. The growing popularity and increased purchases of these collectible items, even among adults, have been interpreted by some observers as a new version of the lipstick index. In this sense, they represent a form of small-scale, emotionally driven luxury consumption that tends to intensify in uncertain economic environments. This study argues that these expressions do more than describe consumer trends. They function as metaphors and cultural references that translate complex macroeconomic processes into simple and easily understandable images. In doing so, they shape public discourse about economic crises in a particularly effective way.

Keywords: *hemline index; lipstick index; men's underwear index; champagne index; cardboard box index; R-word index; guns-to-caviar index; Labubu effect; marketing linguistics; crisis*

1. INTRODUCTION

Are we seeing more women around us wearing lipstick, with shorter hair, and dressed in long skirts? If so, we might begin to suspect that a major economic crisis is approaching. At first hearing, of course, this sounds more like a playful observation than a serious economic consideration. Economic cycles are traditionally interpreted and forecast through complex macroeconomic indicators, statistical models, and detailed financial analyses. At the same time, however, economic and business discourse periodically gives rise to simpler “indicators” based on everyday phenomena, which attempt to capture shifts in the economic mood through changes in consumer behavior. Such indicators are often based on patterns that seem surprising and, at first glance, even humorous. Skirt lengths, lipstick purchases, demand for men's underwear, champagne consumption, or even the use of cardboard boxes have all been interpreted by some experts as being related to economic cycles. Although these indicators obviously do not replace classical macroeconomic indicators, they can still, from time to time, draw attention to changes in consumer sentiment and economic expectations (Fernald & Trehan, 2006; Smith, 2012; Netchaeva & Rees, 2016; MacDonald & Dildar, 2020; Papp-Váry, 2023). The phenomenon is also of interest from the perspective of marketing linguistics. Expressions such as the hemline index, the lipstick index, the men's underwear index, or the R-word index are not merely economic observations but also strongly metaphorical linguistic constructions. Through simple and easily imaginable everyday phenomena, these expressions make complex economic processes more understandable, which is precisely why they spread so rapidly in media and business discourse (Kovács, 2019, 2024).

Similar phenomena can be observed in other areas as well, for example in the case of new terms related to inflation such as shrinkflation or greedflation (Bennett, 2022; Mapes-Christ, 2023; Papp-Váry, 2025). The aim of this study is to provide an overview of those unusual, often metaphorical indicators that have appeared in public discourse related to economic crises and periods of prosperity. On the one hand, the paper presents the most well-known examples of such indicators. On the other hand, it also highlights how they are connected to consumer behavior, media discourse, and changes in the economic mood. The study proceeds from the best-known examples through the individual indicators one by one. It begins with the most famous and also the oldest such indicator, the hemline index, which seeks to interpret the relationship between changes in fashion and economic cycles, and concludes with one of today's cultural phenomena, the Labubu effect, which can likewise be linked to crisis conditions.

2. TWELVE CURIOUS INDICATORS AS SIGNALS OF AN APPROACHING ECONOMIC CRISIS

2.1. Hemline Index

Among all indicators of this kind, perhaps the most widely known is the hemline index. According to the theory, there is an interesting relationship between the length of women's skirts and economic cycles: during periods of economic expansion, shorter skirts tend to become fashionable, whereas in times of economic downturn, longer styles come to the fore (Taylor, 1929; Kim, 2014; Škrinjarić, 2020). The idea was formulated in the late 1920s by George Taylor, a doctoral student at the Wharton Business School, who examined the relationship between fashion and economic cycles. According to his observations, women's clothing becomes bolder and shorter during economic booms, while in periods of economic uncertainty, fashion shifts in a more conservative direction (Taylor, 1929). The hemline index gained more serious attention in connection with the Great Depression between 1929 and 1933. In the years preceding the crisis, longer skirts appeared in fashion, which some interpretations later identified as an early sign of economic decline. In the 1930s, however, shorter skirts became popular again, which some authors interpreted as indicating a shift toward economic recovery (Kim, 2014; Škrinjarić, 2020). Similar patterns have been observed in subsequent decades as well. During the economic boom of the 1960s, for example, the miniskirt became a symbol of fashion, while following the oil crisis of the 1970s, fashion once again shifted in a more conservative direction, and skirt lengths increased. Comparable interpretations have also been made in relation to the 1987 financial crisis and the 2008 global financial crisis (Kim, 2014; Škrinjarić, 2020). In recent years, the theory of the hemline index has once again attracted attention. In the spring of 2022, the fashion world saw the widespread emergence of the so-called ultra-miniskirt or "micro-mini" trend, with one of its most notable representatives being the collection of the Italian brand Miu Miu. By the spring of 2023, however, longer, ankle-length skirts reappeared in greater numbers in the fashion industry, which some analysts linked to rising inflation and changes in consumer sentiment associated with economic uncertainty (Papp-Váry, 2023). As mentioned earlier, related interpretations suggest that bolder fashion trends may reflect periods of economic optimism, when consumers approach fashion with greater confidence and a higher willingness to take risks (Škrinjarić, 2020; Kim & Ko, 2012). This raises the question of why shorter skirts tend to appear during periods of economic expansion, while longer ones dominate during downturns. Interestingly, the wearing of shorter skirts was historically closely associated with another garment, namely expensive silk stockings. According to the classical explanation, during economic booms consumers are more willing to purchase visually striking, status-signaling silk stockings, which become visible when worn with shorter skirts.

In times of economic decline, however, consumption becomes more restrained, resulting in longer skirts and a shift toward more conservative fashion (Taylor, 1929; Kim, 2014; Škrinjarić, 2020). Naturally, this explanation was developed in a specific historical context and is less directly applicable today, not least because the price of silk stockings has decreased significantly. The empirical validity of the hemline index is, in any case, limited, and research suggests that it should be interpreted more as a cultural and media discourse phenomenon than as a strict economic indicator (Papp-Váry, 2023). The period of the Covid-19 pandemic clearly illustrated the limitations of the model. During the pandemic, a significant portion of clothing purchases and fashion consumption shifted toward comfortable, home-oriented wear, leading to increased demand for sweatpants, leggings, and other casual items, while the role of traditional fashion cycles receded into the background (Sheth, 2020).

2.2. Haircut Indicator / Recession Hair

In a similar way to the hemline index, other everyday consumption habits have also been linked to economic cycles. One such example is the frequency of visits to hairdressers, which is sometimes mentioned as an informal economic indicator and has become particularly well known in Japan. The underlying observation is that in times of economic uncertainty, consumers often reduce their use of services that are not considered essential, including those in the beauty industry. Research suggests that during economic downturns, women visit hairdressers less frequently and are more likely to choose shorter, easier-to-maintain hairstyles, which can be seen as an everyday manifestation of reduced consumption. Thus, if we see more women with shorter hair, it is not simply because it is a more practical style. Shorter hair is often cheaper to maintain, easier to manage, requires fewer hair care products, and necessitates fewer visits to the hairdresser, all of which can result in significant cost savings during a period of economic crisis. In the media, this phenomenon is often referred to as “recession hair”. In such periods, consumers tend to shift toward cheaper, more natural, or longer-lasting hairstyles, and they extend the time between haircuts or hair coloring treatments (Nesvig, 2025; Jensen, 2025). The decline in demand for beauty services, such as less frequent haircuts, hair coloring, or other personal care services, may therefore be interpreted as an early sign of economic slowdown (Yang, 2025).

Broader patterns of consumer behavior may also underlie this phenomenon. In times of economic uncertainty, households tend to cut back primarily on discretionary services, while essential expenditures remain relatively stable. As a result, changes in demand for beauty services sometimes appear in media and economic discourse as informal indicators of shifts in consumer sentiment. Although the frequency of visits to hairdressers cannot be considered a fully reliable economic forecasting tool, it clearly illustrates how changes in the economic mood can manifest themselves in everyday consumption habits (Papp-Váry, 2023).

2.3. Lipstick Index

As already mentioned, interesting relationships can be observed between the consumption of cosmetic products and economic cycles. The so-called lipstick index originates from an observation by Leonard Lauder, head of the Estée Lauder company, who noted during the economic downturn of 2001 that lipstick sales not only failed to decline but actually increased (Hill et al., 2012; Netchaeva & Rees, 2016; MacDonald & Dildar, 2020). The phenomenon is typically explained by the fact that during economic crises, consumers substitute high-value luxury goods with smaller, more affordable “emotional luxury” products. A similar pattern was observed during the 2008 financial crisis, when certain segments of the cosmetics market continued to show stable demand.

The pandemic period also produced intriguing figures: according to available data, some categories of decorative cosmetics, including lipsticks and lip glosses, still experienced notable growth in 2022, with reports indicating a 15 percent annual increase in the prestige segment (Circana, 2023). Admittedly, growth was less dynamic in other years. Historical analyses have also shown that demand for cosmetic products increased even during the Great Depression of 1929–1933, suggesting that small-scale luxury consumption may persist even in times of crisis (Hill et al., 2012; Netchaeva & Rees, 2016; MacDonald & Dildar, 2020). The inverse relationship underlying the lipstick index between the state of the economy and the consumption of cosmetic products is generally explained by the idea that during economic downturns, consumers abandon many high-value expenditures, while remaining willing to purchase smaller, affordable luxury items. In this sense, a lipstick or other decorative cosmetic product belongs to the category of “affordable luxury,” in contrast to items such as jewelry, designer clothing, or expensive accessories (Papp-Váry, 2023). The phenomenon can also be interpreted from the perspective of consumer psychology and behavioral economics, as in times of economic uncertainty consumers often seek small purchases that provide short-term emotional satisfaction. At the same time, the reliability of the lipstick index has been questioned by several researchers. Empirical studies have shown that sales of cosmetic products do not always closely follow economic cycles, and there may be periods when sales increase significantly during economic expansion but decline during recession (Hill et al., 2012; Netchaeva & Rees, 2016; MacDonald & Dildar, 2020). For this reason, some authors interpret the phenomenon more as an indicator of consumer sentiment and emotional consumption rather than as a strict economic measure. The Covid-19 pandemic provided a particularly interesting test of the lipstick index theory. Some interpretations suggest that the indicator “failed” during the pandemic, as lipstick sales, although increasing in certain years, declined in many markets. However, this interpretation overlooks the specific social context of the pandemic. Due to the widespread use of face masks, the visibility of the mouth and lips was significantly reduced, diminishing the functional role of lipstick. At the same time, interest increased in cosmetic products emphasizing the eye area, such as eyeliners, mascaras, and eye care products (Sheth, 2020). According to some data, for example, sales of eye care products on Chinese e-commerce platforms increased by as much as 150 percent in February 2020. Similar trends were observed among international luxury cosmetic brands, where demand for eye makeup and eye care products showed significant growth (Biron, 2020). The structure of cosmetic consumption also changed in other areas. During the pandemic, demand for nail polishes and at-home manicure products increased, partly due to the prolonged closure of beauty salons and partly because consumers turned toward home-based beauty routines (Sheth, 2020). These developments clearly demonstrate how the cosmetics market adapts to changes in the social environment, and at the same time highlight that simple indicators such as the lipstick index can only provide a limited basis for accurately predicting economic cycles.

2.4. Sports Illustrated Swimsuit Issue Indicator

Among informal indicators related to economic cycles, one of the most unusual is the so-called Sports Illustrated Swimsuit Issue Indicator. It is based on the observation that the nationality of the model featured on the cover of the annual swimsuit issue of the Sports Illustrated magazine may be related to the performance of the U.S. stock market (Papp-Váry, 2023). According to this indicator, when an American model appears on the cover, the U.S. stock market tends to perform better in the following period than when the cover features a non-American model. The phenomenon has been discussed in several financial blogs and economic media outlets. Based on data from Bespoke Investment Group, for example, since 1978, in years when an American model appeared on the cover of the Swimsuit Issue, the S&P 500 index achieved an average annual return of 14.3 percent, with positive performance in 88 percent of cases.

This was about four percentage points higher than the average return in years when the cover featured a non-American model (Melloy, 2012). Widely cited examples in the media have also contributed to the popularity of the indicator. During the dot-com boom in 1999, for instance, California-born Rebecca Romijn appeared on the cover, while the S&P 500 recorded an increase of more than 20 percent. Similarly favorable market conditions characterized 2010, when Brooklyn Decker from Ohio was featured on the magazine's cover. At the same time, the indicator is far from infallible. One of the most notable counterexamples is 2008, when American-born Marisa Miller appeared on the cover, yet the global financial crisis occurred, and the S&P 500 suffered a decline of approximately 37 percent (Melloy, 2012). In the case of such indicators, it is naturally difficult to establish any causal relationship. The phenomenon is better understood as a cultural and media-related pattern. One possible explanation is that the magazine's editors, consciously or unconsciously, may adapt to the general mood of American society. When economic prospects are optimistic, featuring an American model may reinforce narratives of national success and confidence. In more uncertain economic conditions, this pattern may be less pronounced in editorial decisions. The Sports Illustrated Swimsuit Issue Indicator should therefore not be interpreted primarily as an economic forecasting tool, but rather as a vivid example of the cultural narratives and media stories associated with financial markets. Such "anomalies" demonstrate that alongside serious statistical analyses, playful and media-friendly indicators often emerge in economic discourse, reflecting investor sentiment and the workings of the collective economic imagination (Melloy, 2012).

2.5. Men's Underwear Index

Among informal indicators related to economic cycles, particular attention has been given to the so-called men's underwear index, which in economic discourse is often linked to an observation by Alan Greenspan, former Chairman of the Federal Reserve. According to Greenspan, one of the first consumer expenditures that men tend to cut back on during periods of economic uncertainty is the purchase of new underwear. The reasoning is that underwear is a type of clothing that is largely invisible to the public, so postponing its purchase has fewer social or status-related consequences (Smith, 2012; Stevenson & Wolfers, 2011). The underlying assumption is that during economic downturns, households primarily postpone expenditures that are not essential for everyday social appearance. In periods of economic recovery, by contrast, demand for such products may increase again. Some interpretations suggest that this may be especially true for colorful or patterned underwear, which may serve as even clearer signals of consumer optimism and a greater willingness to spend (Smith, 2012; Papp-Váry, 2023). Empirical data also indicate that the underwear market is, to some extent, sensitive to economic cycles. During the 2008–2009 global financial crisis, for example, the volume of underwear sales declined in the United States, while growth resumed during the subsequent economic recovery.

The cyclical nature of clothing consumption has been confirmed by numerous economic studies, which show that discretionary spending on apparel is particularly sensitive to economic downturns (Aguiar & Hurst, 2007; Papp-Váry, 2023). At the same time, the pandemic period demonstrated that the interpretation of such informal indicators can be highly context-dependent. In some countries, for instance, demand for comfortable homewear, including underwear, pyjamas, and sweatpants, actually increased during lockdowns, reflecting the rise of home-based lifestyles and remote work (Sheth, 2020). This suggests that the men's underwear index should be viewed more as an illustrative example of the relationship between consumer behavior and economic sentiment than as a strictly reliable economic indicator.

2.6. Diaper Index

Among alternative indicators related to economic cycles, examples linked to household and family consumption also emerge. The so-called diaper index is based on the observation that during economic downturns, households attempt to reduce everyday consumption expenditures, which may also be reflected in the use of childcare-related products (The Economic Times, 2019). According to some analyses, during recessionary periods families may try to economize on diaper usage, for example by changing diapers less frequently or by choosing cheaper products. One indirect consequence of this may be an increase in the incidence of diaper rash, which in turn can lead to higher demand for skincare creams and rash treatment products. In the United States, for instance, following the 2008–2009 economic crisis, several reports indicated that while diaper usage declined, sales of baby skincare creams increased (Lubin, 2011; Time, 2011; Sheth, 2020). The phenomenon also highlights that economic crises affect not only luxury consumption but also the basic expenditures of everyday life. The costs associated with raising children can represent a significant burden for households, and in times of economic uncertainty, families often seek ways to reduce these expenses. Interestingly, this may manifest not only in less frequent diaper changes or the purchase of cheaper, lower-quality diaper brands, but also in efforts to toilet train children at a younger age. In other words, parents may encourage their children to use a potty sooner (Papp-Váry, 2023). Nevertheless, the diaper index should be regarded primarily as an illustrative example that demonstrates the sensitivity of household consumption to economic cycles rather than as a precise economic forecasting tool.

2.7. Cardboard Box Index

A lesser-known yet occasionally cited informal indicator of economic activity is the cardboard box index. The idea behind it is that during periods of economic expansion, increases in production, trade, and especially e-commerce volumes are accompanied by rising demand for shipping materials, including cardboard boxes. Since cardboard boxes play a key role in the transportation and storage of goods, their level of use may to some extent reflect changes in overall economic activity (Papp-Váry, 2023). During the 2008–2009 global financial crisis, for example, demand for corrugated packaging declined significantly in the United States, reflecting the downturn in commercial and industrial activity. A similar pattern has been observed more recently: according to data from the Fibre Box Association, demand for cardboard boxes reached a multi-year low in the final quarter of 2022, which some analysts interpreted as a sign of slowing consumer demand (Mohamed, 2025). While such indicators do not replace traditional economic statistics, they can provide an illustrative signal of changes in logistics and trade processes.

2.8. Garbage Indicator

Closely related to the cardboard box index is the so-called garbage indicator, or waste indicator. The concept is based on the relationship between economic activity and the volume of waste generated. During periods of economic growth, consumption and production typically increase, which is accompanied by a rise in waste generation. Conversely, during economic downturns, reduced consumption and declining production often lead to a decrease in waste volumes (Beigl et al., 2008; The Economic Times, 2019). For this reason, some studies suggest that such data can be used as a supplementary indicator in the analysis of economic cycles. Indicators of this type are particularly relevant in examining the relationship between urban waste management and consumption patterns. At the same time, the volume of waste is influenced by many other factors, including environmental regulations, changes in recycling rates, and the broader spread of sustainability principles and practices (Kovács, 2023).

2.9. R-word Index (Recession Word Index)

A particularly interesting example within the discourse on economic crises is the so-called R-word index, which examines the frequency of the word “recession” in the media. The indicator was developed by the weekly magazine *The Economist* and is based on the simple observation that the frequency of the term’s usage in media coverage may be related to perceptions of economic uncertainty (*The Economist*, 2009). The index is calculated by analyzing how often the word “recession” appears in leading U.S. newspapers such as *The New York Times* and *The Washington Post*. The assumption is that the more frequently the term appears in the media, the greater the level of economic concern in public discourse. The indicator thus does not measure economic performance directly but rather reflects changes in economic sentiment and media narratives. This, of course, raises the question of causality. It is not entirely clear whether the media writes more about recession because economic conditions are already deteriorating, or whether intensive media coverage of recession itself reinforces feelings of economic uncertainty among consumers and investors. What is clear, however, is that research on economic expectations shows that media narratives can indeed influence the decisions of economic actors (Shiller, 2017).

2.10. Champagne Index

Among consumption-based indicators related to economic cycles, the champagne index is also frequently mentioned. The idea is that during periods of economic expansion, consumers celebrate more and participate in more social events, which is accompanied by increased demand for champagne and other premium beverages. During economic downturns, however, consumers often turn to cheaper alternatives. The development of the champagne market has in several cases reflected economic cycles. During the 2008–2009 global financial crisis, for example, champagne sales declined significantly across many markets. In the preceding years, particularly between 2000 and 2007, champagne sales had shown rapid growth, reaching a record of 338.7 million bottles sold in 2007. The financial crisis, however, sharply interrupted this trend: in the first six months of 2009, the value of French champagne exports fell by approximately 45 percent, while volume declined by 41 percent compared to the same period of the previous year (Davies, 2009). The downturn was particularly pronounced in the United States and the United Kingdom, traditionally among the most important export markets for champagne. The Covid-19 pandemic also clearly illustrates changes in consumption patterns. In 2020, due to lockdowns and the absence of social events, demand for champagne declined significantly, with sales falling by around 18 percent. However, when social events and celebrations resumed in 2021, sales quickly recovered: global champagne shipments reached 322 million bottles, representing a 32 percent increase compared to the previous year. In the French market, nearly 142 million bottles were sold, marking a return to pre-pandemic levels, while exports reached a new record of approximately 180 million bottles. This growth was largely driven by the revival of social events and the corresponding increase in demand for champagne (Comité Champagne, 2022). The example clearly shows that champagne consumption is closely linked to both social and economic sentiment.

2.11. Guns-to-Caviar Index

The relationship between economic cycles and geopolitical processes is reflected in the so-called guns-to-caviar index. The term “guns” refers to military spending, particularly the financing of military aircraft, while “caviar” metaphorically represents luxury consumption, specifically the purchase of business or private jets. The concept was first used by Richard Aboulafia, an aviation industry analyst at the Teal Group, in industry reports to illustrate how the military and civilian aircraft markets often respond differently to geopolitical and economic developments (Seligson, 2016).

The underlying assumption is that when global geopolitical uncertainty increases, governments allocate a larger share of resources to defense spending and military technology. In contrast, during periods of economic stability and expansion, investments by the corporate and private sectors, including those related to luxury consumption, tend to come to the fore. Changes in the ratio of military to civilian aircraft orders may therefore, according to some analyses, be interpreted as an indicator of both economic and geopolitical sentiment (SIPRI, 2023; The Economic Times, 2022). Naturally, however, this indicator cannot be considered a strict economic forecasting tool. The level of defense spending is influenced by numerous other factors, including security policy conditions, international conflicts, and government priorities. Nevertheless, the guns-to-caviar index provides a vivid illustration of how closely economic cycles and geopolitical processes are often intertwined (Papp-Váry, 2023).

2.12. Labubu Effect

In recent years, a new example has emerged linking economic sentiment and consumer behavior to cultural phenomena, sometimes referred to in the media as the Labubu effect. Labubu is a collectible designer plush figure that has become particularly popular among young adults and so-called “kidults”, adults who purchase products typically associated with children and often display similar patterns of behavior (Bernardini, 2014; Hayward, 2024). The phenomenon can be connected to the broader trend that in times of economic uncertainty, consumers often turn toward smaller items with emotional value. Although these products are not necessarily cheap compared to other plush toys, they remain more affordable than higher-value goods such as electronic devices, designer clothing, jewelry, cars, or home renovations. Moreover, Labubu and similar items offer strong psychological and emotional attachment for consumers. Research on consumer behavior suggests that such forms of “affordable pleasure” can become particularly popular during periods of crisis (Kapferer & Bastien, 2012; Sheth, 2020; Yang & Li, 2025). In this sense, some authors interpret the Labubu phenomenon as a modern version of the lipstick index. While the lipstick index highlights increased demand for cosmetic products during economic downturns, the Labubu effect points to rising demand for collectible figures, toys, and pop-cultural items. This phenomenon is also linked to the spread of “kidult” consumption, in which adults purchase products associated with childhood for emotional or nostalgic reasons, or simply as a form of infantilism (Euromonitor, 2023, 2025; Hayward, 2024). The Labubu effect, therefore, is not merely another economic indicator but also illustrates how economic sentiment and cultural consumption are interconnected in the digital age.

3. CONCLUSION

The unusual indicators presented in this study may at first glance appear humorous or anecdotal. However, the hemline index, the lipstick index, the men’s underwear index, the cardboard box index, and the guns-to-caviar index all suggest that there are often observable relationships between economic processes and everyday consumption habits. It is important to emphasize, however, that these indicators are generally not strict economic measures but rather illustrative metaphors that reflect changes in economic sentiment and society. This is precisely what makes them particularly interesting: they condense complex economic phenomena into simple, easily understandable images, which allows them to spread rapidly in the media and public discourse. At the same time, it is essential to distinguish between correlation and causation. A classic example illustrates this well: statistically, there is a correlation between ice cream sales and the number of shark attacks. The reason, however, is not that increased ice cream consumption leads to more shark activity, but rather that both phenomena intensify during the summer. Warmer weather draws more people to coastal areas, increasing both ice cream consumption and the frequency of sea bathing, and thus the likelihood of shark attacks (Stevens et al., 2025).

A similar caution is needed when interpreting economic indicators. Although the indicators discussed often move in parallel with economic cycles, this does not necessarily imply a direct causal relationship. Nevertheless, these unusual indicators play an important role in communicating economic phenomena, as they make changes in economic sentiment perceptible in a clear, accessible, and memorable way.

ACKNOWLEDGEMENT: *The Hungarian-language version of this paper was published in the proceedings of the Marketing Linguistics 2025 conference organized by Eötvös Loránd University. The present paper is an expanded and revised English-language version of that work.*

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GREEN INVESTMENTS AND CO₂ EMISSIONS: THE MODERATING ROLE OF INSTITUTIONAL QUALITY

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ABSTRACT

The optimal allocation of international climate finance represents a pivotal challenge in the context of today's climate emergency. While the literature suggests that institutional quality shapes the effectiveness of environmental policies, no study has formally tested whether it specifically moderates the impact of green investments on carbon dioxide emissions. This research fills that gap by empirically examining the moderating role of institutional quality in this relationship. This study confronts a significant methodological challenge. Conventional measures of green investments suffer from important limitations in terms of coverage and international comparability. At the same time, governance indicators face problems of dimensionality and multicollinearity. To overcome these constraints, we construct two composite indices using Principal Component Analysis. The first synthesizes four dimensions of green investments (renewable energy production, R&D expenditures, green bonds, and energy efficiency. The second unifies the six dimensions of the Worldwide Governance Indicators into a single composite measure of institutional quality). This dual construction enables more robust measurement while facilitating econometric estimation. Analyzing a panel of countries over the 2000–2023 period using the Panel ARDL-PMG methodology, we deploy a three-stage empirical strategy. In the first and second stages, we estimate two global specifications over the full sample. The baseline model tests the direct effectiveness of green investments in reducing CO₂ emissions alongside the direct effect of institutional quality. The second model introduces an interaction term between green investments and institutional quality, formally testing the institutional conditionality hypothesis. In a third stage, we estimate the interaction specification separately for three income-based country groups, thereby exploring developmental heterogeneity. The empirical results reveal three major findings that challenge conventional theoretical predictions. First, green investments exert a significant negative effect on CO₂ emissions, confirming their environmental effectiveness. Second, the marginal effectiveness of green investments in emission reduction increases as institutional quality improves. Finally, the disaggregated analysis by income level amplifies this picture by uncovering deep developmental heterogeneity. Lower-middle-income economies exhibit maximum direct effectiveness of green investments and strong institutional moderation, while advanced countries show lower effectiveness and no significant institutional moderation. This developmental heterogeneity suggests that advanced and emerging economies operate under fundamentally distinct technological and institutional regimes. These findings challenge the prevailing practice of conditioning climate finance on prior institutional reforms. A strategic geographic reallocation favoring emerging economies could substantially improve overall environmental effectiveness without any increase in total expenditure, maximizing emission reductions per dollar invested.

Keywords: *Green investments, Institutional quality, CO₂ emissions, Panel ARDL-PMG, Institutional conditionality, Climate finance*

1. INTRODUCTION

The global energy transition demands unprecedented financial allocation decisions in a context of scarce resources. Achieving carbon neutrality by 2050 requires tripling annual investments in low-carbon technologies, reaching four trillion dollars by 2030. This massive financial mobilization is unfolding alongside heightened budgetary constraints stemming from successive shocks — the pandemic, the energy crisis, and persistent inflationary pressures. Against this backdrop of capital scarcity and fierce competition between investment priorities, a critical question emerges for international policymakers: where and how should these resources be deployed to maximize emission reductions per dollar invested?

The empirical literature has documented the impact of green investments on carbon dioxide emissions, revealing a robust but contextually variable negative relationship. Chen and Chen (2021), analyzing thirty Chinese provinces, demonstrate marked spatial heterogeneity — developed coastal provinces showing substantial reductions while interior provinces display non-significant effects. Shen et al. (2020) and Sun et al. (2022) confirm that green investments prove particularly effective in regions with initially low emissions, suggesting diminishing returns in already partially decarbonized contexts. The international investigation broadens this perspective considerably. Xu et al. (2023), examining E7 economies, establish that green investments generate significant reductions when supported by education and foreign direct investment. Ganda (2018), analyzing OECD countries, confirms the profound impact of renewable energy investments in economies with robust regulatory frameworks. Li et al. (2022) reveal that effectiveness is moderated by globalization and technological innovation in MINT countries. Luo et al. (2021) confirm these patterns in selected Asian economies. Hordofa et al. (2023) demonstrate that eco-innovation significantly amplifies the impact of green investments in China. Fan et al. (2023) establish that ICT development generates synergistic effects with green investments. Behera et al. (2024), exploring fourteen emerging economies, establish that political stability substantially reinforces this effectiveness. In parallel, a distinct body of literature examines the role of institutional quality in environmental performance, establishing that institutional arrangements constitute fundamental determinants of emission trajectories. Several recent studies confirm the beneficial influence of governance on carbon emission reductions. Dincă et al. (2022), analyzing forty-three developed and developing countries, demonstrate that government effectiveness and regulatory quality exert a significant impact in reducing CO₂ emissions. In the BRICS context, research confirms that all six dimensions of institutional quality contribute favorably to carbon mitigation. Yet nuanced results emerge in certain contexts — a close examination of multinationals reveals that while control of corruption and accountability significantly reduce emissions, political stability and government effectiveness paradoxically show a positive impact on emission rates, suggesting that the current institutional environment remains insufficient to ensure the transition to carbon neutrality. Despite the robustness of this empirical evidence, a theoretical and methodological gap persists. The literature treats green investments and institutional quality as independent determinants of emissions, without interrogating their potential interaction. Yet this question is crucial: determining whether institutions condition the effectiveness of environmental investments would reveal whether governance constitutes a prerequisite for the success of climate policies. The institutional conditionality hypothesis, though central to the architecture of international climate finance, has never been formally tested through an econometric specification including an explicit interaction term between green investments and governance indicators. This study fills that gap by testing whether the effectiveness of green investments in reducing CO₂ emissions is conditioned by institutional quality, and whether it varies systematically according to the level of economic development.

Our empirical investigation draws on the Panel Autoregressive Distributed Lag methodology with the Pooled Mean Group estimator developed by Pesaran, Shin, and Smith (1999), allowing us to simultaneously capture short-run dynamics and long-run equilibrium relationships. We analyze a multi-country panel covering the 2000–2023 period — a timeframe that captures the full maturation cycle of modern renewable energy technologies and encompasses multiple complete economic cycles. Our contribution rests on three major methodological and empirical advances. First, we construct two innovative composite indices using Principal Component Analysis, overcoming the limitations of conventional measures. The green investment index aggregates four fundamental dimensions: renewable energy production, R&D expenditures in clean technologies, green bond issuances, and energy efficiency. The institutional quality index synthesizes the six dimensions of the Worldwide Governance Indicators into a single composite measure unifying political governance, administrative effectiveness, and rule of law. Second, we formally test the institutional conditionality hypothesis by including an explicit interaction term between green investments and institutional quality in our econometric specification — an approach virtually absent from prior literature. Third, we explore developmental heterogeneity by estimating our model separately for three income-based country subgroups, revealing differentiated mechanisms operating in advanced economies compared to emerging ones. Our results reveal a major institutional paradox that contradicts the predictions of conventional economic theory and the assumptions currently guiding the allocation of international climate finance. Contrary to the institutional complementarity hypothesis, the interaction term between green investments and institutional quality carries a negative and statistically significant coefficient, indicating that the effectiveness of green investments in reducing emissions declines as governance improves. The disaggregated analysis amplifies this paradox by revealing that green investments are approximately twice as effective in middle-income economies characterized by imperfect governance compared to advanced economies with robust institutions. This differential effectiveness is explained by the convergence of three economic mechanisms: carbon saturation in developed economies reducing marginal reduction potential; structural expansion induced by strong institutions generating additional emissions; and the technological pragmatism imposed by resource constraints, which favors the rapid deployment of proven solutions. These findings carry profound implications for the architecture of international climate finance. They directly invalidate the dominant practice of systematically conditioning climate finance on prior institutional reforms — a conditionality that may prove actively counterproductive by delaying technological deployments. A strategic geographic reallocation favoring emerging economies could substantially improve overall environmental effectiveness without any budgetary increase, maximizing emission reductions per dollar invested. The paper proceeds as follows. Section 2 presents a thorough literature review positioning our work within the existing corpus. Section 3 details our empirical methodology, including the construction of our composite indices and our econometric identification strategy. Section 4 presents our main results, structured in three stages: global estimation comparing models without and with interaction, stratified analysis by income level, and robustness tests. Section 5 discusses the underlying economic mechanisms and develops the implications for international climate policy.

2. LITERATURE REVIEW

Understanding the determinants of carbon dioxide emissions constitutes a major scientific challenge in the context of today's climate emergency. Faced with accelerating global warming and the need to mobilize massive investments in the energy transition, a fundamental question emerges for international policymakers: which factors effectively reduce emissions, and are there prerequisite conditions that shape the effectiveness of these interventions?

This question carries profound implications for the optimal allocation of international climate finance in a context of financial resource scarcity. If certain prerequisites prove necessary for environmental investments to generate emission reductions, then the allocation strategy should prioritize countries satisfying those conditions. Alternatively, if environmental interventions function effectively regardless of context, then the logic would call for geographic deployment maximizing coverage rather than institutional selectivity. The existing empirical literature has documented the direct impact of numerous determinants on CO₂ emission trajectories, revealing that investments in green technologies, institutional quality, economic development, trade openness, and technological innovation all significantly affect CO₂ emissions. These contributions have established robust relationships between these factors and environmental performance across multiple geographic and temporal contexts. A critical gap persists in this literature, however: almost no study formally examines whether certain of these determinants constitute prerequisites that moderate the effectiveness of other interventions, rather than operating solely as direct and independent factors. This conceptual distinction is fundamental because it determines whether climate policies must be deployed sequentially — with certain conditions needing to be established before others can function effectively — or whether they can be implemented simultaneously as parallel determinants. Our empirical study aims precisely to fill this gap by formally testing whether institutional quality moderates the effectiveness of green investments in reducing CO₂ emissions. More specifically, we examine whether the marginal effect of green investments on emissions varies systematically as a function of countries' governance level, and whether this moderation differs qualitatively according to the stage of economic development. This literature review structures its investigation around this central question by first examining the empirical evidence on green investment effectiveness as a determinant of CO₂ emissions, then exploring the role of institutional quality in environmental performance, before identifying the methodological gap regarding their potential interaction. The hypothesis that green investments reduce emissions rests on solid theoretical mechanisms drawn from environmental economics. Direct technological substitution constitutes the primary channel, whereby renewable capacities progressively replace fossil sources, mechanically generating emission reductions proportional to the scale of deployment. Beyond this immediate substitution effect, green investments also induce positive externalities through technological learning, economies of scale in production, and network effects facilitating adoption by other actors. These theoretical mechanisms suggest that an increase in green investments should translate into a decrease in CO₂ emissions, all else being equal. The empirical literature has documented this negative relationship across multiple contexts, establishing that green investments constitute a significant determinant of emission trajectories. The magnitude of this effect remains debated, however, with several studies revealing substantial heterogeneity across geographic and developmental contexts that remains largely unexplained. Chen and Chen (2021) analyze thirty Chinese provinces over the 2005–2018 period using a spatial panel model, demonstrating that an increase in green investments generates a significant decrease in CO₂ emissions. Their investigation reveals, however, marked spatial heterogeneity: developed coastal provinces such as Guangdong exhibit elasticities reaching minus thirty percent, contrasting with non-significant or even slightly positive effects in interior provinces characterized by weaker governance. This geographic variation suggests that the effectiveness of green investments may be conditioned by specific contextual factors, without formally identifying the underlying mechanisms responsible for this heterogeneity. The authors note that low-performing provinces generally display lower governance scores, higher corruption, and less rigorous enforcement of environmental regulations — yet they do not statistically test whether these institutional differences causally explain the observed variations in the effectiveness of green investments.

Moving beyond isolated national analyses, Azam et al. (2022) examine the world's major emitters (2016–2020) using panel quantile regression, revealing marked disparities according to initial carbon intensity. For moderate emitters (lower quintiles), the elasticity of energy transition investments reaches approximately -0.40, compared to -0.15 for very large emitters (upper quintiles) such as China and Russia. This divergence suggests diminishing marginal environmental returns: countries with extremely high emissions face stronger structural resistance, requiring substantially larger investment volumes to achieve proportional reductions equivalent to those of moderate emitters. This heterogeneity corroborates Yadav et al. (2024), who analyze the BRICS using CS-ARDL and confirm that the effectiveness of green investments varies substantially across these emerging economies despite similar development trajectories. Their country-by-country estimates reveal coefficients varying by a factor of three between high-performing and low-performing countries, positively correlated with governance scores. Nevertheless, their analysis remains essentially comparative, without systematically testing the moderation mechanism through interaction terms in a global specification. Alongside this, Halder and Sethi (2020) emphasize that the effectiveness of environmental policies and financial development is conditioned by institutional quality. By dividing their sample according to the governance median, they observe that countries above the threshold display more negative elasticity coefficients for green energy consumption, indicating a significantly amplified reducing impact on CO₂ emissions. Nevertheless, this sub-sample approach provides only suggestive evidence without precisely quantifying the marginal effect. The absence of a multiplicative interaction term limits the rigorous statistical testing of this conditionality. An important emerging dimension concerns temporal non-linearities and technological complementarities that modulate the effectiveness of green investments over time. These contributions robustly establish that green investments constitute a significant determinant of CO₂ emissions, with a negative relationship consistently documented across multiple geographic, temporal, and methodological contexts. Two major observations nonetheless emerge from this empirical synthesis. First, the heterogeneity observed in the magnitude of the effect across geographic and developmental contexts remains largely unexplained at the level of causal mechanisms. Studies identify significant variations in estimated elasticities — some contexts implying coefficients three to four times larger than others for comparable levels of green investment — without formally testing the structural factors responsible for these differences. Second, while several studies descriptively suggest that contextual factors such as provincial governance, political stability, or institutional capacities might moderate the effectiveness of green investments, none has formally tested this hypothesis through an econometric specification including an explicit interaction term between green investments and institutional quality on a broad and representative international panel. Beyond green investments, a second substantial body of literature examines whether institutional quality itself constitutes a direct determinant of emission trajectories, independently of specific investments in green technologies. The economic theory of institutions, whose modern foundations were established by North (1990), attributes to institutional arrangements a determining role in economic and social performance across multiple domains. North conceptualizes institutions as the rules of the game structuring human interactions, reducing transaction costs, securing property rights, and creating a predictable environment favoring the long-term investments necessary for the structural transformation of economies. Acemoglu and Robinson (2012) substantially refine this perspective by establishing a fundamental conceptual distinction between extractive institutions — concentrating political and economic power in the hands of narrow elites — and inclusive institutions that broadly distribute political power while protecting property rights for the entire population. Applied to the environmental domain, this institutional theory suggests several channels through which governance quality should directly affect nations' environmental performance.

The first channel operates through the effective enforcement of environmental regulations, where strong institutions characterized by robust rule of law and a competent bureaucracy can enforce environmental standards and resist pressure from interest groups seeking to weaken these regulations to preserve their economic rents. In weak institutional contexts characterized by high corruption and regulatory capture, even the most sophisticated formal regulations may remain largely unenforced, creating a gap between declared political ambitions in legislative frameworks and operational reality on the ground. The second channel concerns the credibility and temporal consistency of long-term environmental policies. Government commitments on energy transition must be perceived as durable and credible over the fifteen-to-twenty-five-year horizons that characterize typical return periods for green infrastructure investments such as wind or solar farms. Quality institutions generate this inter-temporal credibility through constitutional mechanisms and checks and balances that limit future governments' capacity to unilaterally renege on commitments made by their predecessors, thereby reducing political risk for private investors and facilitating the mobilization of capital needed for the energy transition. The third channel involves the governance of public funds and the effective control of corruption in the allocation and execution of environmental expenditures. In weak governance contexts, the diversion of financial resources officially allocated to environmental projects drastically reduces the real efficiency per monetary unit invested, with a significant portion of budgets never reaching their intended destination or being captured by corrupt intermediaries. Specific studies on corruption in public infrastructure projects suggest that in some contexts characterized by particularly weak governance, up to thirty to forty percent of budgets may be diverted, implying that environmental effectiveness per budgeted dollar could be halved compared to a context of robust governance. These three theoretical channels collectively suggest that an improvement in institutional quality should directly reduce CO₂ emissions by facilitating the effective implementation of environmental policies, by creating a predictable environment favoring private green investments, and by ensuring that public resources allocated to the environment are actually used for their intended purposes. The empirical evidence directly testing the relationship between institutional quality and CO₂ emissions reveals results broadly consistent with these theoretical predictions in developed economies, accompanied, however, by important nuances and counter-intuitive results in certain developing contexts. Ahmad et al. (2022) analyze the moderating role of institutional quality in the relationship between financial development and environmental degradation, demonstrating that human capital and institutional quality significantly attenuate the negative effects of financial development on ecological footprint. Their results suggest that quality institutions constitute not only a direct determinant of emissions but also a modulator of the effectiveness of other interventions. Sethi et al. (2024) explore the combined role of green finance, green technological innovation, and institutional quality in the environmental sustainability of developing economies. Their CS-ARDL analysis reveals that these three factors interact in complex ways, with institutional quality amplifying the effectiveness of green finance and technological innovation in reducing carbon emissions. Acheampong et al. (2021) examine the moderating role of institutional quality in the effectiveness of renewable energy on emissions in sub-Saharan Africa. Their results demonstrate that in countries with low institutional quality, renewable energy consumption fails to significantly reduce emissions, suggesting that a minimal institutional threshold is necessary for green investments to generate environmental benefits. A critical gap nonetheless persists in this literature: almost no study formally examines whether institutional quality constitutes a prerequisite that modulates the marginal effectiveness of green investments through an econometric specification including an explicit interaction term. This conceptual distinction is fundamental because it determines whether climate policies must be deployed sequentially — with certain institutional conditions needing to be established before green investments can function effectively.

These diverse empirical contributions establish that institutional quality does indeed affect environmental performance in most contexts, though the precise magnitude, directional sign, and underlying causal mechanisms remain debated and contextually contingent. Three main conclusions emerge from this extensive synthesis of the empirical literature. First, the majority of studies conducted in developed economies confirm a direct beneficial effect of institutions on environmental performance, particularly for institutional dimensions related to government effectiveness, regulatory quality, and rule of law — consistent with the predictions of neo-institutional theory, according to which mature institutions facilitate the effective implementation of environmental policies through a competent bureaucracy and robust control mechanisms. Second, paradoxical results emerge recurrently in developing economies, particularly in sub-Saharan Africa and certain Asian economies, where institutional improvement may paradoxically be associated with transitory environmental degradation through mechanisms of structural expansion and rapid industrialization — suggesting that the relationship between institutions and environment potentially follows an inverted-U curve similar to the environmental Kuznets curve. Third, the substantial heterogeneity observed across specific dimensions of institutional quality suggests that different institutional components operate through distinct channels with potentially divergent effects — some dimensions such as government effectiveness primarily affecting policy implementation, while others such as voice and accountability operate through social demand for a quality environment.

3. METHODOLOGY AND DATA

Our empirical analysis draws on a balanced panel of 46 countries observed over 24 consecutive years (2000–2023). Sample selection responds to two strict criteria: first, the continuous availability of at least twenty years of complete data on CO₂ emissions, GDP per capita, green investments, and governance indicators — thereby excluding countries suffering from substantial statistical gaps likely to bias the estimates; second, the presence of significant green investments, excluding countries without meaningful decarbonization effort and ensuring sufficient variance in our main explanatory variable. The sample collectively represents 70% of global CO₂ emissions, 65% of world GDP in purchasing power parity, and 85% of global green investments — considerably strengthening the scope and generalizability of our findings. The geographic composition spans all continents and all development levels. The 2000–2023 period captures the full maturation cycle of modern renewable energy technologies, from the first major commercial installations to the current phase of cost-competitiveness with fossil fuels, while encompassing several complete economic cycles that allow testing the robustness of estimated relationships across different macroeconomic conditions. Our dependent variable corresponds to CO₂ emissions measured in metric tons per capita and transformed using the natural logarithm (LCO₂). This per-capita measure neutralizes the demographic size effect, while the logarithmic transformation normalizes the asymmetric distribution, allows direct interpretation of coefficients as elasticities, and stabilizes the variance of residuals. Empirically measuring green investments constitutes a major methodological challenge given the multidimensional and heterogeneous nature of this concept. Unlike unambiguous economic variables such as GDP or inflation, green investments simultaneously encompass financial flows (green bonds, subsidies), R&D expenditures, physical infrastructure deployments (renewable capacities), and energy efficiency improvements — each dimension contributing distinctly but complementarily to the energy transition. Aggregating these multiple dimensions into a single synthetic indicator requires a robust statistical methodology that avoids arbitrariness in weighting. Our approach relies on Principal Component Analysis (PCA). Our composite green investment index (GI) aggregates four fundamental dimensions capturing the full spectrum of decarbonization efforts.

The first dimension measures annual effective renewable electricity production in gigawatt-hours, encompassing all operational decarbonized technologies: solar photovoltaic and thermal, onshore and offshore wind, modern hydroelectricity (excluding controversial large dams), certified sustainable biomass, and geothermal. This dimension captures the tangible, immediate results of green investments in the form of installed and functional production capacities effectively replacing fossil sources. Data come from the IRENA (International Renewable Energy Agency) database. The second dimension integrates public and private R&D expenditures in decarbonized energy technologies, measured in millions of constant 2020 dollars to neutralize inflation and ensure temporal comparability. This dimension reflects investments in future technological capacities that will determine the efficiency and cost of renewable deployments in coming decades. R&D constitutes a crucial determinant of the cost reduction trajectory historically observed for green technologies — solar photovoltaic having experienced an 89% cost decrease between 2010 and 2023 directly attributable to cumulative technological advances. The third dimension broadens the financial perspective by incorporating annual green bond issuances — debt instruments whose raised capital is contractually and exclusively allocated to financing certified environmental projects according to international Green Bond Principles standards. This dimension captures the mobilization of institutional private capital toward the energy transition, reflecting investor confidence in the financial profitability of green projects and the credibility of issuers' climate commitments. The green bond market has experienced spectacular exponential growth, rising from negligible amounts in 2007 (below 1 billion USD) to over 500 billion dollars in annual issuances in 2023 according to Climate Bonds Initiative statistics — testament to the structural transformation of the global financial system progressively incorporating climate risks into its capital allocation decisions. Finally, the fourth dimension recognizes the crucial and often overlooked role of energy efficiency, measured by the inverse energy intensity — the real GDP generated per unit of primary energy consumed (constant 2017 USD per ton of oil equivalent). This dimension captures economies' capacity to decouple economic growth from energy consumption through technological improvement of industrial processes, building thermal insulation, transportation optimization, and structural tertiarization toward less energy-intensive activities. Energy efficiency theoretically constitutes the most economically cost-effective decarbonization lever — the International Energy Agency estimating in its Net Zero scenario that 40% of necessary emission reductions by 2050 will come from efficiency gains rather than substitution toward decarbonized sources. The assigned weights are as follows: renewable energy production per capita (33.05%), R&D in renewable energies (33.96%), green bond issuances (20.40%), and energy efficiency (12.59%).

$$GI_{it} = 0.3305 \times RenewProd_{it} + 0.3396 \times RDGreen_{it} + 0.2040 \times GreenBonds_{it} + 0.1259 \times EnergyEff_{it}$$

The statistical validity of this construction is confirmed by factor analysis: the first component explains 62.4% of total variance. The standardized and then log-transformed index facilitates econometric interpretation in terms of elasticities. Internal consistency tests (Cronbach's alpha = 0.70; KMO = 0.72) attest to the methodological robustness. Measuring institutional quality in empirical analyses raises a methodological difficulty. The World Bank's Worldwide Governance Indicators (WGI), developed by Kaufmann et al. (2010) and constituting the international reference for governance measurement, provide six distinct dimensions capturing complementary but conceptually differentiated facets of institutional quality: Voice and Accountability, Political Stability and Absence of Violence, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption.

The standard approach would be to include these six dimensions separately as explanatory variables in our regression specifications, thereby preserving the full informational richness of

this multidimensional granularity. However, this direct approach faces three major econometric obstacles making its implementation problematic in our analytical context. First, the six WGI dimensions exhibit strongly elevated bilateral correlations in our sample — correlation coefficients ranging between 0.82 and 0.96 with a mean of 0.89 — generating severe multicollinearity when included simultaneously as independent regressors. This multicollinearity translates into mean variance inflation factors (VIF) reaching 16.48, far exceeding the critical threshold of 10 beyond which estimates become unstable and significance tests lose their statistical power. Second, including the six dimensions separately rapidly exhausts the available degrees of freedom, particularly when testing interaction effects between green investments and institutional quality — our central hypothesis. Third, with 1,104 total observations, 46 countries, and 24 periods, estimating twelve additional coefficients (six direct effects plus six interactions) would undermine the statistical precision of our main estimates. Faced with these considerations, we adopt the Principal Component Analysis approach to construct a composite institutional quality index (IQINDEX) that objectively aggregates the six WGI dimensions into a single synthetic indicator. This approach, explicitly recommended by the OECD (2015) in its reference methodological manual on composite indicator construction and recently validated in the specific context of institutional governance by Vatamanu et al. (2025), presents the crucial methodological advantage of deriving aggregation weights in a purely statistical manner from the empirical covariance structure of the data, rather than imposing them arbitrarily according to the researcher's subjective judgment. The resulting composite index is formally expressed as:

$$IQINDEX_{it} = 0.1493 \times Voice_{it} + 0.1560 \times Stability_{it} + 0.1721 \times Effectiveness_{it} + 0.1730 \times Regulatory_{it} + 0.1770 \times RuleLaw_{it} + 0.1736 \times Corruption_{it}$$

The application of principal component analysis to these six standardized dimensions produces statistically robust results validating this aggregative approach. The Kaiser-Meyer-Olkin test reaches a value of 0.92, far exceeding the excellence threshold of 0.80, indicating that the observed correlations result massively from a common latent factor rather than random coincidences. Cronbach's alpha of 0.98 reveals exceptional internal consistency surpassing conventional psychometric reliability thresholds, confirming that the six dimensions measure a unified theoretical concept with a robustness comparable to the most rigorous instruments in the social sciences. The first principal component explains 91.2% of total variance — a remarkably high proportion that far exceeds the recommended threshold of 60% and attests that an overwhelming share of the information contained in the six variables can be synthesized by a single latent factor with minimal informational loss. Our specification includes five control variables neutralizing potential confounding factors. Economic development constitutes the first fundamental control, measured by the logarithm of real GDP per capita in purchasing power parity (LGDP, constant 2017 international dollars, World Bank). Population size (LPOP) controls for economic scale effects that directly affect the relationship between green investments and emissions. Trade openness (LTRADE), measured by the logarithm of the ratio of total trade to GDP, controls for three economic channels through which international integration affects emissions independently of domestic green investments. General technological innovation (LINNOV), measured by worldwide patent applications, isolates the specific effect of green investments by controlling for the country's general innovation capacities. Finally, ICT development (LICT), measured by internet usage in the population, controls for economic transformations induced by digitalization that affect emissions through channels distinct from green investments. Our modeling rests on the Panel Autoregressive Distributed Lag (Panel ARDL) model with the Pooled Mean Group (PMG) estimator developed by Pesaran, Shin, and Smith (1999).

This methodological choice is motivated by four econometric properties particularly well-suited to our research question and data structure. First, the Panel ARDL approach simultaneously captures short-run dynamics and long-run equilibrium relationships. Second, the PMG estimator accommodates heterogeneity in short-run dynamics across countries while constraining long-run coefficients to be identical across panel entities. Third, unlike classical cointegration approaches requiring all variables to be integrated of the same order, the Panel ARDL functions with mixed integration orders, accommodating both I(0) and I(1) variables simultaneously. Fourth, the Panel ARDL model explicitly incorporates an Error Correction Mechanism (ECM) capturing the speed of adjustment of emissions toward their long-run equilibrium level following exogenous shocks. Our baseline Panel ARDL-PMG specification without interaction is formally written as:

Model 1 (Without Interaction):

$$\begin{aligned} \Delta LCO2_{it} = & \sum_{j=1} \lambda_{ij} \Delta LCO2_{i,t-j} + \sum_{j=0} \gamma_{ij} \Delta LGI_{i,t-j} + \sum_{j=0} \delta_{ij} \Delta IQINDEX_{i,t-j} + \sum_{j=0} \theta_{ij} \Delta LGDP_{i,t-j} + \\ & \sum_{j=0} \psi_{ij} \Delta LPOP_{i,t-j} + \sum_{j=0} \rho_{ij} \Delta LTRADE_{i,t-j} + \sum_{j=0} \sigma_{ij} \Delta LINNOV_{i,t-j} + \sum_{j=0} \tau_{ij} \Delta LICT_{i,t-j} + ECM + \varepsilon_{it} \end{aligned}$$

Model 2 (With Interaction):

To test our central hypothesis of institutional conditionality (H2), we enrich the preceding specification by introducing an interaction term between green investments and institutional quality in the long-run relationship:

$$\begin{aligned} \Delta LCO2_{it} = & \sum_{j=1} \lambda_{ij} \Delta LCO2_{i,t-j} + \sum_{j=0} \gamma_{ij} \Delta LGI_{i,t-j} + \sum_{j=0} \delta_{ij} \Delta IQINDEX_{i,t-j} + \sum_{j=0} \beta_{ij} (LGI \times IQINDEX)_{i,t-1} \\ & + \sum_{j=0} \theta_{ij} \Delta LGDP_{i,t-j} + \sum_{j=0} \psi_{ij} \Delta LPOP_{i,t-j} + \sum_{j=0} \rho_{ij} \Delta LTRADE_{i,t-j} + \sum_{j=0} \sigma_{ij} \Delta LINNOV_{i,t-j} + \\ & \sum_{j=0} \tau_{ij} \Delta LICT_{i,t-j} + ECM + \varepsilon_{it} \end{aligned}$$

The coefficient β on the interaction term ($LGI \times IQINDEX$) directly tests whether the marginal effect of green investments on emissions varies systematically as a function of institutional quality. A negative and statistically significant β coefficient would confirm the institutional conditionality hypothesis, indicating that the marginal effectiveness of green investments in reducing emissions grows with improvements in institutional quality.

Our empirical strategy unfolds in three progressive stages successively testing our three formal hypotheses. Stage 1 estimates Model 1 (without interaction) on the global sample of 46 countries, providing direct long-run effects of green investments γ and institutional quality δ on CO₂ emissions — testing hypothesis H1 of direct effectiveness of green investments. Stage 2 estimates Model 2 (with interaction) on the global sample, introducing the interaction term ($LGI \times IQINDEX$) to test hypothesis H2 of institutional conditionality. Stage 3 re-estimates Model 2 separately for three subsamples stratified by income level, testing hypothesis H3 of developmental heterogeneity.

4. EMPIRICAL RESULTS

This section presents the results of our Panel ARDL-PMG analysis examining the impact of green investments on CO₂ emissions and testing whether this effect is conditioned by institutional quality. We proceed in three progressive empirical stages successively testing our three formal hypotheses: the direct effectiveness of green investments (H1), the institutional conditionality of this effect (H2), and the heterogeneity of this conditionality according to level of economic development (H3). Table 1 presents the results of our baseline Panel ARDL-PMG specification excluding the interaction term, thereby providing estimates of the direct long-run effects of green investments and institutional quality on CO₂ emissions. This first stage tests our hypothesis H1 of direct effectiveness of green investments in reducing emissions.

Table 1: Comparison of ARDL-PMG and GI×IQ Interaction Models

Variable	ARDL-PMG		GI×IQ Interaction	
	Coef.	P-value	Coef.	P-value
Long-Run Effects (LR)				
LGI	-0.964***	0.000	-1.027***	0.000
IQINDEX	0.233***	0.003	0.104	0.122
GI×IQ	---	---	-0.352**	0.045
LGDP	0.005	0.940	0.012	0.842
LPOP	-0.666***	0.000	-0.679***	0.000
LTRADE	-0.871***	0.000	-0.866***	0.000
LINNOV	0.036***	0.000	0.017***	0.000
LICT	-0.042**	0.034	-0.005	0.438
Short-Run Effects (SR)				
ECM	-0.142***	0.000	-0.146***	0.000
LGI	-0.333**	0.010	0.119	0.924
IQINDEX	0.025	0.478	0.020	0.870
GI×IQ	---	---	-0.316	0.766
LGDP	0.866***	0.000	0.872***	0.000
LPOP	1.509	0.166	1.820	0.110
LTRADE	-0.019	0.556	-0.032	0.357
LINNOV	0.005***	0.000	0.004***	0.006
LICT	-0.007	0.893	0.011	0.863
Const.	2.323***	0.000	2.401***	0.000

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. P-values in parentheses.

In the long run, green investments exert a strongly significant negative effect on CO₂ emissions, with an estimated coefficient of -0.964. This confirms that green investments constitute a determining lever of national emission trajectories, empirically validating the theoretical predictions of the energy transition literature according to which massive technological substitution of fossil sources by renewable capacities can radically transform national carbon balances. Institutional quality presents a positive coefficient of +0.233 in the model without interaction. This surprising result contradicts conventional neo-institutionalist theoretical predictions, according to which quality institutions should reduce emissions through effective enforcement of environmental regulations, long-term credibility of climate commitments, and control of corruption in the allocation of public green funds. Several economic mechanisms could explain this apparent positive association. The scale effect potentially dominates the technique effect in developmental trajectories — countries improving their institutional quality experiencing phases of economic expansion where growth mechanically increases emissions.

Moreover, strong governance paradoxically facilitates intensive exploitation of fossil resources by securing property rights that attract extractive investments. Finally, this direct positive effect might mask a conditional relationship in which institutional quality affects emissions indirectly by modulating the effectiveness of green investments — an interpretation motivating our subsequent interaction specification. Among the control variables, population exhibits a significant negative coefficient of -0.666, suggesting that a larger population dilutes per-capita emissions through economies of scale in infrastructure use and potentially reduced average consumption per inhabitant. International trade presents a negative coefficient of -0.871, consistent with the hypothesis that trade openness facilitates the international transfer of clean technologies and promotes specialization toward less carbon-intensive sectors in certain countries. Innovation, with a positive coefficient of +0.036, possibly reflects that innovative countries experience rapid economic expansion that temporarily increases emissions despite technological efficiency gains. ICT presents a negative coefficient of -0.042, suggesting that digitalization modestly reduces emissions through dematerialization and process optimization. The error correction coefficient (ECM) stands at -0.142, confirming the existence of a convergence mechanism toward the long-run equilibrium relationship. Economically, this coefficient indicates that 14.2% of any deviation between observed emissions and their long-run equilibrium level is absorbed annually. The half-life of these disequilibria is 4.54 years, meaning it takes on average four and a half years for half an exogenous temporary shock on emissions to dissipate and the system to return halfway toward its long-run equilibrium. This relatively slow adjustment speed reflects the structural depth and inherent rigidities of national energy systems where production and consumption infrastructure exhibit considerable inertia: power plants typically operate for thirty to fifty years, buildings for fifty to one hundred years, and consumption behaviors evolve progressively through multigenerational cultural processes — implying that adjustments toward new carbon equilibria require unavoidable multidecadal delays even in the face of major political or technological shocks. Short-run dynamics reveal that green investments also present a significant negative coefficient of -0.333, indicating that even in the short run, before full structural effects materialize, an increase in green investments immediately reduces emissions — albeit with an amplitude approximately three times smaller than the long-run effect. This difference in magnitude between short and long run reflects that the full environmental benefits of green investments unfold progressively: a solar plant installed in year t immediately begins reducing emissions by partially substituting fossil production, but its cumulative effect grows over the following three decades through operational learning, progressive optimization, and above all the spillover effects stimulating complementary subsequent investments in storage, smart grids, and additional capacities. GDP exhibits a positive short-run coefficient of +0.866, reflecting that immediate cyclical economic expansions transitively increase emissions through increased industrial activity and consumption — a short-run effect that does not persist structurally in the long run after neutralization of other factors, as documented by the non-significant long-run coefficient.

Table 1 also presents the results of our central specification incorporating the interaction term between green investments and institutional quality ($LGI \times IQINDEX$), formally testing our hypothesis H2 according to which the effectiveness of green investments in reducing emissions is conditioned by countries' governance level. This specification constitutes the analytical core of our empirical contribution, since it shifts the research question beyond the estimation of direct additive and independent effects toward an examination of interactions and complementarities between determinants. The interaction coefficient stands at -0.352, statistically significant at the 5% level. The negative sign of this coefficient carries fundamental economic significance: it indicates that the marginal effectiveness of green investments in reducing emissions grows (becomes more negative) as institutional quality improves.

Formally, the marginal effect of green investments on emissions is no longer constant but is expressed as a linear function of institutional quality:

$$\partial LCO2/\partial LGI = \beta_1 + \beta_3 \times IQINDEX = -1.027 + (-0.352) \times IQINDEX$$

where $\beta_1 = -1.027$ represents the direct effect of green investments and $\beta_3 = -0.352$ captures the amplification of this effect by institutional quality.

To concretely quantify the economic magnitude of this moderation, we calculate the effectiveness of green investments at three representative levels of institutional quality corresponding to actual countries in our sample. In a weak governance country characterized by $IQINDEX = -1$ (approximately Nigeria, Bangladesh, or Pakistan in our sample):

$$\partial LCO2/\partial LGI|IQINDEX=-1 = -1.027 - 0.352 \times (-1) = -1.027 + 0.352 = -0.675$$

A 10% increase in green investments reduces emissions by only 6.75% in this failing governance context. In a country with average governance characterized by $IQINDEX = 0$ (close to the sample median, approximately Portugal, Poland, or Malaysia):

$$\partial LCO2/\partial LGI|IQINDEX=0 = -1.027 - 0.352 \times (0) = -1.027$$

A 10% increase in green investments reduces emissions by 10.27%. In a country with strong governance characterized by $IQINDEX = +1$ (approximately Finland, Norway, or New Zealand in our sample):

$$\partial LCO2/\partial LGI|IQINDEX=+1 = -1.027 - 0.352 \times (+1) = -1.027 - 0.352 = -1.379$$

A 10% increase in green investments reduces emissions by 13.79%. The effectiveness gap between strong and weak governance thus stands at $-1.379 / -0.675 = 2.04$, indicating that green investments are twice as effective in countries with strong governance compared to those with weak governance. This concrete quantification reveals that institutional quality does not constitute a simple additive determinant of emissions operating independently and in parallel with green investments, but functions fundamentally as a modulator amplifying or attenuating the effectiveness of these investments according to the governance level.

This result confirms our hypothesis H2 of institutional conditionality, empirically validating the theoretical paradigm according to which institutions do not constitute simple independent background variables but operate as structural conditions shaping the effectiveness of other interventions. Several economic channels theoretically explain this positive institutional moderation. First, strong institutions characterized by rule of law and control of corruption ensure that resources allocated to green investments reach their intended destinations rather than being diverted by corruption or diluted in bureaucratic inefficiencies, maximizing environmental intensity per monetary unit invested. Studies suggest that in failing governance contexts, up to 30–40% of budgets may be illegally captured — implying that improving governance could almost double the effectiveness of green investments simply by reducing these leakages, a mechanism consistent with the magnitude of our interaction coefficient. Second, regulatory quality and government effectiveness determine the administration's technical capacity to design and implement sophisticated environmental policies complementary to green investments — such as guaranteed feed-in tariffs, energy efficiency standards, and fiscal incentives favoring decarbonized technologies.

These policies amplify the effectiveness of green investments by creating economic environments favorable to their optimal deployment, whereas in weak governance contexts, even massive investments generate disappointing results for lack of appropriate regulatory frameworks. Third, political stability and the credibility of governmental commitments determine the private sector's investment horizon in renewable infrastructure requiring fifteen to twenty-five years to amortize high fixed costs. The inclusion of the interaction term slightly modifies the interpretation of direct effects. The green investment coefficient (LGI) now stands at -1.027, slightly more negative than in the model without interaction (-0.964). Institutional quality (IQINDEX) presents a direct coefficient of +0.104 that is no longer statistically significant, contrasting with the significant positive coefficient (+0.233) observed in the model without interaction. Control variables present coefficients largely consistent with the model without interaction, attesting to the structural robustness of the results. Short-run dynamics reveal no significant effects for either green investments, institutional quality, or their interaction, indicating that institutional moderation effects operate structurally in the long run through processes of progressive accumulation and systemic transformation of energy infrastructures and economic behaviors — rather than through immediate conjunctural adjustments. Table 2 presents the results of our interaction model estimated separately for three country groups stratified by income level. This stratification tests our hypothesis H3 that institutional conditionality varies qualitatively according to the stage of economic development, potentially revealing that advanced and emerging economies operate under fundamentally distinct technological and institutional regimes where the mechanisms linking green investments, governance, and emissions differ fundamentally.

Table 2: Heterogeneous Effects by Development Level

Variable	High-Income Countries	Lower-Middle Income	Upper-Middle Income
<i>Long-Run Effects</i>			
LGI	-1.491*** (0.000)	-3.748*** (0.000)	-3.008** (0.017)
IQINDEX	0.085 (0.294)	-0.239* (0.060)	0.153 (0.320)
GI×IQ	0.417 (0.264)	-1.494** (0.024)	-2.270* (0.078)
LGDP	-0.271** (0.019)	1.421*** (0.000)	0.864*** (0.000)
LPOP	-1.472*** (0.000)	-0.145 (0.606)	1.846*** (0.000)
LTRADE	-0.288*** (0.001)	-0.418*** (0.001)	0.023 (0.794)
LINNOV	0.040*** (0.000)	0.025*** (0.002)	0.023*** (0.001)
LICT	-0.143*** (0.001)	-0.034 (0.488)	-0.158*** (0.002)
ECM	-0.208*** (0.000)	-0.332** (0.030)	-0.191† (0.054)

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. *P*-values in parentheses.

In the long run, in advanced economies, green investments exert a strongly significant negative effect of -1.491. This estimate, clearly above the global sample coefficient, suggests that developed countries achieve maximum environmental effectiveness in deploying green investments, potentially thanks to their advanced technological infrastructure, superior technical absorption capacities, and sophisticated energy systems facilitating massive integration of intermittent renewables through smart grids and storage capacities.

However, surprisingly, the interaction term presents a coefficient of +0.417 that is not statistically significant, indicating that within the group of developed countries, institutional quality does not significantly moderate the effectiveness of green investments. This counter-intuitive result suggests that among advanced economies already characterized by relatively high and homogeneous governance levels, institutional quality no longer marginally affects the effectiveness of green investments. Economically, this pattern could reflect a threshold or saturation effect: beyond a certain level of institutional development, marginal environmental efficiency gains from additional institutional improvements become negligible because the minimum conditions necessary for effective deployment of green technologies (rule of law, corruption control, regulatory capacities) are already satisfied, and the binding constraints shift toward other factors such as political preferences, social acceptability, or economic opportunity costs rather than fundamental institutional failures. Lower-middle-income economies reveal a radically different and economically fascinating pattern. Green investments exhibit an extremely negative coefficient of -3.748 — an effect 2.5 times larger than in the global sample and 2.5 times greater than in rich countries. This strong effectiveness may reflect several mechanisms: first, these countries start from very low levels of renewable deployment, implying that the first green investments substitute the most carbon-intensive and technologically least efficient fossil sources, generating maximum marginal emission reductions; second, their energy systems, less complex and less locked into inherited fossil infrastructure, paradoxically offer superior structural flexibility to rapidly integrate decentralized renewable technologies; third, international development aid and North-South technology transfers prioritize these countries with subsidized cutting-edge technologies, maximizing effectiveness per monetary unit invested. Even more remarkably, the interaction term presents a strongly negative coefficient of -1.494, indicating an extremely strong institutional moderation: the effectiveness of green investments grows massively with improvements in institutional quality in these emerging economies. Institutional quality itself presents a direct coefficient of -0.239 marginally significant ($p = 0.060$), suggesting that beyond its moderating role, improving governance also directly reduces emissions in these emerging contexts — contrasting with the positive effect observed globally and the null effect in rich countries. The ECM coefficient of -0.332 ($p = 0.030$) indicates a faster adjustment speed (half-life of 2.1 years) than in rich countries, possibly due to the lower inertia of less developed energy systems. The nine upper-middle-income economies present results qualitatively similar to less developed countries. Green investments carry a coefficient of -3.008, indicating slightly lower effectiveness than in the less developed group. The interaction term presents a negative coefficient of -2.270 marginally significant at the 10% threshold ($p = 0.078$), also suggesting positive institutional moderation. The ECM coefficient of -0.191 corresponds to a half-life of 3.6 years. The systematic comparison of the three groups reveals deep and economically significant developmental heterogeneity in the mechanisms linking green investments, institutional quality, and CO₂ emissions. First, the direct effectiveness of green investments paradoxically declines with the level of development — maximum in emerging countries (-3.748 and -3.008), it diminishes in advanced economies (-1.491). This counter-intuitive finding suggests that low-cost emission reduction opportunities are more abundant in less developed economies starting from very low levels of renewable deployment and inefficient fossil infrastructure, while rich countries having already realized the most profitable technological substitutions face increasing marginal costs for additional reductions. Second, institutional moderation operates primarily in emerging economies (-1.494 and -2.270, both significant) but disappears in rich countries (+0.417, not significant), suggesting a threshold or saturation effect where marginal gains from institutional improvement on the effectiveness of green investments are exhausted beyond a certain level of institutional development already reached by advanced economies.

These results provide a nuanced answer to our hypothesis H3: developmental heterogeneity is confirmed, but with a paradoxical pattern where the direct effectiveness of green investments declines with development while the importance of institutional moderation grows in less developed countries. This paradox carries profound implications for the optimal allocation of international climate finance, which we discuss in the next section.

5. DISCUSSION

Our empirical results reveal a major institutional paradox that contradicts the conventional theoretical predictions of neo-institutional economics: green investments prove 2.51 times more effective in countries with low institutional quality compared to those with strong governance. This finding, consistent across our three specifications and particularly pronounced in lower-middle-income economies, raises fundamental questions about underlying mechanisms and suggests an important reconfiguration of international climate finance strategies. Our long-run coefficient for green investments in the global model falls in the upper range of the literature validating the environmental effectiveness of green technologies. Chen and Chen (2021) estimate an average elasticity of -0.41 for Chinese provinces, lower than our estimate but consistent with our stratified results for emerging economies. Yadav et al. (2024), examining the BRICS, confirm substantial heterogeneity with coefficients varying by a factor of three — qualitatively consistent with our finding. However, their observation that coefficients are positively correlated with governance contrasts with our negative interaction, a divergence explainable by their sample limited to BRICS, which does not capture the full developmental spectrum. Our central interaction result contradicts several studies positing institutional complementarity. Ahmad et al. (2022), analyzing the G7, conclude that institutions amplify the effectiveness of environmental interventions. This divergence is explained by three factors: their exclusive focus on economies with exceptionally high and homogeneous governance (consistent with our rich-country subsample showing a non-significant interaction), their different variable of interest (general financial development vs. targeted green investments), and their different performance measure (ecological footprint vs. CO₂ emissions). Sethi et al. (2024) similarly conclude a positive interaction, but their sub-sample approach without a formal interaction term does not rigorously test the statistical significance of moderation. Acheampong et al. (2021) document a result closer to ours, revealing that in sub-Saharan Africa, renewable energies fail to significantly reduce emissions in countries with very low governance, suggesting a minimal institutional threshold. This finding is partially compatible with our results if the relationship is non-linear: below an extreme critical threshold (totally collapsed governance), effectiveness might collapse; above it but below advanced levels, effectiveness would be maximal; beyond, diminishing returns would set in. Our sample, excluding fragile states for lack of continuous data, probably does not capture this extreme lower portion. Four interconnected mechanisms explain the observed paradox:

Carbon saturation and diminishing returns. Advanced economies with strong governance have already exploited a substantial portion of easily accessible reduction potential. France generates 70% of its electricity via nuclear power, Norway 98% via hydroelectricity, Sweden combines nuclear and renewables for a near-decarbonized mix. Their buildings comply with strict insulation standards; their industries have adopted best available technologies. In this context, additional green investments generate declining marginal reductions. Installing one gigawatt of solar in Germany, which has already deployed 70 GW representing 46% of its electricity production, primarily substitutes relatively efficient gas (0.4 kg CO₂/kWh). In contrast, one gigawatt in India, where 70% of electricity comes from coal (0.9–1.1 kg CO₂/kWh), generates 2–3 times greater reductions through this differential in the carbon intensity of the substituted source.

Structural expansion induced by strong institutions. Robust institutions paradoxically facilitate the development of carbon-intensive sectors. Legal security fosters the emergence of heavy industries (steel, chemicals, cement) requiring massive long-term investments. Regulatory efficiency enables the development of sophisticated transportation infrastructure (highway networks, multiple airports). Prosperity generates a middle class with energy-intensive consumption patterns (spacious air-conditioned homes, multiple vehicles, frequent air travel). Green investments must then compensate not only for existing emissions but also for this induced expansion, reducing their apparent effectiveness. Technological pragmatism induced by constraints. Countries with weak governance, confronted with limited capacities, favor standardized and proven technologies (crystalline silicon solar panels, standard wind turbines) offering the best cost-effectiveness ratio. Countries with strong governance explore a broader range including innovative but less mature solutions (floating offshore wind, green hydrogen, carbon capture), a diversification that dilutes investments and delays the mass deployment of proven solutions. Simplified decision-making processes allow remarkably rapid deployments: a 500 MW solar park in India requires 18–24 months compared to 5–8 years in Germany, during which public consultations, legal appeals, and multi-level negotiations fragment the project. The forced recourse to international private capital imposes strict economic discipline, with only projects offering the best cost-effectiveness ratio attracting capital. Technical absorption capacities. Modern renewable technologies are largely standardized and modular, their deployment primarily requiring engineering expertise rather than sophisticated administration. Countries like India or Vietnam manage to deploy massive capacities through partnerships with specialized international developers that bypass local administrative failures. Paradoxically, advanced economies face complex regulatory rigidities slowing deployment despite their superior administrative capacities. Our negative interaction coefficient establishes a substitution rather than complementarity relationship for green investments, contradicting the neo-institutionalist postulate that public interventions systematically function better in strong governance environments (North, 1990; Acemoglu & Robinson, 2012). This finding suggests that institutional complementarity is not universal but contingent on the characteristics of the intervention: standardized and transferable technologies deployable through the international private sector and displaying diminishing returns due to progressive saturation. Interventions requiring sophisticated public administration (education, health) will exhibit strong complementarity, while investments in standardized infrastructure might exhibit substitution. For our recommendations, international climate finance currently allocates resources according to institutional absorption capacities, favoring countries with strong governance. Our ratio of 2.51 implies that a reallocation increasing the proportion toward major emerging economies from 65% to 80% (15 percentage points) would increase overall effectiveness. Conditioning finance on prior institutional reforms generates three perverse effects: reforms require 5–15 years during which potential reductions never materialize; institutional constraints paradoxically impose a beneficial pragmatism that would disappear with the reforms; and conditionalities create counter-productive political dynamics reducing the acceptability of finance. A results-based finance approach — where disbursements are conditioned on ex-post verified reductions rather than ex-ante promised reforms — would maximize environmental effectiveness. Emerging economies, having deployed massive capacities in constrained contexts, have accumulated operational expertise potentially more relevant for other developing countries than the North's R&D expertise. India has installed 150 GW of renewables while negotiating among the world's lowest costs and adapting technologies to local conditions. This expertise in rapid, low-cost deployment is directly transferable to Bangladesh, Nigeria, or Ethiopia. Triangular mechanisms — where financing comes from the North but technical expertise from the South — and dedicated South-South exchange platforms should be institutionalized as central components of climate cooperation.

As for limitations, our 46-country sample excludes fragile states and many African countries, limiting generality regarding a possible minimal institutional threshold below which effectiveness would collapse entirely. Our 2000–2023 period captures a specific phase of technological maturation that may evolve substantially in coming decades. Our approach imposes a long-run homogeneity constraint that, while not statistically rejected, might mask subtle heterogeneities. Our focus on CO₂ emissions neglects other environmental dimensions potentially affected differently. These limitations open promising avenues: analyses decomposing the composite index by investment type, quasi-experimental approaches exploiting exogenous variations, and multicriteria analyses examining multiple sustainability dimensions.

6. CONCLUSION

This study empirically examines whether the effectiveness of green investments in reducing CO₂ emissions depends on countries' institutional quality — a fundamental question for the optimal allocation of international climate finance. Our Panel ARDL-PMG analysis covering 46 countries observed over 2000–2023 reveals three major findings that challenge conventional theoretical predictions. First, green investments significantly reduce CO₂ emissions in the long run, confirming their environmental effectiveness and validating international efforts to mobilize capital toward decarbonized technologies. Second, the marginal effectiveness of green investments in reducing emissions grows (becomes more negative) as institutional quality improves, validating the institutional conditionality hypothesis. This is explained by the fact that solid governance maximizes the impact of green investments by securing funds, establishing clear rules, and providing the stability necessary for the private sector. Third, this institutional conditionality varies qualitatively according to the stage of development. Emerging economies exhibit maximum direct effectiveness of green investments and strong institutional moderation, while developed countries show lower effectiveness and absent institutional moderation. This developmental heterogeneity suggests that advanced and emerging economies operate under distinct technological and institutional regimes. These findings carry profound implications for economic theory and climate policies. Theoretically, our results challenge the universality of institutional complementarity postulated by neo-institutional literature, revealing that it is contingent on the specific characteristics of interventions. Policy-wise, our results advocate for a reconfiguration of the international climate finance architecture. A geographic reallocation increasing by 15 percentage points the proportion of financing toward major emerging economies would improve overall effectiveness. Approval procedures should be radically simplified and co-financing requirements relaxed. Above all, the dominant practice of conditioning climate finance on prior institutional reforms should be abandoned in favor of an approach based on ex-post verifiable results. South-South partnerships, valuing the operational expertise accumulated by emerging economies in rapid, large-scale, low-cost deployment, should be institutionalized as central components of international climate cooperation. Our study nonetheless presents several limitations opening promising avenues for future research. The exclusion of fragile states for lack of continuous data limits generality regarding a possible minimal institutional threshold below which effectiveness would collapse. The aggregation of heterogeneous dimensions in our composite index might mask differentiated interactions by type of green investment. The observed period captures a specific technological phase that will evolve in coming decades. Future research decomposing the index by investment type, exploiting quasi-experimental variations to strengthen causal identification, and examining multiple environmental dimensions beyond CO₂ emissions alone would substantially enrich our understanding of the contextually contingent determinants of climate policy effectiveness.

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APPENDIX

The validity of the Panel ARDL approach rests on several conditions that we verify prior to estimation.

Unit Root Test: We apply Pesaran's (2007) CIPS test (Cross-sectionally Augmented IPS), a second-generation extension of the standard IPS test that is robust to the cross-sectional dependence characterizing modern macroeconomic panels. The results reveal mixed integration orders: LCO2, LGDP, and LPOP are clearly I(1) with CIPS statistics that fail to reject the null hypothesis of unit root in levels but strongly reject it in first differences; while LGI, IQINDEX, LTRADE, LINNOV, and LICT present ambiguous results suggesting trend stationarity I(0) or weak integration. This heterogeneity justifies the Panel ARDL approach accommodating mixed integration orders.

Cointegration Test: Kao's (1999) cointegration test with bootstrap correction examines the null hypothesis of no long-run relationship between the variables. The modified ADF statistic ($t = -4.73$, $p < 0.001$) strongly rejects the absence of cointegration, confirming the existence of a stable long-run equilibrium relationship linking CO₂ emissions, green investments, institutional quality, and control variables. This cointegration formally validates the estimation of long-run coefficients via the Panel ARDL.

Lag Structure Selection: The Akaike (AIC) and Schwarz (BIC) information criteria converge in selecting an ARDL(1,1,1,1,1,1,1,1) specification, implying $p = 1$ lag for the dependent variable and $q = 1$ lag for each explanatory variable. This parsimony avoids overfitting while capturing the main adjustment dynamics.

Hausman Test: The modified Hausman test for Panel ARDL models compares the PMG estimator (long-run homogeneity constraint) with the fully heterogeneous Mean Group estimator. The χ^2 statistic = 3.24 ($p = 0.661$) does not reject the null hypothesis of homogeneity of long-run coefficients, statistically validating the PMG specification as appropriate and efficient for our sample. This non-rejection confirms our theoretical hypothesis that structural long-run mechanisms operate universally.

ENHANCING THE SUSTAINABILITY OF CRUISE TOURISM THROUGH PORT-CITY PARTNERSHIPS AND STAKEHOLDER COOPERATION

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ABSTRACT

Cruise tourism plays a significant role in the global economy by creating jobs, boosting local businesses, generating substantial revenue, and providing various socio-economic benefits. Its continued growth, and the complex interplay of environmental and socio-economic impacts, have made the sustainability of cruise tourism a prominent topic within the industry, academia, and the general public. With further industry growth anticipated and the need to mitigate negative impacts on ecosystems and societies – such as a significant ecological footprint, overcrowding, infrastructure congestion, disproportionate economic gains favouring large operators, limited direct revenue for local communities, and cultural commodification – regulation of the industry is essential. This can be achieved through binding legal framework, industry recommendations and guidelines, voluntary standards such as the Eco-Management and Audit Scheme, the Global Sustainable Tourism Council, and the European Sustainability Reporting Standards, as well as strong stakeholder alliances. Ports are vital to the sustainability of the cruise industry and its destinations, and a sustainable port-city relationship should align the interests of diverse industry actors and local communities. This paper analyses the effects of cooperation among various industry stakeholders through their prominent associations and partnerships, such as the International Association of Cities and Ports and its joint Cruises and Port Cities Working Group, the Association of Mediterranean Cruise Ports, and the European Sea Ports Organisation, examining their practices and incentives to mitigate adverse environmental and socio-economic impacts and to reconcile the differing expectations of the cruise sector and communities. The paper reviews the industry significant efforts to promote sustainable practices in economic, environmental, and social terms, and to engage all stakeholders, particularly through incentives, training, and empowerment aimed at community inclusion. It highlights the importance of continually promoting a culture of quality and innovation, clear communication, and transparency of core values, principles, and actions towards a shared vision.

Keywords: *Cruise Tourism, Industry Regulations, Partnership, Stakeholders, Sustainability*

1. INTRODUCTION

Cruise tourism is a significant economic activity and plays a vital role in the global economy by creating jobs, supporting local businesses, generating substantial revenue, and providing various socio-economic benefits. In 2023, the total economic impact of cruising reached \$168.6 billion, contributing \$85.6 billion to global GDP, supporting 1.6 million jobs, and generating \$56.9 billion in wages. The most visited region in 2023 was the Caribbean, with 12.80 million cruise passengers out of 31.69 million (40%), followed by the Mediterranean with 5.46 million (17%) and non-Mediterranean Europe with 2.98 million (9%). In Europe that year, the total economic impact was €55.3 billion, supporting 440,000 jobs and generating €16.8 billion in wages (CLIA, 2025). Approximately 75% of jobs supported by cruising are created through onshore activities, particularly at ports. Ports are important drivers of economic growth and change, advancing the prosperity of port cities. Cruise ports can benefit host cities through visitor spending, but they also pose challenges and generate tensions between ports and cities. Over recent decades, the continuous growth in the number and size of cruise ships, and the increase in passenger numbers visiting cruise destinations, have created significant problems for ports and destinations. These include a considerable ecological footprint, overcrowding, infrastructure congestion, disproportionate economic gains favouring large operators, limited direct revenue for local communities, and cultural commodification. These negative environmental and socio-economic impacts depend on the carrying capacity of the host city (Notteboom et al., 2026) and can significantly diminish the quality of life in the host city as well as spoil the experience for visitors. Alongside rising awareness among local communities of the adverse impacts of cruise tourism, their stronger engagement and activism, and the cruise industry's increasing commitment to achieving sustainable development goals, the importance of a good port-city relationship has emerged as a key pillar of sustainability. Given the significant economic importance of cruise tourism – through economic benefits, job creation, and local business growth – its steady growth over the decades, and the complex mutual interactions of environmental and socio-economic impacts on ecosystems and societies, cruise tourism sustainability has become a prominent topic within the industry, academy and the public sphere. Environmental and socio-economic impacts of cruising tourism are important issue in academic papers (Hoarau-Heemstra et al., 2023; Chou et al., 2024; Godovykh et al., 2025; Papathanassis, 2025). These impacts include complex interrelated issues such as a considerable ecological footprint, overcrowding, infrastructure congestion, disproportionate economic gains favouring large operators, limited direct revenue for local communities, cultural commodification. With further industry growth anticipated and the need to mitigate negative impacts, regulation of the industry is essential. According to Notteboom et al. (2026), the challenges associated with cruise tourism include aligning expansion with local economic development strategies, mitigating the negative environmental impacts of hosting cruise ships and passengers at ports, and ensuring cooperation among all stakeholders, including local communities, to consider different needs. This paper reviews the implementation of regulation through binding legal frameworks, voluntary standards, industry recommendations, and strong stakeholder alliances. It analyses the effects of cooperation among various stakeholders through associations and partnerships, including the Cruise Lines International Association (CLIA), the International Association of Ports and Harbors (IAPH), the International Association of Cities and Ports (AIVP) and its joint Cruises and Port Cities Working Group, the European Sea Ports Organisation (ESPO), the Association of Mediterranean Cruise Ports (MedCruise), other associations, and related initiatives. The paper explores their practices and incentives to promote cruise tourism sustainability and facilitate cooperation to efficiently reconcile the opposing expectations of the cruise sector and communities, and to effectively mitigate the adverse environmental and socio-economic impacts of the cruise industry.

2. CRUISE INDUSTRY REGULATIONS AND STANDARDS REGARDING SUSTAINABILITY

2.1. Cruise industry regulations regarding sustainability

Various international conventions concerning shipping and the protection of the marine environment form the basis of the industry's binding legal framework for sustainability. Key conventions regarding the environmental sustainability of the cruise industry include the International Convention for the Prevention of Pollution from Ships (MARPOL), the International Convention on the Control of Harmful Anti-fouling Systems on Ships (AFS), the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM), and the Convention on Biological Diversity (CBD). In some cases, regional conventions also apply, such as the OSPAR Convention, the Helsinki Convention, the Barcelona Convention, and the Bucharest Convention for European Union member states and neighbouring countries. Within the European Union, the European Climate Law and the related European Green Deal have established a legal framework for achieving a climate-neutral European economy and society by 2050, together with the EU Emissions Trading System (EU ETS), the Ambient Air Quality Directive (AAQD), and other maritime-related regulations such as the FuelEU Maritime Regulation and the Regulation on the Monitoring, Reporting and Verification of CO₂ Emissions (the MRV Regulation). The European Union legal framework for protecting the marine ecosystem and biodiversity includes the Port Reception Facilities Directive (PRFD), the Environmental Noise Directive (END), the Biocide Directive, the EU Marine Strategy Framework Directive (MSFD), the EU Water Framework Directive and the Birds and Habitats Directives. In addition, EU companies must disclose data related to environmental, social, and governance (ESG) aspects of their business activities under the EU Corporate Sustainability Reporting Directive (CSRD) or the EU Taxonomy Regulation. In addition to hard law, which is not always fully effective in mitigating the negative environmental and socio-economic impacts of cruise tourism, as effective regulations require enhanced monitoring and enforcement mechanisms, soft law provides a valuable path towards sustainability. This includes standards, policies, strategic and operational recommendations and guidelines, and examples of good practice.

2.2. Sustainability standards

Globally, various voluntary reporting frameworks and standards exist. Companies may align ESG reporting with United Nations Sustainable Development Goals (SDGs) and targets, as well as a range of other ESG reporting standards (International Sustainability Standards Board – IFRS ISSB standards; Sustainability Accounting Standards Board – SASB Standards; Global Reporting Initiative ESG Standards – GRI standards; Task Force on Nature-related Financial Disclosures – TNFD), environmental standards (Environmental management systems ISO 14001:2015, Eco-Management and Audit Scheme – EMAS), or social standards (Social responsibility ISO 26000; Social Accountability International – SA8000) (ICS, 2026). Standards enhance performance and regulatory compliance, strengthen stakeholder trust, build the organisation's reputation, and serve as evidence of the organisation's commitment to sustainability. Global Sustainable Tourism Council (GSTC) Standards are the global benchmarks for sustainability in tourism and travel, addressing sustainable management and the socio-economic, cultural, and environmental impacts of the industry. The GSTC Standards include Destination Standards for public policy-makers and destination managers, and Industry Standards for any tourism business, with specific performance indicators for hotels and tour operators. The Standards may be updated with supplementary location-specific and activity-specific criteria. The GSTC is a member of the ISEAL Alliance, an international body that provides guidance on the development and management of sustainability standards across all sectors (GSTC, 2026).

Established in 1994, Green Award is a voluntary certification programme for ships and ship management companies that exceed industry standards in safety, quality, and environmental performance. Over 1500 ships have been certified, and more than 200 incentive providers, including ports and maritime service providers, have participated in the Green Award Programme (Green Award, 2026). It serves as a tool for Corporate Social Responsibility (CSR) for ports and companies, and Green Award-certified companies and ships are entitled to various incentives for their responsible behaviour, including discounts on port dues, services, and products.

3. STAKEHOLDER ALLIANCES, INITIATIVES, POLICY PATHWAYS, GUIDELINES, AND EXAMPLES OF GOOD PRACTICE

Various stakeholders experience differing levels of negative socio-economic and environmental pressures, with local communities often bearing the greatest burden. Despite a comprehensive range of regulations and various existing standards, strong stakeholder alliances are essential to unlock the sustainability of cruise tourism fully. Stakeholder cooperation can be fostered through partnerships and other initiatives at local, regional, and international levels. Raising the issue to the international level promotes shared understanding, provides effective mechanisms, and generates ideas for future actions, while considering the unique characteristics of each destination (Notteboom et al., 2026). One of the most effective ways to address sustainability challenges is to share best practices, often through campaigns, publications, and various tools. An excellent example of an awareness-raising campaign is Tourism for SDGs, a platform developed by the World Tourism Organization (UN Tourism) to examine how tourism is represented in national SDG strategies and to support better integration of tourism into future national SDG planning. Public bodies, companies, donor communities, travellers, international organisations, academia, and civil society organisations (CSOs) participate in joint learning, sharing, and action.

3.1. Cruise Lines International Association (CLIA)

Cruise Lines International Association (CLIA), founded in 1975, is now the world's largest cruise association, representing a diverse cruise industry that includes cruise lines, leaders, ports, destinations, shipyards, and travel professionals. CLIA's vision is "... for the cruise industry to be recognised as a leader in responsible travel and the best way to see the world" (CLIA, 2026a). Key areas of interest for CLIA include Destination Stewardship, Environmental Sustainability, Workforce Development, Health & Safety, and Economic & Social Impact. The four strategic pillars of the Association are: Lead the Way as a Force for Good; Demonstrate Global Commitment and Local Focus; Leverage the Power of Partnerships; and Build and Maintain Long-term Financial Strength. It promotes partnerships with local authorities, collaborative agreements, community engagement, and diverse solutions. The CLIA Guiding Principles for Responsible Tourism (CLIA, 2026b) set out seven principles for sustainable tourism in the destinations cruise ships visit (Figure 1).

Figure following on the next Page

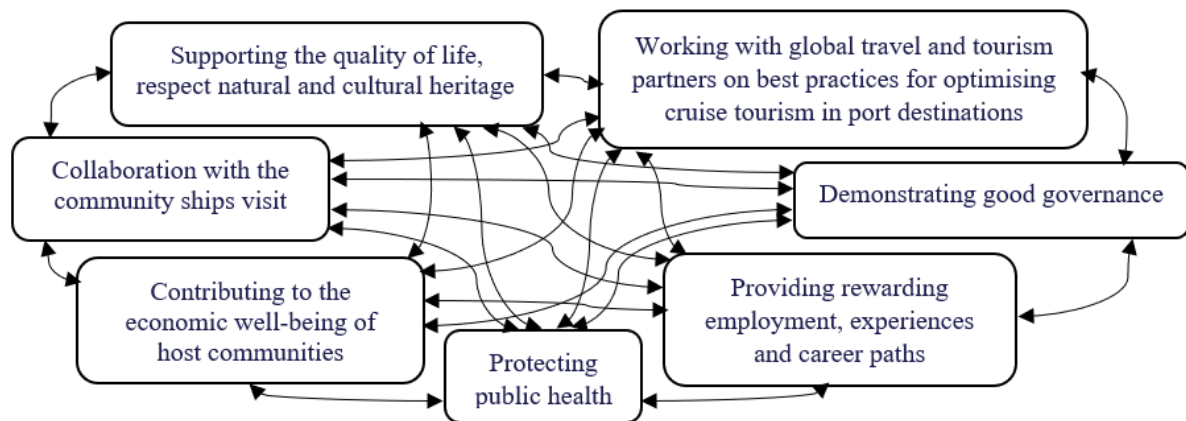


Figure 1: Seven principles for sustainable tourism in the destinations cruise ships visit (Source: authors according to CLIA, 2026b).

Table 1. lists examples of good practices of CLIA principles for sustainable tourism in the destinations cruise ships visit.

CLIA principles for sustainable tourism	Examples of good practices
Collaborate with the communities ships visit	- CLIA member cruise lines have signed voluntary Blue Flag Agreements in several Italian ports. - A Charter of Sustainable Cruising in the French Mediterranean.
Support quality of life and respect cultural and natural heritage	- Collaborating with local officials, partners, and stakeholders on destination management plans. - Timing arrivals and departures, and optimising disembarkation to balance visitor flow and reduce congestion and crowding. - Dispersing visitor excursions throughout the destination.
Contribute to the economic well-being of host communities	- Sourcing ship provisions locally and sustainably to provide predictable revenue for local businesses. - Promoting local services, excursions, activities, cultural and other attractions to support local businesses and prioritise passenger spending with them.
Protect public health	- Conducting pre-boarding health screenings of passengers and reporting to authorities. - Implementing strict cleaning and sanitation protocols, as well as outbreak prevention and response protocols.
Provide rewarding employment experiences and career paths	- Hiring to support the communities served by cruise lines.
Demonstrate good governance	- Providing accurate and timely information to authorities and stakeholders. - Commissioning third-party research to validate claims and provide data for effective decision-making.
Work with global partners on best practices for optimising cruise tourism in port destinations	- Including a module on optimising socio-economic benefits in communities as part of the Destinations International management certification programme.

Table 1: Examples of good practices of CLIA principles for sustainable tourism in the destinations cruise ships visit (Source: CLIA, 2026b)

The CLIA Guiding Principles for Responsible Tourism advocate cooperation between the cruise sector, ports, and destinations. To facilitate this cooperation and drawing on experience, CLIA has developed a set of Principles for Mutually Successful Engagement: transparency, consultation, cooperation, timing, and enforcement. These five principles guide cooperation and joint activities, taking into account local rules and the accountability of all parties:

1. Transparency – clear, written communication from authorities to all affected parties.
2. Consultation to support a solutions-based approach to destination stewardship – establishment of a local cruise committee with the authority to involve all stakeholders in policy development.
3. Cooperation with local and regional authorities, engaging key stakeholders in policy development, and considering potential impacts on neighbouring ports and cities. Impacted stakeholders should meet at least twice a year.
4. Timing to ensure aligned and effective implementation of policies by industry, ports, and destinations, taking into account the changing requirements of different stakeholders.
5. Enforcement of local tourism policies to support initiatives aligned with long-term strategies, based on continuous dialogue among all stakeholders. (CLIA, 2026b).

3.2. The International Association of Ports and Harbors (IAPH)

Established in 1955, IAPH represents over 190 ports and 167 port-related businesses. IAPH aims to be the "Global Ports' Forum for Industry Collaboration and Excellence" by promoting the interests of ports through strong synergies with other industry partners and stakeholders, addressing common issues, and enhancing sustainable practices. IAPH holds Consultative Status as an NGO with the United Nations (UN), including the Economic and Social Council (ECOSOC) and the International Maritime Organization (IMO).

Since 2011, the IAPH Environmental Ship Index (ESI) has measured the environmental footprint of merchant ships, enabling ports to reward ships that demonstrate clear improvements in emission performance, with over 6,700 ships registered and more than 60 ports participating (IAPH, 2026). Since 1 January 2026, ESI has been administered by OceanScore and includes a professional onboard verification scheme with a registration fee. The IAPH Cruise Emissions at Berth Project Group, comprising representatives from several IAPH cruise ports and CLIA, has worked on the data reporting model and the design, development, and implementation of an improved at-berth performance and emissions indicator for each port call, starting with cruise ships (IAPH, 2026).

Powered by IAPH, the World Ports Sustainability Program (WPSP) serves as the reference database of best practices for ports implementing the SDGs in their operations across six themes: Digitalisation, Infrastructure, Health, Safety & Security, Environmental Care, Community Building, and Climate & Energy (Table 2). The programme's mission is "to empower port community actors worldwide to engage with business, governmental and societal stakeholders in creating sustainable added value for the local communities and wider regions in which their ports are embedded" (WPSP, 2026a).

WSPS themes	Topics
Digitalisation	Intra-port and hinterland mobility; port call optimisation and just-in-time (JIT) arrival; Port Community Systems (PCS)
Infrastructure	Optimising use of existing port capacity; sustainable dredging projects and beneficial use of dredged material
Health Safety and Security	Using innovation to establish secure and accessible port areas; cybersecurity measures

Environmental care	Addressing pollution and water consumption; re-use and recycling initiatives; protecting habitats and biodiversity
Community building	Port information and training centres; open port initiatives; community and social engagement programmes; education and employment initiatives; transparency and reporting; responsible supply chains
Climate and Energy	Circular economy; bio-based economy; renewable energy; clean ship incentives

Table 2: WPSP key themes and topics (Source: WPSP, 2026a)

IAPH also created the Sustainability Awards scheme to recognize the highest-quality port sustainability projects submitted to the WPSP database across six WPSP theme categories, plus the Akiyama Award each year. Another notable tool developed by IAPH is Port Endeavor, an engaging business game designed to educate port professionals about port sustainability. To achieve the objective of the game – creating the most sustainable port while working within a budget – participants must collaborate with their team, make informed decisions, and earn recognition through WPSP Badges. Port Endeavor draws on real-life examples from the hundreds of projects in the WPSP database and best practices (WPSP, 2026b).

3.3. The International Association of Port Cities (AIVP) and Cruises and Port Cities Working Group

In 1988, AIVP was established in Le Havre by port and city stakeholders to improve relations between cities and ports by promoting dialogue and cooperation, aiming to support the development of port cities that address the needs of all stakeholders: port authorities, local communities, and economic operators (AIVP, 2026). AIVP also plays an important role in sharing knowledge and information, fostering solidarity between large and small port cities, as well as between developed and developing countries, countering the gentrification of maritime and port spaces, and promoting social inclusion. In 2018, AIVP adopted Agenda 2030 for sustainable port cities, which sets out 10 goals and 46 measures for action: Climate change adaptation; Energy transition and circular economy; Sustainable mobility; Renewed governance; Investing in human capital; Port culture and identity; Quality food for all; Port City interface; Health and life quality; Protecting biodiversity. AIVP has developed several useful tools, including a self-assessment tool for its port and city members to use annually to evaluate their progress in implementing the 10 objectives of Agenda 2030. The self-assessment tool is comprehensive, consisting of approximately 120 questions, and members are expected to take time to discuss their answers, as no single person will have all the necessary information. The Good Practices Agenda 2030 is also a helpful online decision-making tool, providing access to over 150 good practices for building sustainable City-Port relations, as well as a library of projects (AIVP, 2026). In 2021, the Cruises and Port Cities Working Group was launched as a joint initiative by AIVP and MedCruise to promote more sustainable relationships between the cruise tourism industry and urban port communities. It is described as "a collaborative platform for port authorities, city representatives, cruise operators, and other stakeholders to exchange knowledge and good practices for sustainable cruise-port relations, promote dialogue, and support sustainability policies" (Cruises and Port Cities Working Group, 2026). An important strategic document, the Cruise Port City Compass – Global Cases Inspiring Sustainable Connections & Communities (AIVP and MedCruise, 2026), was created based on meetings held between 2021 and 2024. It outlines challenges, practical solutions, and cruise-related case studies to enhance sustainable cruise-port relations. Current priorities include:

- Governance and Citizens' Engagement, encouraging cruise companies to contribute more enthusiastically to the life of port cities;
- Flow Management and Mobility, seeking solutions for managing passenger flows and reducing congestion in urban areas (Cruises and Port Cities Working Group, 2026).

3.4. The European Sea Ports Organisation (ESPO) and EcoPorts

Established in 1993 from the Port Working Group founded in 1974, the ESPO is an independent lobby representing seaport interests, comprising port authorities, port administrations, and port associations from EU and Norwegian seaports. ESPO maintains ongoing dialogue with all European port and maritime sector stakeholders (ESPO, 2026a). The ESPO Technical Committees and Networks address a range of policy and technical issues, including the Port Governance and Management Committee, which focuses on port-city relations; the Sustainable Development Committee, which covers EcoPorts; and the Ferry and Cruise Port Policy Network. The ESPO Code of Good Practices for Cruise and Ferry Ports (ESPO, 2026b) was developed by ESPO in collaboration with Cruise Baltic, Cruise Europe, Cruise Norway, MedCruise, and Cruise Britain to identify key challenges and highlight best-practices. The identified challenges include the port-city relationship, infrastructure, cooperation, relations with cruise and ferry lines, and security. The code also serves as a tool to enhance dialogue with all stakeholders in the sector and to inform policy-makers and the wider public about challenges, bottom-up initiatives, and good practices. The port-city relationship chapter covers topics such as enhancing mutual understanding between port and city, integrating the city into the port and the port into the city, educating stakeholders and passengers, promoting the sustainability of cruise and ferry port activities, and managing congestion and pressure on infrastructure and services (Table 3).

Port-city relationship topic	Examples of mitigating measures
Enhance the mutual understanding between port and city	Inform citizens about the benefits and added value of the cruise business, such as the possibility that cruise passengers may revisit the destination.
Integrate the city into the port and the port into the city	Create a tourist information point in the port to promote tourist attractions, book excursions, and offer local products. Engage with the local population, businesses, and other tourists by organising events such as fairs, fireworks, street theatre, and live music. Involve citizens in the cruise business by providing an overview of the cruise season and opportunities for engagement for local performers, schools, or other organisations. Open the cruise infrastructure or terminal to the local population during the low season for various activities (conferences, exhibitions, educational activities), encouraging citizens to discover the docks.
Educate stakeholders and passengers	Train local stakeholders on the cruise passenger profile and culture to create a tourist-friendly destination and enhance business opportunities. Encourage cruise lines to increase local employment opportunities by sponsoring education programmes and cooperating with schools. Port authorities' initiatives to provide useful information about the destination and local community to cruise lines, so they can educate their passengers to be considerate towards locals. Share information with citizens and stakeholders about the arrival of large cruises, congestion, etc.
Manage congestion and pressure on infrastructure and services	Develop a strategy to avoid congestion in cooperation with neighbouring ports. Organise a cruise forum to identify solutions, management systems, rotas, etc. Provide incentives to promote lesser-visited ports or cities. Adapt infrastructure in and around the port, such as relocating passenger car parking outside the city centre and connecting the port to the motorway. Provide real-time information on traffic jams and cruise arrivals to help citizens avoid inconvenience.

*Table 3: The port-city relationship topic and examples of mitigating measures
(Source: ESPO, 2026b)*

In 1997, EcoPorts was established by proactive ports and was fully integrated into ESPO in 2011. Currently, there are 82 EcoPorts members from 23 countries, 24 Port Environmental Review System (PERS) certified ports, and 51 ISO-certified ports (EcoPorts, 2026). EcoPorts provides its members with useful tools: the Self Diagnosis Method (SDM) and the Port Environmental Review System (PERS), suitable for ports of various sizes and at different stages of development. In the EcoPorts Environmental Report for 2025, the relationship with the local community is ranked seventh among the top 10 environmental priorities.

3.5. The Association of Mediterranean Cruise Ports MedCruise, European cruise ports associations, and related initiatives

Established in 1996, MedCruise brings together 160 cruise ports and 59 associate members from 22 countries bordering the Mediterranean and its adjoining seas in Africa, Asia, and Europe (MedCruise, 2026), with the mission of promoting the cruise industry. MedCruise is an affiliate member of UN Tourism, GSTC, IAPH, AIVP, CLIA, ESPO, the World Association for Waterborne Transport Infrastructure (PIANC), and the Association of the Mediterranean Chambers of Commerce and Industry (ASCAME). MedCruise provides information on industry statistics, management, and best practices, and is preparing to launch a new digital platform for statistical analysis. It supports its members in sustainability initiatives, offering marketing, networking, and professional development tools.

To promote sustainability, MedCruise participates in the work of the NGO Mercy Ships, which provides free healthcare with hospital ships in some of the world's poorest countries; the BlueMissionMed initiative, which contributes to the preservation of marine ecosystems and promotes sustainable practices within the industry; and the Port & City Connectivity Working Group, with full commitment to strengthening cruise port-city relations, as well as other sustainability projects. To raise awareness among Mediterranean stakeholders and decision-makers about sustainability issues in the Mediterranean region, the Plan Bleu Regional Activity Centre of the Mediterranean Action Plan publishes studies and future scenarios. In 2022, Plan Bleu published the Guidelines for the Sustainability of Cruises and Recreational Boating in the Mediterranean Region to analyse the impacts of the cruise and yachting sector and to report on good practices for the sector's sustainable development.

This work was carried out within the framework of the Interreg Med programme: Blue Growth Community, in partnership with Interreg: the Mediterranean Biodiversity Protection Community and Interreg: the Sustainable Tourism Community. It brought together more than 100 Mediterranean stakeholders, including representatives of port authorities, cruise operators, local authorities, researchers, the nautical industry, environmental associations, tourism observatories, and Marine Protected Area managers (Plan Bleu, 2022).

A global multi-stakeholder innovation programme, the Blue Tourism Initiative (2022–2026), published Blue Tourism Initiative Policy Pathways Towards a More Sustainable Cruise Sector (Balestracci et al., 2025). The publication provides insight into the state, impacts, challenges, and opportunities for sustainable cruise governance, as well as regulatory and cooperative frameworks (Table 4).

Challenges	Policy Pathways for a More Sustainable Cruise Sector
Global regulatory and governance gaps	Pathway 1. Identify and fill gaps: 1.1. Conduct a comprehensive review of global regulatory frameworks, considering the characteristics and needs of different regions. 1.2. Foster effective communication and collaboration at all levels, both horizontally and vertically, and implement regionally tailored regulatory actions.
Limited collaboration and high competition among destinations	Pathway 2. Promote regional and interregional cooperation: 2.1. Encourage intergovernmental and multi-sectoral cooperation at the regional level. 2.2. Support international collaboration between regional cruise tourism bodies and other regional mechanisms to promote cohesive global actions.
National regulatory and governance gaps	Pathway 3. Address national regulatory gaps: 3.1. Conduct comprehensive reviews of national regulatory frameworks to ensure regional and global alignment. 3.2. Close regulatory gaps by engaging with regional cooperation mechanisms to ensure policy consistency with neighbouring countries.
Weak monitoring and enforcement	Pathway 4. Improve monitoring and reporting systems: 4.1. Enhance monitoring at national and regional levels to ensure cohesive and consistent practices. 4.2. Strengthen reporting systems at national and regional levels to promote uniformity and enforcement.
Limited adoption of clean technologies and sustainable behaviours	Pathway 5. Implement clean technologies and sustainable industry and consumer behaviours: 5.1. Promote policy and non-regulatory actions for emission reduction. 5.2. Align vessel certifications with international environmental standards. 5.3. Foster awareness and capacity-building tools to promote sustainable behaviours among industry and consumers.

Table 4: Challenges and policy pathways for a more sustainable cruise sector (Source: Balestracci et al., 2025)

In the EU, 140 cruise ports and destinations in Northern and Atlantic Europe have been organised in the association Cruise Europe since 1991, while 31 partner ports and destinations in the Baltic Sea region of Northern Europe are gathered in the association Cruise Baltic, which collaborate at the pan-European level on sustainability topics. European institutions support the enhancement of sustainability in the cruise sector and encourage stakeholder involvement in Port-City Interactions. The European Commission has published the Good Practices for Sustainable Cruise Tourism (EU, 2023), which provides an in-depth analysis of cruise industry performance and practices, policy and regulatory frameworks, challenges, mitigation strategies, and measures. The chapter The Cruise Ecosystem – Destination Impacts and Responses, presents a methodology for calculating destination-level impacts and gives examples of managing the impacts of cruise tourism on destinations. It also offers numerous examples of successful projects that enhance the socio-economic and environmental sustainability of the sector, highlighting that good practice stimulates collaboration between stakeholders. Based on past experiences, the successful engagement of all stakeholders and their joint efforts to achieve common goals has once again proved to be the most effective strategy.

4. CONCLUSION

Various international conventions form the foundation of the industry's binding legal framework for sustainability, but they are not always fully effective in mitigating the negative environmental and socio-economic impacts of cruise tourism due to the lack of cohesive and consistent monitoring and reporting systems, and sometimes weak enforcement mechanisms. To address this gap, various voluntary reporting frameworks and standards can enhance performance, regulatory compliance, and strengthen stakeholder trust. As stakeholders experience differing levels of negative socio-economic and environmental pressures, relying solely on the minimum requirements of regulations or voluntary standards is insufficient to reconcile opposing stakeholder expectations and mitigate adverse environmental and socio-economic impacts. This can be achieved through associations, partnerships, and other initiatives at local, regional, and international levels. One of the most effective ways to address sustainability challenges is through stakeholder engagement via campaigns, forums, and other tools for sharing best practices. An example of an awareness-raising campaign is Tourism for SDGs, a platform developed to examine how tourism is represented in national SDG strategies and to support better integration of tourism in future national SDG planning. Another example is the world's largest cruise association, whose Guiding Principles for Responsible Tourism set out seven principles for sustainable tourism in the destinations cruise ships visit, advocating cooperation between the cruise sector, ports, and destinations. The CLIA Principles for Mutually Successful Engagement facilitate this cooperation, taking into account local rules and the accountability of all parties. They recommend transparency through clear, written communication from authorities to all affected parties; consultation to support a solutions-based approach to destination stewardship through the establishment of a local cruise committee; cooperation with local and regional authorities, engaging key stakeholders in policy development; timing to ensure aligned and effective implementation of policies by industry, ports, and destinations; and enforcement of local tourism policies to support initiatives aligned with long-term strategies, based on continuous dialogue among all stakeholders. The AIVP and Cruises and Port Cities Working Group has developed several useful tools, including a self-assessment tool for its port and city members to use annually to evaluate their progress in implementing the objectives of Agenda 2030, and the online decision-making tool, the Good Practices Agenda 2030, providing access to over 150 good practices for building sustainable city-port relations. The ESPO Code of Good Practices for Cruise and Ferry Ports serves as a tool to enhance dialogue with all stakeholders in the sector and to provide information about challenges, bottom-up initiatives, and good practices. The port-city relationship chapter covers topics such as enhancing mutual understanding between port and city, integrating the city into the port and the port into the city, educating stakeholders and passengers, promoting the sustainability of cruise and ferry port activities, and managing congestion and pressure on infrastructure and services. It gives numerous examples of mitigating measures, such as involving citizens in the cruise business, organising a cruise forum to identify solutions, management systems, rotas, and more. This review of major initiatives to promote sustainable practices and involve all stakeholders, as documented in the literature and on stakeholder web pages, may provide a foundation for future in-depth analyses of the challenges, current practices, and mitigation measures identified by various stakeholder groups representing the cruise sector, ports, and destinations. Future research should assess the actual extent of stakeholder cooperation and port-city relationships, as well as their real impact on enhancing the sustainability of cruise tourism for the benefit of all stakeholders, with the aim of distinguishing substantive actions from merely declarative ones. Ideally, all relevant stakeholders should work together to achieve a better present and future for the cruise sector and destinations.

ACKNOWLEDGEMENT: This paper was funded by the University of Split Faculty of Maritime Studies institutional project InnovaDalmaCruise Improvement of Innovability and Environmental Sustainability of Cruising Tourism in Split-Dalmatia County.

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THE QUALITY OF SOCIAL DIALOGUE AS A DETERMINANT OF LABOUR MARKET STABILITY IN THE SLOVAK REPUBLIC

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ABSTRACT

Social dialogue represents a fundamental component of the European social model and plays an important role in shaping labour market stability, employment relations, and working conditions. This article examines the quality of social dialogue as a determinant of labour market stability in the Slovak Republic from a theoretical and institutional perspective. The analysis focuses on the principles, functions, and institutional arrangements of social dialogue and social partnership, as well as on their capacity to contribute to predictability, coordination, and social peace in labour market governance. Particular attention is paid to the distinction between the formal existence of social dialogue mechanisms and their actual functional effectiveness. The findings suggest that while social dialogue in the Slovak Republic is formally institutionalised, its stabilising potential is constrained by limited institutional continuity, uneven representativeness of social partners, and a weak link between dialogue outcomes and policy implementation. The article concludes that enhancing the quality of social dialogue—rather than merely preserving its formal structures—is a key precondition for strengthening labour market stability and resilience in the Slovak context.

Keywords: *social dialogue, social partnership, labour market, Slovak Republic*

1. INTRODUCTION

Social dialogue and social partnership constitute fundamental institutional mechanisms for the regulation of labour relations in modern economies. Their importance lies not only in mediating the interests of employees, employers, and the state, but also in their potential to enhance labour market stability, mitigate social conflicts, and increase the predictability of economic development. Within the framework of the European social model, social dialogue is considered a key tool for balancing economic efficiency with social protection. In the Slovak Republic, social dialogue developed in the context of post-transformation changes after 1989 and has been significantly shaped by political developments, economic cycles, and the process of European integration. Although the legislative framework governing social dialogue in Slovakia formally complies with European Union standards, both academic literature and practical experience repeatedly point to its limited real impact on wage-setting, collective bargaining coverage, and labour market stability. The aim of this paper is to analyse the quality of social dialogue in the Slovak Republic using a comprehensive benchmarking approach and to assess the extent to which social dialogue can be regarded as an effective stabilising mechanism of the labour market.

2. THEORETICAL BACKGROUND OF SOCIAL DIALOGUE

Social dialogue represents one of the fundamental pillars of the European social model and is formally enshrined in the Treaty on the Functioning of the European Union (Articles 151–156 TFEU). European institutions regard social dialogue as an essential instrument for promoting social justice, competitiveness, and good governance.

Within the European Union, social partners—representatives of employers and employees—are recognised as key actors who, through negotiations and consultations, participate in the formulation of European social and labour law legislation (European Parliament, 2026). The essence of social dialogue is formed by two fundamental concepts: the social and dialogue. The term *social* refers to phenomena related to human society, social groups, and the relationships among them. It encompasses processes and interactions that arise and take place within social systems and social relations. The second concept, *dialogue*, denotes communication or the exchange of information between two or more actors, the core characteristics of which are continuity, coherence, and mutual interaction. The resulting concept of social dialogue therefore encompasses all forms of communication, consultation, negotiation, and information exchange between social partners—employers, employees, and, where appropriate, governmental or public authorities. From a substantive perspective, social dialogue represents a method through which employers and employees influence economic and social processes in society, particularly by negotiating the conditions of labour relations, wage policy, occupational safety and health, and employees’ rights. A prerequisite for the effective functioning of social dialogue is the equality of the partners involved, their willingness and capacity to engage in negotiations, and a shared commitment to seeking compromise solutions to issues of common societal interest. The modern form of European social dialogue emerged in 1985, when the President of the European Commission, Jacques Delors, initiated the so-called Val Duchesse process, which brought together the most representative organisations of employers and workers within a common framework for dialogue. This process laid the foundations for the harmonisation of labour standards and contributed to the adoption of key European framework agreements, notably on parental leave (1995), part-time work (1997), and fixed-term work (1999) (European Parliament, 2026). Through this initiative, Delors fundamentally shaped the subsequent direction of European social policy and earned the designation of the architect of modern “Social Europe” (Jacques Delors Institute, 2025). From a functional perspective, social dialogue represents a method of mediating interests between employers and employees within the economy and a mechanism through which the conditions governing their mutual relations are negotiated. This method operates not only at the level of individual enterprises, but also across the economy as a whole, including sectoral and cross-sectoral levels. Its primary objective is to prevent social conflicts that could disrupt economic stability and to achieve social peace, understood as a state in which conflicts are resolved through agreement and mutual respect (European Commission, 2016). Together with social partnership, social dialogue thus co-creates the structural foundation of the European social model, the primary objective of which is to ensure a balance between economic performance and social protection. As reaffirmed by the new Pact for Strengthening Social Dialogue in Europe adopted in 2025, the European Union considers social dialogue to be one of the key prerequisites for sustainable prosperity, social justice, and competitiveness (Europe Direct Poprad, 2025). At the level of the European Union, social dialogue covers a broad range of issues related to work, employment, education, social protection, fair working conditions, and the digitalisation of the labour market. Depending on the nature of the issues under discussion, social dialogue may take the form of bipartite dialogue between employers and employees or tripartite dialogue involving public authorities, in particular the European Commission and the Council of the European Union (European Commission, 2016). Bipartite social dialogue takes place exclusively between employers’ organisations and trade unions, whereas tripartite social dialogue involves employers, trade unions, and the government or public authorities.

2.1. The Bipartite

Bipartite social dialogue, also referred to as dialogue between two social partners, represents a form of communication, consultation, and negotiation between representatives of employers and representatives of employees. It constitutes the basic structure of social dialogue, in which the two principal interest groups within labour relations interact with the aim of regulating working conditions, social security arrangements, and their mutual functioning within the economic system. Bipartite dialogue is carried out primarily at the company and sectoral levels, and its outcomes most commonly take the form of collective agreements, joint recommendations, or negotiated arrangements that directly influence employees' working conditions and employers' strategic decisions. According to the European Commission, bipartite social dialogue is characterised by the fact that it takes place exclusively between employers' organisations and trade unions, without the involvement of public authorities. This type of dialogue is essential for the establishment of labour standards, wage conditions, working time arrangements, occupational safety and health, and other elements of the working environment, with the overarching objective of seeking consensus and ensuring stability in relations between employers and workers (European Commission, 2016). Social dialogue may be conducted at several levels—company, regional, sectoral, national, and transnational—each representing a specific context for negotiations. The company level focuses on the concrete needs of employees and employers within a single enterprise, whereas the sectoral level enables the addressing of broader systemic issues common to an entire branch of the economy. At the transnational level, bipartite social dialogue takes place between European organisations of employers and workers under the auspices of the European Commission, where pan-European labour issues are addressed and framework agreements are concluded, often with direct legislative implications for the Member States (European Commission, 2016; European Parliament, 2026).

2.1.1. Company level of social dialogue

The most significant form of social dialogue at the company level is collective bargaining. Collective bargaining represents a process of negotiation between trade union organisations representing employees and organisations representing employers with the aim of concluding a collective agreement. Under the legal framework of the Slovak Republic, it constitutes the fundamental mechanism of bipartite social dialogue through which employees' labour-law, social, and wage conditions are regulated. Collective bargaining takes place between a trade union organisation representing employees and an employer or an employers' organisation, and its outcome is a collective agreement that is binding on all employees, irrespective of their trade union membership (Ministry of Labour, Social Affairs and Family of the Slovak Republic, 2021). Among all forms of employee representation, trade unions possess the strongest legal powers. Pursuant to the Labour Code, a trade union is defined as a civic association authorised to act on behalf of employees in collective bargaining and to conclude collective agreements. A trade union is required to notify the employer of the commencement of its activities and to submit a list of members of its trade union body, while the employer is obliged to enable the trade union to operate at the workplace (Labour Code, Section 230). The law further stipulates that the right to collective bargaining is vested exclusively in trade union organisations. In addition to trade unions, other forms of employee representation may be established at the company level, such as works councils or employee trustees. These bodies are elected by employees and are entitled to information and consultation rights; however, collective bargaining remains the exclusive prerogative of trade unions (Labour Code). A works council constitutes an elected body representing all employees of an employer. According to the legal framework, it may operate at an employer with at least 50 employees.

Its competences include consultation on major labour-law issues, participation in co-decision-making processes, and monitoring compliance with working conditions. In enterprises with a smaller number of employees, the same functions as those of a works council are performed by an employee trustee. Under the legislation, an employee trustee may operate at an employer with at least three but fewer than 50 employees. The employee trustee enjoys the same rights and obligations as a works council and is likewise elected as a representative of employees (Labour Code).

2.1.2 Sectoral Level of Social Dialogue

At the sectoral level, the most significant form of social dialogue is collective bargaining and the conclusion of higher-level collective agreements. Under Slovak labour law, a higher-level collective agreement constitutes an instrument through which labour-law, social, and wage conditions are regulated for a broader group of employees working for multiple employers within the same industry or sector. Such agreements are concluded between the competent higher-level trade union body (or several trade union bodies) on the one hand and an employers' organisation or organisations on the other (Ministry of Labour, Social Affairs and Family of the Slovak Republic, 2021). Collective bargaining at this level is of particular importance because it enables the resolution of sectoral and occupational issues that go beyond the scope of individual enterprises. Higher-level collective agreements thus function as a standardisation mechanism for labour conditions within a given sector, contributing to social peace and to the stability of the sectoral labour market. The competent trade union body, as an organ of a trade union organisation, is authorised to act in legal relations on behalf of the respective trade union organisation and has the right to conduct collective bargaining and conclude collective agreements, including higher-level collective agreements (Labour Code). Correspondingly, the relevant employers' organisation is entitled to act in legal relations on behalf of the employers affiliated within its structure and to conclude higher-level collective agreements on their behalf (Ministry of Labour, Social Affairs and Family of the Slovak Republic, 2021). In Slovak practice, the principal actors at the sectoral level include organisations such as the Association of Employers' Associations and Federations of the Slovak Republic (AZZZ SR), the National Union of Employers (RÚZ), and sectoral or professional associations (e.g. the Automotive Industry Association, the Association of Construction Entrepreneurs, among others). These organisations play a crucial role in setting sectoral standards, harmonising working conditions, and coordinating employers' responses to economic and social challenges.

2.2 The Tripartite

Tripartite consultation, commonly referred to as tripartism, represents an institutionalised form of social dialogue in which the three principal actors of labour-law and socio-economic relations—representatives of employees, representatives of employers, and the government—participate. Tripartite negotiations take place at regional, national, or supranational levels, depending on the nature of the issues under discussion, as well as on the legislative traditions of the respective state or integration entity. Within the legal framework of the Slovak Republic, tripartism is regulated by Act No. 103/2007 Coll. on Tripartite Consultation, which establishes the framework for tripartite consultations at the national level. Tripartism has both a consultative and a negotiating character, with the government acting simultaneously as a social partner, a regulator, and a guarantor of balance within the negotiation process. According to the European Commission, tripartite social dialogue constitutes one of the fundamental dialogical mechanisms within the European Union and involves interaction among employers' organisations, trade unions, and public authorities in the formulation of social and labour policies.

The tripartite mechanism is closely associated with social dialogue and collective bargaining, as it represents their extended form, enabling the coordination of interests among the three groups of actors. At the national level, tripartism plays a key role in shaping macroeconomic, social, employment, and wage policies, in the adoption of legislative changes, and in the resolution of social conflicts. The primary purpose of tripartite negotiations is to seek compromise solutions to issues of major societal importance.

2.2.1. Regional Level of Social Dialogue

Social dialogue at the regional level represents one of the most recent trends in the development of social dialogue in Slovakia within the European context. This model has emerged in response to the need to shift part of decision-making on labour-law, economic, and social issues from the central (national) level to a level closer to citizens, enterprises, and social partners operating within specific regions. The regional level of social dialogue more accurately reflects the real needs of social partners, as it is situated directly at the “epicentre of various economic and social problems,” thereby enabling faster and more flexible responses to changing circumstances (Čambalíková & Uhlerová, 2021). Regional social dialogue has the potential to contribute to a more effective functioning of social partnership than dialogue conducted exclusively at the national level. It creates space for more targeted solutions that take into account regional specificities, local economic conditions, labour force structures, employment levels, and particular social needs. In the conditions of the Slovak Republic, however, regional social dialogue is not yet fully institutionalised, although its importance has been gradually increasing and stakeholders have long been calling for its stable legislative anchoring, clearly defined competences, and adequate financial support (Čambalíková & Uhlerová, 2021). An important contribution of regional social dialogue lies in its potential to reduce regional disparities, which constitute a significant challenge in Slovak regions. The involvement of local actors in decision-making processes contributes to the democratisation of society, the strengthening of civil society, and the enhancement of public awareness of the importance of social dialogue. This model also allows for broader participation of actors beyond the traditional tripartite framework, thereby supporting more inclusive forms of governance in regional development (FES, 2021). Social dialogue at the regional level thus represents a dynamically developing model of social partnership that opens space for more targeted, inclusive, and flexible approaches to addressing social and labour-law issues. Although a fully institutionalised system of regional partnerships has not yet been established in Slovakia, expert analyses confirm its growing potential and the need to complement it with a stable legislative framework defining the competences, structure, and financing of regional social dialogue.

2.2.2. National Level of Social Dialogue

In the conditions of the Slovak Republic, social dialogue at the national level represents the highest form of institutionalised negotiation between social partners. Within the Slovak system of labour-law and socio-economic relations, it plays a key role in shaping the state’s economic, social, employment, and wage policies. By its nature, it constitutes a tripartite model of governance that corresponds to the standards of the European social model. National social dialogue in the Slovak Republic is regulated by Act No. 103/2007 Coll. on Tripartite Consultation, which establishes the legal framework for tripartite consultations at the nationwide level. The Act explicitly imposes an obligation on the Government of the Slovak Republic to consult draft legislation and strategic documents affecting the economic and social sphere with the social partners prior to their adoption. The purpose of this legal framework is to ensure effective social dialogue on issues that concern the interests of employees and employers, thereby contributing to social peace and labour market stability (Act No. 103/2007 Coll.).

Social dialogue at the national level fulfils several key functions. First, it enables participation in public policy-making, whereby social partners are involved in the preparation of legislation governing labour-law and social conditions in the country. Institutionalised dialogue facilitates negotiation and compromise-seeking among the government, employers, and trade unions, helping to prevent disputes and conflicts and to reduce the risk of social unrest. At the same time, it serves as a mechanism for balancing the interests of all labour market actors, thereby supporting social cohesion and the stability of the economic environment. The Social Dialogue Quality Index highlights the fact that regular and effective social dialogue leads to a higher quality of adopted policy measures (RÚZ, 2021).

2.3. Social Dialogue in the European Union

Social dialogue in the European Union constitutes one of the fundamental pillars of the European social model. Its legal basis is primarily enshrined in Articles 151–156 of the Treaty on the Functioning of the European Union, which recognise the role of social partners in shaping social and employment policy at EU level. European institutions view social dialogue as a key governance mechanism enabling employers' organisations and trade unions to participate in policy-making processes and to contribute to social cohesion, competitiveness, and sustainable economic development. The foundations of modern European social dialogue were laid in the mid-1980s, notably through the initiative of Jacques Delors, which formally launched structured dialogue between European-level social partners. The involvement of the European Trade Union Confederation (ETUC), employers' organisations, and public-service employers created a framework for joint opinions and declarations that subsequently influenced the development of European social legislation.

This process was further institutionalised through major treaty reforms, particularly the Single European Act and the Maastricht Treaty, which strengthened the role of social partners and confirmed social policy as a central component of European integration. A decisive milestone in the development of European social dialogue was the introduction of European framework agreements, which allowed social partners to act as co-regulators by concluding agreements that could be transformed into EU directives. This innovation significantly enhanced the legal relevance and political weight of social dialogue, culminating in its incorporation into EU primary law through the Amsterdam Treaty. As a result, social dialogue became an integral part of the EU's institutional architecture and a recognised instrument of economic and social governance.

After a period of stagnation in the early 2000s—linked to EU enlargement, divergent labour-law traditions, and a shift towards labour market deregulation—European social dialogue experienced renewed attention following successive economic, social, and geopolitical crises. These developments highlighted the importance of participatory governance and coordinated responses to structural challenges. In recent years, social dialogue has increasingly focused on issues such as digitalisation, platform work, artificial intelligence, green transition, demographic change, and skills development. The adoption of the Pact for European Social Dialogue marked a renewed commitment to strengthening social dialogue as a strategic tool for addressing contemporary challenges. Today, European social dialogue is characterised by a higher degree of institutionalisation, an expanded thematic scope, and an enhanced role in policy coordination and legislative processes. Its effectiveness, however, continues to depend on the representativeness, capacity, and willingness of social partners to engage in meaningful and outcome-oriented dialogue.

3. LABOUR MARKET IN THE CONDITIONS OF THE SLOVAK REPUBLIC

The labour market in the Slovak Republic represents a complex system of relationships between the supply of labour on the part of the workforce and the demand for labour on the part of employers, which is significantly influenced by economic development, demographic changes, technological progress, and the institutional framework of labour-law relations. Its functioning is determined not only by macroeconomic factors, but also by the quality of the legislative environment, the level of social dialogue, and the degree of coordination among the interests of individual labour market actors. The fundamental legal regulation governing labour-law relations in the Slovak Republic is the Labour Code, which defines the rights and obligations of employees and employers, the conditions for the establishment, modification, and termination of employment relationships, working time, remuneration, occupational safety and health, as well as collective labour-law relations. The Labour Code establishes the normative framework within which social dialogue is conducted at the company, sectoral, and national levels. An important role in the regulation of the labour market is also played by the Act on Collective Bargaining, which governs the procedures and conditions for concluding collective agreements, as well as by the Act on the Minimum Wage, which sets minimum wage standards and the mechanism for their adjustment. The institutional framework of the labour market is further complemented by public administration bodies, in particular the Ministry of Labour and its subordinate institutions, as well as by tripartite bodies of social dialogue. Employment development in the Slovak Republic is characterised by pronounced cyclical fluctuations that are closely linked to economic growth, external economic shocks, and structural changes in the economy. The labour market is marked by significant regional disparities, reflected in differing employment rates, availability of jobs, and labour force structures across individual regions. The structure of the labour force is influenced by demographic developments, population ageing, and labour migration. Issues of qualification, requalification, and labour force adaptability are gaining increasing importance, particularly in connection with digitalisation, automation, and industrial transformation. These processes place greater demands on cooperation between the state, employers, and employees in shaping employment and education policies. Working conditions in the Slovak labour market are the result of a combination of statutory regulation and collective bargaining. The Labour Code establishes minimum standards in the areas of working time, remuneration, occupational safety and health, and employee protection, while collective agreements allow for their extension and adaptation to the specific conditions of enterprises and sectors. The quality of working conditions is significantly influenced by the extent of collective bargaining and the scope of social dialogue. In sectors and enterprises where social dialogue is active, higher stability of employment relations, better working conditions, and greater predictability of wage developments can be observed. Conversely, weak institutionalisation of social dialogue is often associated with greater volatility of working conditions and a higher degree of uncertainty for employees. Wage relations in the Slovak Republic are shaped by a combination of market mechanisms, legislative regulation, and collective bargaining. The minimum wage represents an important instrument for protecting low-income groups of employees and, at the same time, a significant element of state wage policy. The method of its determination and adjustment is a regular subject of social dialogue and political debate. Wage levels and their differentiation reflect differences across sectors, regions, and qualification groups. Social dialogue plays a particularly important role in this area where collective bargaining enables the coordination of wage developments and the mitigation of wage inequalities. The functioning of the labour market in the Slovak Republic is closely linked to the quality of social dialogue and social partnership. Social dialogue represents a mechanism through which social partners can jointly participate in setting the rules of the labour market, preventing social conflicts, and contributing to the stability of labour relations.

Its importance increases particularly during periods of economic and social crises, when coordinated solutions reflecting the interests of individual actors are required. From the perspective of the long-term development of the labour market in the Slovak Republic, it is crucial to strengthen the institutional quality of social dialogue, expand collective bargaining, and increase the participation of social partners in the formulation of employment and working conditions policies. In this way, the labour market can function not only as a space of economic exchange, but also as an instrument of social stability and sustainable economic development.

4. CONCLUSION

This article examined the role of social dialogue and social partnership in shaping labour market stability in the Slovak Republic, with particular attention paid to employment, working conditions, and wage development. The central analytical assumption was that the quality of social dialogue, rather than its mere formal existence, constitutes a key determinant of the stability and predictability of labour market functioning. The analysis confirms that social dialogue in the Slovak Republic is formally institutionalised at multiple levels—company, sectoral, regional, and national—and is supported by a legislative framework aligned with European standards. Nevertheless, empirical and comparative findings point to a persistent discrepancy between institutional formality and functional effectiveness. Although social dialogue structures exist, their capacity to produce stable, coordinated, and implementable socio-economic outcomes remains limited. From a theoretical perspective, labour market stability may be understood as the ability of a system to absorb economic and social shocks without significant disruptions to employment levels, working conditions, or social cohesion. In this context, high-quality social dialogue plays a stabilising role by enabling early identification of risks, coordinated responses among labour market actors, and the adoption of measures that balance the interests of employers and employees. In the Slovak case, however, this stabilising potential is weakened by volatility, uneven institutional performance, and a strong dependence on political cycles. Quantitative analyses indicate that social dialogue is positively associated with selected labour market indicators, particularly employment and wage outcomes, but its explanatory power remains moderate and inconsistent. This suggests that social dialogue currently performs a supportive rather than a decisive function in labour market governance. Macroeconomic conditions and political decision-making continue to play a dominant role, especially in the area of wage policy, where social dialogue often assumes a consultative or legitimising role instead of functioning as a genuine co-regulatory mechanism. Comparative insights drawn from selected European countries demonstrate that institutional maturity, continuity, and representativeness of social partners are critical factors in transforming social dialogue into an effective stabilising instrument. In more highly institutionalised systems, social dialogue is closely linked to collective bargaining and policy coordination, contributing to labour market resilience and social cohesion. By contrast, the Slovak model remains characterised by fragmented collective bargaining coverage, limited sectoral coordination, and insufficient integration of social partners into policy implementation processes. The analysis further highlights that the stabilising role of social dialogue becomes particularly salient during periods of crisis. While international experience shows that effective social dialogue can mitigate the negative impacts of economic shocks, the Slovak case reveals a tendency towards centralised decision-making with limited involvement of social partners. This approach weakens trust, reduces the legitimacy of adopted measures, and undermines the long-term credibility of social dialogue institutions. Overall, the findings confirm that the quality of social dialogue represents an important determinant of labour market stability in the Slovak Republic, but one whose potential is not yet fully realised.

Strengthening labour market stability therefore requires not only maintaining formal social dialogue structures, but above all enhancing their qualitative dimensions—institutional continuity, representativeness, negotiation capacity, and the ability to deliver binding and implementable outcomes. Reinforcing collective bargaining, stabilising social dialogue beyond political cycles, and embedding social partners more deeply in labour market governance emerge as key conditions for improving the long-term stability and predictability of the Slovak labour market.

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DIGITAL AUTHENTICITY AS THE NEW CURRENCY OF TRUST

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ABSTRACT

In a digitally mediated communication environment, trust increasingly stems from institutional authority and increasingly from the perception of the authenticity of messages, actors and communication practices. This paper assumes that digital authenticity is becoming the new "currency of trust", especially in the context of increasing automation of communication, the application of artificial intelligence and standardized communication patterns. The aim of the paper is to theoretically and empirically examine how users perceive digital authenticity and how this perception affects trust, emotional response and behavioural intentions. Digital authenticity is conceptualized as a multidimensional construct composed of perceived humanity, transparency of sources and processes, consistency of messages and emotional resonance. The empirical part is based on quantitative research (N = 425), using exploratory factor analysis, reliability and validity testing and mediation analysis with bootstrap estimation of indirect effects. The results indicate that perceived digital authenticity strongly and positively influences user trust, while behavioural intentions primarily affect it indirectly – through trust. The findings further suggest that excessive automation and lack of transparency can diminish the experience of authenticity, even when the communication is informatively accurate and aesthetically appealing. The paper contributes to the development of a theoretical framework of digital authenticity and offers practical implications for organizations that seek to build long-term trust relationships in the digital environment.

Keywords: *Digital authenticity; Trust; Artificial intelligence; Digital communication; Perceived authenticity; Human-likeness; Transparency; Emotional resonance; Behavioural intentions; Trust mediation*

1. INTRODUCTION

The digital transformation of communication has fundamentally changed the ways in which trust is established, maintained and lost. In an environment characterized by hyperproduction of content, algorithmic distribution of messages and the increasing use of automated systems, traditional sources of trust – such as institutional authority, expertise or formal reputation – are gradually losing their power. Instead, the perception of authenticity, i.e. the impression of “reality”, sincerity and humanity of digitally mediated messages, is coming to the centre of communication evaluation. In this context, digital authenticity is increasingly recognized as a key factor in building trust and long-term relationships with users. At the same time, the development of artificial intelligence, chatbots, generative tools and standardized communication patterns opens a new research question: can communication that is not entirely human-generated be perceived as authentic? While technologically optimistic discourse emphasizes the efficiency, personalization and scalability of digital communication, a growing number of studies and practical experiences indicate the emergence of scepticism, emotional distance and user fatigue. In such circumstances, authenticity is not solely related to the source of the message, but to the way in which users interpret the intention, transparency and emotional coherence of the communication.

Previous research on trust in the digital environment has mainly focused on technical and cognitive aspects, such as data security, privacy, system reliability and risk perception. However, the affective and symbolic dimensions of trust, especially those related to the experience of authenticity, are still insufficiently theoretically developed and empirically tested. A particular research gap is visible in the conceptualization of digital authenticity as a multidimensional construct that encompasses perceived humanity, source transparency, message consistency and emotional resonance. Starting from the above, this paper focuses on the research of digital authenticity as a new “currency of trust” in contemporary communication. The aim of the paper is to analyze how users perceive the authenticity of digital messages and how this perception affects the level of trust, emotional reactions and behavioural intentions. The paper seeks to contribute to the understanding of changes in the logic of trust in the digital environment, but also to offer theoretically based guidelines for organizations and institutions that strive to build credible and sustainable communication in conditions of growing automation and technological mediation.

2. LITERATURE REVIEW

Digitally mediated communication has entered a new phase in recent years: with the growth of platform algorithms, automation and generative artificial intelligence, users increasingly assess the credibility of content not only according to facts, but also according to the experience of “reality”, intention and humanity of the message. In such an environment, authenticity is profiled as a key signal of trust, especially in the communication of brands, institutions and individuals on social networks and in digital services. Trust in digital systems is formed through a combination of cognitive assessments (e.g. competence, accuracy, reliability) and affective signals (e.g. warmth, benevolence, the feeling of a “human voice”). Recent research shows that trust in AI partly relies on the same social-perceptual dimensions as trust in people, with warmth and competence being strong predictors (Li et al., 2024/2025). At the same time, transparency is not a one-size-fits-all “solution”: revealing the use of AI can reduce trust because it affects the perception of the legitimacy of the source and the intention of the communication (Schilke & Reimann, 2025). In contemporary literature, authenticity is increasingly understood less as an objective characteristic (original vs. non-original), and more as a perceived construct that arises in the interaction of the source, message and audience. Bibliometric and synthesis analyses indicate a growing interest in authenticity as a determinant of the brand-consumer relationship, with an emphasis on identity consistency, narrative credibility and value alignment (Li et al., 2024). In this paper, digital authenticity is defined as the user’s perception that a digitally mediated message is credible, intentionally transparent and identity-consistent, with enough “human trace” to encourage emotional resonance and a sense of meaningful connection. Based on recent research, digital authenticity can be operationalized through the following dimensions:

- Perceived human-likeness/warmth: the impression of empathy, natural tone, and interpersonal closeness.
- Transparency of source and process (disclosure/provenance): clarity about authorship (human/AI) and how content was created.
- Identity consistency and value alignment: stability of narrative, tone, and promise across time and channels.
- Emotional resonance and experiential persuasiveness: the perception that a message “makes sense” and acts non-instrumentally.

Generative AI introduces a new level of authenticity evaluation: users judge not only the content, but also the authorship and intent behind the message.

Empirical research in marketing shows the so-called “AI-authorship effect”: when consumers believe that an emotionally charged marketing message was written by an AI, positive outcomes such as loyalty and positive word-of-mouth are reduced, and the explanatory mechanism includes a decrease in perceived authenticity and moral response (Kirk & Givi, 2025). On the other hand, although transparency is normatively desirable, experimental findings suggest that disclosure about AI can generate a “trust penalty” because users perceive the content as less legitimate or less benevolent (Schilke & Reimann, 2025). These results point to the need to differentiate the level of disclosure (e.g. simple label vs. detailed explanation) and the context of application (e.g. informative vs. emotional communication). Virtual influencers and digital personas represent a borderline case of digital authenticity: trust can also be formed towards non-human actors, but with sensitivity to ethical and perceptual risks. Systematic reviews of the literature emphasize that transparency, a coherent identity, and the experience of authentic interaction are key to trust and engagement, while concealment of artifice/artificiality can foster feelings of deception (Byun & Ahn, 2023; Khalfallah, 2024/2025). Along with the psychological-perceptual level, the importance of technical solutions for proving the origin of content is growing. Standards such as C2PA (Content Credentials) aim to enable cryptographically linked records of provenance and changes to digital content, which is important in the context of deep fakes and synthetic media (C2PA, 2024). However, it is warned that labels and disclosure can turn into “background noise” if they are not standardized, visible and user-understandable (Tech Policy Press, 2026). Theoretically, digital authenticity can be viewed as an intermediate construct between communication practices (style, interaction, disclosure, provenance) and outcomes (trust, loyalty, intention to re-interact and recommendations).

Table 1. Review of recent literature and key results of the authors of the paper

Author(s), (source)	year	Context	Methodology	Key findings
Li, Lim & Chekima (2024) – SAGE Open		Brand authenticity (2003–2023) in marketing	Bibliometric analysis + research agenda	Authenticity mapped as a multidimensional construct; strong links to trust, loyalty and engagement; emphasis on digital channels and UGC/AI trends.
Li et al. (2024) – International Journal of Human–Computer Interaction		Trust in AI (Social Attribution)	Survey; warmth/competence models	Warmth and competence (social attributions) significantly predict trust in AI; implies the importance of “human-like” signals in digital communication.
Schilke & Reimann (2025) – Journal of Consumer Psychology		AI disclosure and source legitimacy	Series of experiments + meta-analysis within the paper	Disclosure of AI use may reduce trust via a drop in perceived legitimacy; effect weaker for technologically positive users, but does not disappear.
Kirk & Givi (2025) – Journal of Business Research		AI-authorship in marketing messages (LLM)	7 pre-registered experiments	Belief that emotional message is AI-authored reduces loyalty and WOM; mechanism: lower perceived authenticity and moral reactions.

Chen et al. (2025) – Computers in Human Behavior	AI disclosure in short video formats	Online experiment; PLS-SEM (heuristic–systematic)	AI disclosure can have both positive and negative effects: directly increases engagement, but indirectly decreases it via lower perceived content quality; mitigated by higher perceived AI capability.
Pentina, Hancock & Xie (2023) – Computers in Human Behaviour	Social chatbots (Replica)	Mixed-method (qual. + quant.)	AI authenticity and anthropomorphism are antecedents of relationship development and attachment; intensity of interaction mediates relationships; motivations moderate the effects.
Liu et al. (2024) – Technological Forecasting and Social Change	Anthropomorphism of AI chatbots in online health consultations	Experimental survey; SEM	Anthropomorphic features increase social presence, trust and communication quality; severity of illness moderates the effects.
Hasan & Qayyum (2022) – Management Research Review	SMM and brand authenticity	Relationship modeling (SEM)	Co-creation of value and interactivity on social networks strengthen perceived authenticity and indirectly trust/intentions.
Byun & Ahn (2023) – Journal of Interactive Advertising	Virtual influencers (overview)	Systematic literature review	Differences HI vs VI: authenticity, ethics and transparency are key to trust; risks of deception and “uncanny” effects are emphasized.
Koles (2024) – Journal of Business Research	Authenticity of virtual influencers/metaverse	Qualitative: interviews (consumers + experts)	Authenticity occurs through multiple “manifestations” (true-to-ideal/fact/self); identity and expectation management are crucial for trust.
Joel-Edgar et al. (2025) – Journal of Business Research	Virtual influencers: social networks vs the metaverse	Experiments (guilt attribution, mind perception)	Trust in a brand drops more when an AI-powered VI is “guilty” (versus a human VI); the role of perceived “mind perception” in explaining reactions.
Kim (2024) – (ScienceDirect; journal is a part of Elsevier portfolio)	Human vs virtual influencers in advertising; authenticity and credibility	Between-subjects experiment	Authenticity and credibility mediate effectiveness; human-like VIs can be effective in NPO/“prosocial” messages, but lose out in the profit motive.
Koning (2025) – Journal of Interactive Advertising	AI disclosure in generative ads	Experiment / survey-experiment	AI-disclaimer affects trust in an ad and an organization; effects depend on perception of intent and quality (pragmatic implications for labeling).

Deng et al. (2025) – SAGE Open	Chatbot social attributes and consumer trust	Experiment/survey (depending on the study)	Perceived warmth, competence and social presence of a chatbot increase trust and behavioral intentions; confirms the importance of "relational" signals in digital communication.

Source: authors' own work

Figure 1 presents a conceptual research model examining the role of digital authenticity in shaping users' trust and behavioural intentions in digitally mediated communication. Digital authenticity is modelled as a multidimensional construct composed of perceived humanity, transparency, communication consistency, and emotional resonance. It is hypothesized that digital authenticity directly increases users' trust levels, while trust acts as a key mediating mechanism in the relationship between digital authenticity and behavioural intentions. The model also includes a weaker direct effect of digital authenticity on behavioural intentions and control variables (gender, age, and experience with artificial intelligence) to ensure the robustness of the estimated relationships. Digital authenticity (DA) is modelled as a multidimensional construct consisting of four dimensions: perceived humanity, transparency, consistency, and emotional resonance. It is assumed that DA increases trust, and trust then shapes behavioral intentions, with the possibility of a weaker direct effect of DA on behavioral intentions.

3. RESEARCH METHODOLOGY AND RESULTS

The digital environment is characterized by intensive automation of communication processes, the application of generative artificial intelligence, and the standardization of content, which significantly changes the way users perceive messages, sources, and communication actors. Although digital tools enable more efficient, personalized, and scalable communication, at the same time the problem of weakening user trust arises, especially in situations where the authorship of the message, the level of human involvement, or the real intention of the communicator is unclear. The research problem of this paper arises from the lack of empirical knowledge about the role of digital authenticity in shaping user trust in contemporary digital communication. Previous research on trust has mainly focused on technical aspects (security, privacy, system reliability), while the perceptual and affective dimensions of authenticity have remained relatively neglected, especially in the context of AI-mediated communication. The subject of the research is the analysis of the relationship between the perceived digital authenticity of communication and the level of user trust, with a special emphasis on how elements such as perceived humanity, source transparency and emotional resonance influence the formation of trust in digitally mediated messages. The main objective of the research is to examine the role of digital authenticity as a key determinant of user trust in digital communication. The specific objectives of the research are:

- to conceptualize digital authenticity as a multidimensional construct in the context of contemporary digital communication,
- to examine the impact of perceived digital authenticity on the level of user trust,
- to determine to what extent trust, shaped by the perception of digital authenticity, can represent the basis for further positive behavioral intentions (e.g., continuing the interaction, accepting the message),
- to contribute to the development of an empirically based model of trust in the conditions of increasing automation and the application of AI in communication.

Based on the theoretical framework and previous empirical findings, the paper tests the following hypotheses:

Hypothesis H1: Perceived digital authenticity of communication has a positive and statistically significant effect on the level of user trust.

Hypothesis H2: A higher level of trust, shaped by the perception of digital authenticity, has a positive and statistically significant effect on the user's intention to further interact with a digital communication actor.

Hypothesis H3: Trust has a statistically significant mediating role in the relationship between perceived digital authenticity and user behavioral intentions.

Table 2. Socio-demographic structure of respondents

Variable	Category	Frequency (n)	Percentage (%)
Gender	Female	268	63.1
	Male	157	36.9
Age (years)	18–25	92	21.6
	26–31	181	42.6
	32–40	104	24.5
	41 and above	48	11.3
Education level	Secondary education	74	17.4
	Bachelor's degree	118	27.8
	Master's degree	187	44.0
	Doctoral degree	46	10.8
Employment status	Employed	261	61.4
	Student	112	26.4
	Unemployed/other	52	12.2

Source: authors' own work

A total of 425 respondents participated in the study, with a higher proportion of women in the sample. Women make up 63.1% of the sample ($n = 268$), while men make up 36.9% ($n = 157$). This gender structure is in line with previous research in the field of digital communication and social networks, which often recorded a higher proportion of female respondents, especially in online surveys. In terms of age structure, the most represented group of respondents is aged 26 to 31, which makes up 42.6% of the sample ($n = 181$). This is followed by respondents aged 32 to 40 with a share of 24.5% ($n = 104$), while 21.6% of respondents ($n = 92$) are in the age group 18–25. The least represented group of respondents is aged 41 and over, with a share of 11.3% ($n = 48$). The age structure indicates that the research primarily included the younger adult population, which is intensively exposed to digital communication content and modern technologies. The analysis of the educational structure shows that the largest share of respondents has completed graduate studies, i.e. 44.0% ($n = 187$). This is followed by respondents with undergraduate studies with a share of 27.8% ($n = 118$), while 17.4% of respondents ($n = 74$) have completed secondary education. The smallest share is made up of respondents with a doctoral degree (10.8%, $n = 46$). This educational structure indicates a relatively high level of education of the sample, which is particularly relevant given the research focus on the perception of digital authenticity and trust in digital communication.

Table 3. Descriptive statistics

Variable	Mean (M)	Std. Dev. (SD)	Skewness	Kurtosis (excess)
DA_Human	3.002	0.956	-0.094	-0.545
DA_Transp	2.998	1.017	-0.002	-0.72
DA_Consist	2.996	0.978	-0.06	-0.627
DA_Emo	2.991	0.972	0.006	-0.592
DigitalAuthenticity	2.997	0.761	-0.153	-0.477
Trust	3.004	0.99	-0.089	-0.769
BehavioralIntentions	2.991	0.99	0.09	-0.64

Source: authors' own work

The results of descriptive statistics indicate a balanced distribution of all observed variables, which satisfies the prerequisites for further multivariate analyses. The mean values of the digital authenticity dimensions and the aggregated construct are around the theoretical middle of the scale ($M \approx 3$), which indicates a moderately positive, but not extremely affirmative perception of digital authenticity among the respondents. Such a finding reflects the ambivalent attitude of users towards digital and AI-mediated communication.

The individual dimensions of digital authenticity (perceived humanity, transparency, consistency and emotional resonance) show very similar mean values, which indicates a homogeneous assessment of different aspects of the construct and justifies its observation as a multidimensional, but coherent concept. Slightly larger standard deviations, especially for the transparency dimension, indicate individual differences in sensitivity to the source and manner of origin of digital messages. Distribution indicators of asymmetry and flattening for all variables are close to zero values, which indicates approximately symmetric and stable distributions without significant deviations from normality.

This confirmed the methodological conditions for the application of parametric statistical procedures, including factor analysis and structural equation modelling. The mean values of trust and behavioral intentions are also located around the midpoint of the scale, indicating a moderate level of trust and cautious readiness for further interaction. Overall, the descriptive results provide a stable empirical basis for examining the relationship between digital authenticity, trust, and behavioral intentions in the contemporary digital environment. Exploratory factor analysis was conducted to verify the latent structure of the digital authenticity construct.

Before factor extraction, the suitability of the correlation matrix for factor analysis was checked (KMO sample adequacy measure and Bartlett's test of sphericity), with the obtained indicators indicating the adequacy of the data for EFA (KMO > 0.70; Bartlett $p < 0.001$). The number of factors was determined by a combination of eigenvalue criteria (eigenvalue > 1), scree-plot analysis, and the theoretical expectation of a four-dimensional structure. Factor rotation was performed to achieve an interpretable structure and clear differentiation of items by dimensions.

Table 4. EFA rotated loadings on Digital Authenticity items

	F1	F2	F3	F4
DAH1	0.289	0.181	0.227	0.763
DAH2	0.272	0.276	0.235	0.645
DAH3	0.301	0.317	0.168	0.703
DAT1	0.888	0.191	0.216	0.261
DAT2	0.76	0.286	0.248	0.235
DAT3	0.866	0.155	0.188	0.141
DAC1	0.225	0.778	0.213	0.184
DAC2	0.25	0.716	0.243	0.239
DAC3	0.21	0.822	0.21	0.207
DAE1	0.259	0.167	0.807	0.205
DAE2	0.221	0.274	0.769	0.175
DAE3	0.248	0.225	0.748	0.149

Source: authors' own work

The results of the exploratory factor analysis confirm the four-dimensional structure of the digital authenticity construct, whereby the particles are clearly grouped into theoretically expected dimensions: perceived humanity (DA_Human), transparency (DA_Transparency), consistency (DA_Consistency) and emotional resonance (DA_Emotiona Resonance). The obtained structure points to a good conceptual clarity of the measuring instrument and confirms the justification of observing digital authenticity as a multidimensional construct. Particles of perceived humanity (DAH1–DAH3) achieve the highest factor loadings on the fourth factor (F4), with relatively low loadings on the other factors. Such a pattern indicates a clear discrimination of this dimension in relation to other aspects of digital authenticity and confirms that respondents recognize the perceived humanity of digital communication as a specific and relatively autonomous element of authenticity.

The transparency dimension (DAT1–DAT3) shows extremely high factor loadings on the first factor (F1), which indicates a strong coherence of the particles within this dimension. Transparency is thus empirically confirmed as a clearly identifiable aspect of digital authenticity, whereby the respondents consistently distinguish the transparency of the source and process of message creation from other elements of communication. Particles measuring consistency (DAC1–DAC3) are dominantly grouped on the second factor (F2), with high and stable loadings, which confirms that respondents perceive consistency of communication as a separate dimension of authenticity.

This finding suggests that message stability, communication tone, and identity consistency are important signals of credibility in the digital environment. Emotional resonance (DAE1–DAE3) is clearly distinguished on the third factor (F3), with high factor loadings and minimal cross-loadings. This confirms that the emotional response to digital communication constitutes a separate but integral dimension of digital authenticity, which is in line with theoretical approaches that emphasize the affective component of trust and relationships in digital environments.

Table 5. EFA variance explained

	SS loadings	Proportion Var	Cumulative Var
F1	2.7	0.225	0.225
F2	2.3	0.192	0.417
F3	2.231	0.186	0.603
F4	1.863	0.155	0.758

Source: authors' own work

The results of the exploratory factor analysis show that the four extracted factors together explain 75.8% of the total variance, which indicates a high level of explanation of the latent structure of the digital authenticity construct. The first factor (F1) explains 22.5% of the variance, while the second (F2) and third factors (F3) explain an additional 19.2% and 18.6% of the variance, respectively. The fourth factor (F4) contributes another 15.5% of the explained variance. This distribution of variance indicates a balanced contribution of all factors, without a dominant single factor, which further confirms the multidimensional nature of digital authenticity and the justification for retaining the four-factor solution.

Table 6. Reliability: Cronbach's alpha and McDonald's omega

Scale	Items	Cronbach's Alpha	McDonald's $\hat{\omega}^2$
DA_Human	3	0.75	0.75
DA_Transparency	3	0.809	0.809
DA_Consistency	3	0.775	0.776
DA_EmotionalResonance	3	0.783	0.783
Trust	4	0.862	0.862
BehavioralIntentions	3	0.797	0.797

Source: authors' own work

The results of the reliability analysis show that all the scales used achieve satisfactory to high internal consistency. The values of Cronbach's Alpha coefficient and McDonald's omega coefficient for all constructs exceed the recommended threshold of 0.70, indicating reliable measurement of the latent variables. Particularly high reliability was recorded for the construct of trust, while the dimensions of digital authenticity also show stable and consistent results. These findings confirm that the measurement instruments are suitable for further factor and structural analyses.

Table 7. Validity (proxy CFA): CR and AVE + loading range

Construct	CR	AVE	Min $\hat{\lambda}$	Max $\hat{\lambda}$
DA_Human	0.75	0.499	0.7	0.71
DA_Transparency	0.808	0.585	0.723	0.799
DA_Consistency	0.775	0.534	0.699	0.75
DA_EmotionalResonance	0.782	0.545	0.723	0.758
Trust	0.861	0.608	0.773	0.791
BehavioralIntentions	0.797	0.566	0.72	0.774

Source: authors' own work

The results of the convergent validity analysis show that all constructs achieve satisfactory composite reliability values ($CR > 0.70$), which confirms the stability of the measurement model. The values of the average variance extracted (AVE) for most constructs exceed the recommended threshold of 0.50, while for the dimension of perceived humanity the AVE value is borderline, but acceptable given the satisfactory factor loading of the items and the CR value. The range of standardized factor loadings (λ) additionally confirms that all items contribute significantly to the corresponding constructs, which ensures the convergent validity of the measurement model and justifies its application in further structural analyses.

Table 8. HTMT ratios between constructs

Pair	HTMT
Trust – Behavioural Intentions	0.706
DA Human – Trust	0.681
DA Human – DA Transparency	0.648
DA Human – DA Consistency	0.646
DA Transparency – Trust	0.619
DA Emotional Resonance – Trust	0.609
DA Consistency – DA Emotional Resonance	0.590
DA Human – DA Emotional Resonance	0.582
DA Transparency – DA Emotional Resonance	0.581
DA Consistency – Trust	0.574
DA Transparency – DA Consistency	0.568
DA Human – Behavioural Intentions	0.459
DA Transparency – Behavioural Intentions	0.432
DA Emotional Resonance – Behavioural Intentions	0.424

Source: authors' own work

The results of the HTMT analysis show that all ratio values are below the recommended threshold of 0.85, indicating satisfactory discriminant validity between the observed constructs. This means that the dimensions of digital authenticity, trust and behavioral intentions are empirically distinct from each other, despite the expected relationship. The highest HTMT values were recorded between trust and behavioral intentions, which is theoretically justified given their close relationship, while the lower values between the dimensions of digital authenticity and behavioral intentions further confirmed the clear demarcation of the constructs. Overall, the results confirm the suitability of the measurement model for further structural analyses. In order to formally test the mediation mechanism, a mediation model was set up in which digital authenticity (DA) predicts trust, and trust predicts behavioral intentions. The model can be represented by the following equations:

- (1) $\text{Trust} = \alpha_0 + a \cdot \text{DA} + \gamma' \cdot \text{Controls} + \varepsilon_1$
- (2) $\text{BI} = \beta_0 + b \cdot \text{Trust} + c' \cdot \text{DA} + \delta' \cdot \text{Controls} + \varepsilon_2$

The indirect effect is calculated as $IE = a \times b$, while the total effect is $TE = c' + (a \times b)$. The significance of the indirect effect was assessed using the bootstrap method (95% confidence interval).

Table 9. SEM mediation (OLS proxy)

Effect	Estimate	Bootstrap 95% CI (Lower)	Bootstrap 95% CI (Upper)
a: Digital Authenticity → Trust	0.859		
b: Trust → Behavioural Intentions	0.528		
c': Digital Authenticity → Behavioral Intentions (direct)	0.111		
Indirect effect (a × b)	0.453	0.363	0.552
Total effect (c' + a × b)	0.564	0.459	0.672

Source: authors' own work

The results of the mediation analysis confirm that digital authenticity strongly and positively predicts user trust (a-path), while trust statistically significantly predicts behavioral intentions (b-path). The indirect effect of digital authenticity on behavioral intentions via trust is statistically significant, with the bootstrap 95% confidence interval excluding the zero value. At the same time, the direct effect of digital authenticity on behavioral intentions (c') is significantly weaker than the indirect effect, suggesting that digital authenticity acts primarily as an antecedent of trust, and trust is a key mechanism for transforming perceptions of authenticity into concrete behavioral outcomes.

Table 10. Standardised effects including controls

Predictor	β (M1: Trust)	β (M2: Behavioral Intentions)
Digital Authenticity	0.660	0.085
Trust		0.529
Female	0.055	-0.059
Age (ordinal)	0.045	-0.005
AI experience (ordinal)	0.039	0.039

Source: authors' own work

The results of the standardized regression coefficients show that digital authenticity is a strong predictor of trust in the first model (M1), even after including control variables. In the second model (M2), which explains behavioral intentions, trust is confirmed as a key predictor, while the direct effect of digital authenticity is significantly weaker. This pattern of results further confirms the mediating role of trust in the relationship between digital authenticity and behavioral intentions. The control variables (gender, age, and level of experience with artificial intelligence) show weak or negligible effects in both models, which suggests that the observed relationships between the main constructs are not significantly conditioned by basic socio-demographic characteristics.

Table 11. Multi-group path estimates (proxy multi-group SEM)

Group	N	DA → Trust (a)	Trust → BI (b)	DA → BI (c')	R ² Trust	R ² BI
Gender: Female	262	0.772	0.533	0.132	0.371	0.340
Gender: Male	163	0.979	0.526	0.091	0.535	0.370
Age: 18–31	277	0.842	0.484	0.150	0.416	0.331
Age: 32+	148	0.881	0.584	0.071	0.465	0.395
AI experience: High	133	0.864	0.601	-0.115	0.387	0.342
AI experience: Low/Medium	292	0.852	0.489	0.215	0.465	0.365

Source: authors' own work

The results of the multi-group analysis show that the impact of digital authenticity on trust is strong and consistent across all observed groups, regardless of gender, age, and level of experience with AI. A somewhat more pronounced effect was observed among male respondents and the older age group, indicating slight differences in the strength of the relationship, but not a change in the direction of the effect. The impact of trust on behavioral intentions is also stable across all groups, while the direct effect of digital authenticity on behavioral intentions is weak and inconsistent, and even negative in the group of respondents with high experience with AI. This pattern further confirms the mediating role of trust and suggests that behavioral intentions in the digital environment are primarily shaped through trust, and not directly through the perception of digital authenticity.

Table 12. Tested relations and results of the structural model

Designation	Hypothesis	Tested relation	Result
H1	Perceived digital authenticity positively and statistically significantly influences user trust.	DA → Trust	Supported
H2	User trust positively and statistically significantly influences behavioral intentions in digital communication.	Trust → BI	Supported
H3	Digital authenticity has an indirect effect on behavioral intentions through trust.	DA → Trust → BI	Supported (bootstrap CI does not include 0)

Source: authors' own work

The results of the structural model, presented in Table 12, provide strong empirical support for the conceptual framework that views digital authenticity as a key source of trust in contemporary digital communication, and trust as a central mechanism for shaping users' behavioral intentions. First of all, the confirmation of hypothesis H1 shows that perceived digital authenticity has a strong and statistically significant effect on users' trust.

This finding suggests that users do not build trust in digitally mediated communication primarily on the basis of technical correctness, institutional authority, or formal reputation of the source, but rather on the basis of perceptions of humanity, transparency, consistency, and emotional resonance of the message. This empirically confirms the theoretical assumption that the logic of trust in the digital environment is shifting from a rational-institutional to a perceptual-relational dimension. This result is in line with recent research that emphasizes the importance of social attributions such as warmth, benevolence, and "human-like" signals in assessing the credibility of digital and AI-mediated actors. Hypothesis H2, which examines the relationship between trust and behavioral intentions, is also confirmed. Trust was shown to be a strong predictor of intention to continue the interaction, message acceptance, and potential recommendation. This finding confirms the central role of trust as a mediating variable that connects communication perceptions with concrete behavioral outcomes. In the context of digital communication, trust thus does not appear as an abstract attitude, but as a functional mechanism that enables the transition from message evaluation to user action. The results of this research thus build on existing models of trust in digital and technological systems, but additionally enrich them by emphasizing the affective and symbolic components of trust. The most significant theoretical contribution comes from the confirmation of hypothesis H3, which indicates a statistically significant indirect effect of digital authenticity on behavioral intentions through trust. The results of the bootstrap analysis show that the confidence interval does not include the zero value, thus confirming the stable mediation role of trust. At the same time, the direct effect of digital authenticity on behavioral intentions turned out to be weak, suggesting that digital authenticity does not generate behavioral outcomes by itself, but does so indirectly – through building trust. This pattern of results clearly points to the conclusion that trust is a necessary “transmission mechanism” by which perceptions of authenticity are translated into concrete behavioral intentions. In a broader theoretical sense, the results confirm that digital authenticity acts as a precursor to trust, not as its substitute. This has important implications in the context of increasing automation and the application of artificial intelligence in communication. Although digital systems can generate informatively accurate, aesthetically appealing, and functionally efficient messages, the absence of perceived authenticity can limit the development of trust and consequently reduce user engagement. This further explains the empirical findings indicating user scepticism towards overly automated or non-transparent forms of communication, especially when it comes to emotionally coloured messages. The results of the structural model confirm the hierarchical logic of the relationship between the observed constructs: digital authenticity → trust → behavioral intentions. This logic supports the central thesis of the paper that digital authenticity functions as a new “currency of trust” in the contemporary communication environment. Trust does not appear as a secondary outcome of communication, but as a key intermediate resource that enables the transformation of perceptual signals into sustainable relationships and behavioral decisions of users.

4. DISCUSSION OF RESEARCH RESULTS

The research results confirm that digital authenticity represents a central perceptual signal on the basis of which users form trust in a digital environment. The result that digital authenticity strongly predicts trust is consistent with recent works showing that trust in digital and AI-mediated systems is not based solely on cognitive assessments (accuracy, competence), but also on social-perceptual attributes such as warmth, humanity and social presence. This confirms that authenticity in digital communication is less and less an “objective property of the source”, and more and more an interpretive construct that arises in the interaction of message, context and audience expectations. Of particular importance is the finding that the direct effect of digital authenticity on behavioral intentions is relatively weak, while the indirect effect via trust is strong and statistically significant.

Such a pattern indicates that authenticity in digital communication primarily functions as an “input mechanism” that enables the formation of trust; only after trust is established do positive behavioral implications such as the intention to continue the interaction, acceptance of the message and the tendency to recommend appear. This result is theoretically relevant because it suggests that authenticity is not just another predictor of behaviour, but a prior assumption of a relational relationship, i.e. a condition for the activation of behavioral outcomes. The analysis of the dimensions of digital authenticity further supports the conceptualization of the construct as multidimensional. The fact that the items clearly cluster into four theoretically expected dimensions (humanity, transparency, consistency, emotional resonance) suggests that users assess authenticity through multiple complementary signals. In practical terms, this means that organizations cannot “buy” trust with just one element (e.g. aesthetics or informational accuracy), but must manage a combination of identity consistency, understandable transparency, and a communication tone that leaves the impression of a human trace and emotional persuasiveness. An interesting signal emerges from the analysis of groups according to experience with artificial intelligence: in the group of respondents with higher AI experience, the direct effect of digital authenticity on behavioral intentions shows inconsistency and even a negative direction. Although the basic mediation logic remains stable ($DA \rightarrow Trust \rightarrow BI$), this finding may indicate that more AI-experienced users evaluate messages with stricter criteria, with greater sensitivity to automation patterns, standardized style, and potential instrumental intent of the communicator. In other words, for some audiences, higher exposure to AI tools may increase the ability to detect “syntheticity,” which reduces direct readiness for behavioral outcomes, even when authenticity is perceived to be relatively high. This result justifies the recommendation that future research include moderator constructs such as AI scepticism, digital literacy, and need for authenticity, in order to more precisely explain when authenticity transitions into behavioral intention and when it remains a “relational signal” without direct action.

5. CONCLUSION

This paper starts from the thesis that in a digitally mediated communication environment, trust increasingly functions as a result of the perception of authenticity, and less and less as a reflex of institutional power or formal reputation. In conditions of growing automation, generative artificial intelligence and standardized communication patterns, users value not only the accuracy of information, but also the intention, human trace, transparency and emotional persuasiveness of the message. Thus, digital authenticity can justifiably be viewed as a new “currency of trust” in contemporary communication. The theoretical contribution of the paper is reflected in the conceptualization of digital authenticity as a multidimensional construct that includes perceived humanity, transparency of source and process, consistency of communication and emotional resonance. Empirical findings further confirm this proposition: exploratory factor analysis identified four clearly interpretable dimensions, with a high total explained variance. In addition, indicators of reliability and validity indicate the stability of the measurement instrument and the acceptability of the measurement model for further structural testing. The key research findings of this paper are that perceived digital authenticity strongly and positively influences user trust, thus confirming Hypothesis H1. Furthermore, trust was shown to be a primary predictor of behavioral intentions, including the intention to continue interacting and accept the message, thus confirming Hypothesis H2. Mediation analysis indicates that the direct effect of digital authenticity on behavioral intentions is weak, while the indirect effect via trust is statistically significant, indicating that authenticity acts primarily by “opening the channel” of trust, and then trust generates behavioral outcomes. The inclusion of control variables (gender, age, experience with AI) did not significantly change the key relationships, which further supports the robustness of the model.

Multi-group results suggest that the basic logic of the relationships remains stable, with possible nuances in the intensity of effects across different groups, especially in the segment of higher AI experience where the direct effect of authenticity on behavioral intentions is inconsistent, indicating the potential role of scepticism or different message evaluation criteria. The practical implications of the work are particularly relevant for organizations and institutions that communicate in a digital environment. The findings suggest that increasing the effectiveness and scalability of communication must not be achieved at the expense of authenticity, as loss of humanity, insufficient transparency or impaired consistency can reduce trust and indirectly reduce user engagement. Therefore, it is recommended to develop communication strategies that integrate a "human-in-the-loop" approach, differentiated disclosure about AI use (depending on the context of the message) and consistent management of the identity and tone of communication across channels. The limitations of the work stem primarily from the quantitative, survey design and reliance on perceptual measures, as well as from the fact that the sample consists to a greater extent of younger and highly educated respondents. Future research should extend the model by introducing moderator variables (eg, AI scepticism, digital literacy, need for authenticity), test the stability of the construct in different cultural and platform contexts, and apply experimental and longitudinal designs to more precisely establish causal mechanisms. The results suggest that increasing the effectiveness and scalability of digital communication should not be achieved at the expense of authenticity. Organizations should (1) preserve "human-in-the-loop" elements in communication when the goal is to build trust, (2) design transparency as a user-friendly practice (clear authorship and intent), (3) maintain consistency of identity and values across channels, and (4) develop communication formats that encourage emotional resonance without excessive instrumentality. Especially in the context of generative AI, a differentiated approach to disclosure of AI use is recommended depending on the type of message (informative vs. emotional) and the sensitivity of the audience. The results of the paper confirm that digital authenticity is a fundamental prerequisite for building trust, and trust is a key mechanism that transforms authenticity into concrete behavioral outcomes. In this sense, digital authenticity is indeed becoming the "currency" with which trust is purchased and maintained in the digital environment, especially in an era in which the boundaries between human and automated content are increasingly blurred.

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MAPPING THE ROLE OF ARTIFICIAL INTELLIGENCE IN CORPORATE INVESTMENT EFFICIENCY: QUALITATIVE INSIGHTS INTO DECISION-MAKING PROCESSES.

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ABSTRACT

Artificial intelligence (AI) has become an indispensable part of everyday life. Similarly, managers use this technology to make strategic decisions at both the national (macroeconomics) and company (microeconomics) levels. This paper will look at how AI can be used as a tool to support investment decisions. Specifically, we will focus on how adopting AI can improve the investment efficiency of firms, as well as how to use the databases available to obtain information on the performance of nations and companies. To achieve this, we will establish a qualitative documentary review of recent phenomena that was carried out on scientific literature published from 2016 to 2026 in indexed databases. The analysis centered around three key dimensions: corporate investment efficiency, Artificial Intelligence, and decision making. The results indicate that artificial intelligence is increasingly perceived as a highly effective tool used at the corporate level, and it has established itself as an important asset in the decision-making process of managers in various sectors of activity, but it is essential to ensure the quality of the data used to guarantee the relevance of this technology.

Keywords: *Artificial Intelligence, investment, firms, efficiency. decision-makers*

1. INTRODUCTION

In history, the emergence of Artificial Intelligence dates to a meeting organized for the first time by 10 speakers in the United States at Dartmouth College in 1956. It was during this meeting that the term Artificial Intelligence appeared, referring to tools that enable complex information processing. The impact of Artificial Intelligence on the economy and industry has gradually evolved from the macroeconomic to the microeconomic level. Artificial Intelligence technologies have brought enormous innovations and had a significant impact on the functioning and management of businesses (Elahi et al., 2019). From a theoretical perspective, this paper aims to answer the following question: How does Artificial Intelligence impact investment decisions to make them more efficient? We begin by examining the relationship between artificial intelligence and businesses, as well as its general application by companies. We then discuss the specific effect of AI on investment decisions made by executives and how this tool contributes to making decision-making processes more efficient. We conclude with a summary of all the tools currently available through AI and the challenges associated with their use.

2. ARTIFICIAL INTELLIGENCE IN MICROECONOMICS

2.1. AI and businesses

The incorporation of artificial intelligence into production units has become more crucial than ever, given the need to transform conventional production factors into efficient ones. However, the use of AI is no longer limited to operational processes, but also extends to decision-making (Idrissi & Jabraoui, 2021). According to the report by THE ROYAL SOCIETY (THE ROYAL SOCIETY, 2018), AI offers businesses access to big data, which allows them to manipulate and test multiple AI models in real time through customer interactions to improve their commercial performance. A sector study conducted by Masayuki (Masayuki, 2016) examines the impact of AI on businesses and confirms that those operating in the tertiary (service) sector are seeing positive returns from the use of Big Data and AI. In particular, the analysis revealed that it is crucial to focus more on the industrial sector to encourage the use of AI technologies to improve its performance and productivity, following the example of Japan. In recent years, several national and international researchers have set out to study the effect of artificial intelligence on corporate governance. This research focuses on four aspects: the first concerns the transformative impact of artificial intelligence on corporate governance. In the context of the mobile internet, the deep integration of technical, organizational, and social networks not only offers new governance tools but also significantly influences traditional models of corporate governance. In a study conducted by Zhang and Kong (Zhang & Kong, 2022), in which they compared public and private companies, the results indicated that private companies are able to implement AI more effectively than public companies. This further promotes better investment decision-making. The topic of investment efficiency in public enterprises is also addressed by Xie et al (Xie et al., 2022), who demonstrate that the flexibility of these public enterprises can more effectively promote the deployment of AI. As a result, they could use this AI to support their investment decisions more effectively. A hypothesis suggesting that the use of AI significantly reduces inefficient investments in private companies more than in public companies is adopted by Du et al. (Du et al., 2018) and allows them, in particular, to maximize social welfare and even achieve socio-political objectives.

2.2. AI and investment decisions

As part of their examination of the challenges that AI poses to investment decisions, Li et al. (Li et al., 2021) introduced a concept called Artificial Intelligence Orientation (AIO), which analyzes the impact of AI on inefficient investments. According to the authors, AIO is defined as the orientation of a company's overall strategic objectives in terms of the introduction and application of AI technology, as well as the challenges it faces in doing so. The use of AI, according to the AIO concept, allows executives to examine and anticipate large amounts of data, accurately grasp market dynamics, and make investment decisions on a more scientific basis. According to research conducted by Cui, Xu, and Razzaq (Cui et al., 2022). They offer their expertise to executives, guiding them on how to invest in, manage, and implement AI technology within the company. Artificial Intelligence is seen as a powerful tool for optimizing the investment decision-making process. First, it is used by investors to analyze very large, more sophisticated, and less structured data, enabling them to identify potential avenues for exploitation. AI follows an acquisition procedure to effectively exploit the data and incorporate it into a coherent system through the acquisition, cleaning, and processing of this data. Data scientists are needed to ensure the effectiveness of AI techniques. Artificial Intelligence also helps to build a comprehensive perspective for investors to better understand companies, thanks to the fusion of traditional financial indicators and innovative AI analysis. Active data-driven investment approaches have an informational advantage over other traditional strategies. This gives them a competitive edge over other market players by interpreting and exploiting information before it is assimilated by the market.

The data that helps investors in their decision-making process includes information relating to company profits, such as the price/earnings ratio, indicators of stock market performance and trading volume, as well as data associated with the digital domain, such as transactions, internet traffic flow, etc. The evolution of artificial intelligence has changed the investment decision-making process based on these indicators. To leverage AI effectively in decision-making strategies, two key elements are required: solid, robust data and data scientists capable of developing relevant hypotheses and stimulating innovative ideas. One of the uses of Artificial Intelligence in the decision-making process for managers is predictive analysis, which enables them to identify projects threatened by inappropriate budget execution. It also helps identify project risks and key indicators affecting the financial aspects of projects. In addition, it serves to minimize the negative consequences associated with poorly estimated portfolio budgets and lost opportunities(Wach & Chomiak-Orsa, 2021).

2.3. The challenges of using AI

According to a study conducted by SimCorp (SimCorp, 2024) among 200 executives worldwide on the use of AI in the investment process, the results showed that 75% of participants recognized the enormous benefits of AI. However, several challenges arose, such as the relevance of the availability of information. Other risks are associated with the use of artificial intelligence for financial investment in particular(AUTORITE DES MARCHES FINANCIERS, 2025), as highlighted by the AMF:

- The use of AI is not subject to rigorous requirements, and there is a lack of regulatory control.
- Information and data may be erroneous, incomplete, or inaccurate.
- The use of AI sometimes requires personal information, which could compromise the security of this data.

As mentioned by (Buczynski et al., 2025), AI could present a challenge in that the results of its actions may not be attributable to a specific human intervention or directive. The relationship between government policies on artificial intelligence (AI) and the resilience of corporate supply chains is attracting growing interest among researchers. In this regard, (Cheng & Zhang, 2026) demonstrate, using a sample of 4,144 Chinese companies listed on the A-share market, that pilot AI policies significantly enhance supply chain resilience. Similarly, (Wang & Wu, 2026) highlight the positive moderating role of government financial support in the relationship between AI technology adoption and innovation financing among Chinese firms. Their findings provide both theoretical insights and practical implications for policymakers and businesses seeking to leverage AI to strengthen financing capabilities.

In addition, (Bu et al., 2026) find that AI substantially improves financing efficiency in small and medium-sized enterprises (SMEs) by lowering costs and risks while increasing returns. These effects operate through reduced information asymmetry, eased financing constraints, and enhanced innovation. The impact is particularly strong for non-state-owned firms, technology-intensive sectors, and firms located in eastern China, offering valuable insights for the digital transformation of SMEs in emerging economies. Finally, (Khan et al., 2026), report a positive association between AI adoption and foreign institutional investment inflows. This relationship is stronger among younger firms and is further reinforced by higher firm performance, whereas firm age exerts a negative effect. The robustness of these findings underscores the strategic importance of AI adoption as a means of attracting foreign investment.

3. DISCUSSION

3.1. Analysis of temporal distribution

An analysis of the temporal distribution reveals a significant concentration of publications in the recent period (2021–2026), confirming the emerging and dynamic nature of the AI-investment field. This trend reflects the acceleration of research linked to the maturity of AI technologies and their growing penetration into financial practices.

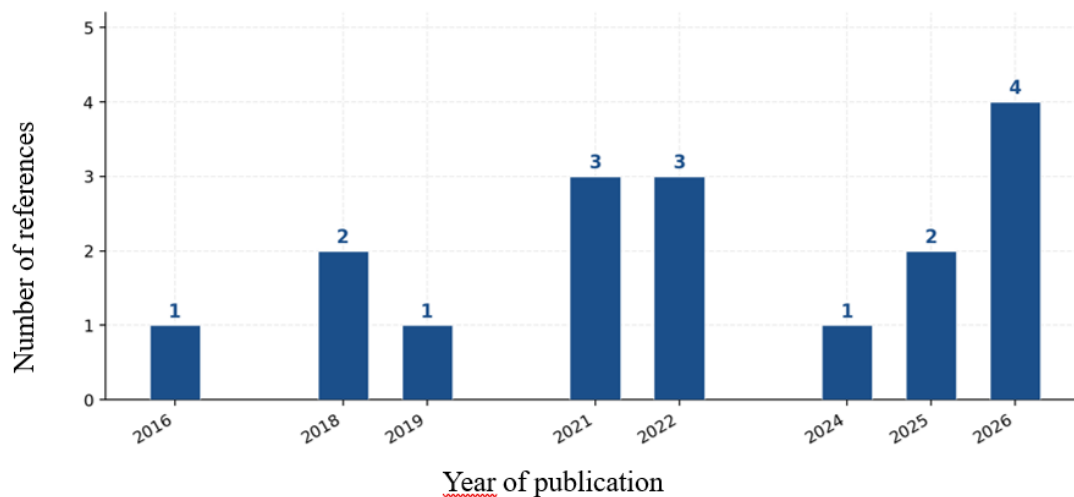


Figure 1. Chronology of the publications analyzed (2016–2026)
(Source: author's elaboration)

Key observations:

- 2016–2019: A pioneering period with 3 publications (17.6%), which laid the initial conceptual foundations for AI applied to economic fields.
- 2021–2022: A consolidation phase with 6 publications (35.3%), marked by disciplinary and geographical diversification.
- 2024–2026: A significant acceleration with 7 publications (41.2%), including 5 starting in 2026, indicating a field experiencing rapid scientific growth.

3.2. Geographic distribution of contributions

A map showing the authors' countries of origin highlights a wide geographical diversity, with a marked predominance of Chinese research, reflecting China's central role in current debates on AI and economic policy.

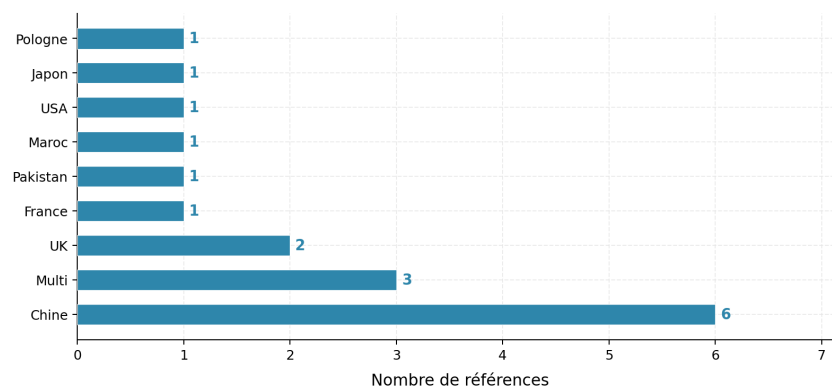


Figure 2. Geographical distribution of authors
(Source: author's elaboration)

Analysis by region:

- China: 7 references (41.2%) — making it the leading contributor to the corpus, particularly on the topics of financial efficiency, corporate governance, and AI policies.
- Multiple countries (international collaborations): 3 references (17.6%) — reflecting the collaborative nature of AI research.
- United Kingdom: 2 references (11.8%) — represented by leading institutions such as the Royal Society.
- France, United States, Morocco, Japan, Poland: 1 reference each (5.9%) — providing diverse regional perspectives.

Morocco's presence via Idrissi & Jabraoui (2021) is particularly noteworthy in the context of a qualitative article, demonstrating the integration of Southern perspectives into AI research.

3.3. Analysis of journals and bibliographic sources

The diversity of the journals invited to contribute illustrates the interdisciplinary nature of research on AI and investment, which lies at the intersection of management, economics, law, and information science.

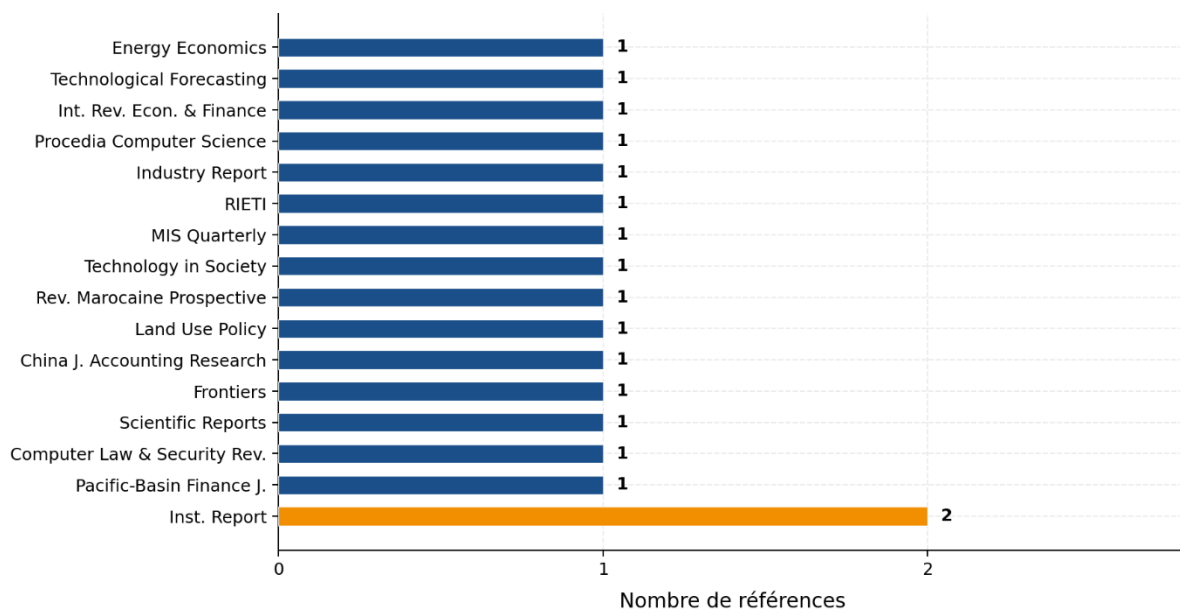


*Figure3. References and sources cited
(Source: author's elaboration)*

Key target journals:

- Pacific-Basin Finance Journal — specializing in Asian and international finance.
- Computer Law & Security Review — digital law and AI system regulation.
- Scientific Reports (Nature Publishing) — a multidisciplinary journal with a high impact factor.
- Technology in Society — focused on the intersection of technology, society, and innovation policy.
- MIS Quarterly — a leading journal in the field of information systems and management.
- Energy Economics, Technological Forecasting, Land Use Policy — providing complementary perspectives specific to each sector.

Institutional reports (AMF, Royal Society, RIETI, SimCorp) round out the corpus by adding a normative and practical dimension essential for grounding the analysis in real-world realities. As mentioned above and confirmed by all the studies we reviewed, we can see that Artificial Intelligence is increasingly perceived as a highly effective tool used at the corporate level. Whether it is to identify the target customer base and understand market demand dynamics, to develop production strategies, or to design effective investment strategies. AI offers companies tools primarily focused on processing BIG DATA (massive and complex data), enabling analysis, structuring, and generation of comprehensive and clear insights into market trends. This allows companies to improve their competitiveness. In particular, AI uses sophisticated algorithms and predictive models to provide information systems that help companies anticipate and prevent the risks inherent in their operations. In addition, these algorithms contribute to the efficiency of investments by optimizing the use of production factors. The information system provided by AI can guide investors in their decision-making process regarding the choice of countries in which companies can set up and in which the company can benefit from various advantages, whether comparative or absolute. Thus, the direction of investment flows can be influenced by the tools provided by Artificial Intelligence, particularly the efficiency of these investments and not just their location. The studies analyzed in this paper have highlighted a crucial aspect, namely the challenges of using AI by investors, including those related to the relevance of the information and data processed. Given that falsification of the latter can lead to erroneous investment decisions.

4. CONCLUSION

This paper aimed to conduct a theoretical exploration of the use of Artificial Intelligence by investors and the influence of the tools it offers on effective decision-making, particularly about foreign investment decisions. We were able to identify all these instruments, including the challenges faced by leaders in the current AI context. All of the studies cited in this paper are recent studies, covering different countries, and even comparing them with each other, which have conducted comparative analyses of the use of AI by public and private companies in different sectors of activity. The conclusion is that artificial intelligence has established itself as an important asset in the decision-making process of managers in various sectors of activity, but it is essential to ensure the quality of the data used to guarantee the relevance of this technology.

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EXPERIENTIAL MARKETING AS A DRIVER OF SUSTAINABLE CUSTOMER LOYALTY EVIDENCE FROM THE MOROCCAN TELECOMMUNICATIONS SECTOR

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ABSTRACT

In a telecommunications market defined by near-perfect competitive parity, where three national operators hold virtually equal market shares in a sector valued at approximately USD 7-8 billion in between 2025-2026, price-based differentiation had reached a structural ceiling. It is within this competitive impasse that experiential marketing emerges as a decisive strategic variable; not merely integrated orchestration sensory dimensions, but through the integrated orchestration of physical experience, digital engagement, and ecological brand commitment. This study investigates the extent to which experiential marketing across its sensory, digital and ecological dimensions significantly influences the construction of durable customer loyalty, whether this influence varies according to the strategies effectively deployed by competing operators. To address this issue, a mixed bi-perspective methodology is adopted, combining two complementary research instruments. The first is a structured questionnaire administered to a sample of Moroccan telecom subscribers, capturing loyalty perceptions, satisfaction levels, and experiential attitudes from the customer standpoint. The second is a comparative documentary benchmark of the experiential and ecological practices of Morocco's three main operators: Maroc Telecom, Orange Group and Inwi. These results are based on recent data spanning 2023 to 2025, examining actual strategies from the operator standpoint. This dual perspective design constitutes the study's core methodological contribution: By confronting what customers perceive with what operators actually practice, it surfaces the gaps that conventional single-source studies tend to obscure. Building on this dual-perspective analysis, this paper ultimately puts forward the Phygital Experience as an original integrative framework revealing that while experiential satisfaction remains the dominant loyalty predictor, digital and ecological dimensions represent critically underactivated strategic levers within the Moroccan telecommunications sector.

Keywords: *Experiential marketing, sustainable loyalty, digital customer experience, perceived CSR, competitive benchmark, telecommunications, Morocco*

1. INTRODUCTION

The Moroccan telecommunications sector stands today as one of the most competitive markets on the African continent. With a sector valued at approximately USD 7-8 billion between 2025 and 2026 (U.S. International Trade Administration, 2024), three national operators: Maroc Telecom, Orange Maroc, and Inwi, compete within a saturated environment of 137.5% mobile penetration (ANRT, 2024). In this hypercompetitive configuration, where products and pricing progressively converge, differentiation through price alone has gradually reached a structural ceiling. The challenge is no longer to convince the customer to join an operator but to give them a reason anchored in lived experience and emotion to stay.

It is precisely in this space that experiential marketing emerges as a decisive strategic variable. Since the foundational contributions of Pine and Gilmore (1999) on the experience economy and Schmitt (2000) on strategic experiential marketing, the discipline has undergone a profound transformation: from the sensory orchestration of physical points of sale described by Rieunier (2006), it has expanded to encompass digital, omnichannel, and now ecological experiences, mirroring the evolving expectations of contemporary consumers. Today's customer no longer simply expects reliable network coverage, they expect to be recognized, engaged, and surprised. The digital transition, driven by the rise of artificial intelligence and the proliferation of mobile interfaces, is fundamentally reconfiguring the nature of customer experience in telecommunications services. Simultaneously, the growing importance of environmental concerns confers a new strategic dimension on operators' corporate social responsibility, making perceived ecological authenticity an emerging determinant of attitudinal loyalty. This paper seeks to explore, *how experiential marketing (digital, phygital, and ecological dimensions) influences customer loyalty in Moroccan telecommunications sector*. Rather than assuming a uniform deployment, the analysis pays particular attention to the unevenness of these practices and the way such disparities subtly shape differentiated competitive positions and, ultimately customer loyalty. This paper is organized as follow: a literature review covering classical experiential marketing, the digital dimension, and the ecological dimension; a presentation of the conceptual framework; the methodology; the results; and a discussion offering theoretical and managerial implications.

2. LITERATURE REVIEW

2.1 Foundations of Experiential Marketing: From the Experience Economy to the Contemporary Era

Understanding experiential marketing requires returning to its intellectual origins without becoming confined by them. Pine and Gilmore (1999), in *The Experience Economy*, conceptualized a paradigm shift: value resides not in the product or service, but in the memorable experience they generate. This theoretical framework, developed at the turn of the century, retains striking relevance in the contemporary Moroccan context, where telecom operators seek precisely to transcend pure service logic and embed themselves in an economy of relationship. It was Schmitt (2000), in *Experiential Marketing*, who provided the first rigorous operational framework, organizing experience around five strategic experiential modules; Sense, Feel, Think, Act, Relate and repositioning the consumer as a simultaneously sensory, emotional, and social being. Building on this approach, Rieunier (2006) applied these principles to sensory marketing in retail environments, documenting the effects of visual, auditory, and olfactory stimuli on in-store behavior. These landmarks remain highly relevant for understanding the sensory dimension of telecom experiential marketing, particularly in the design of commercial agencies. More recent contributions, such as Kotler and Keller (2021) in *Marketing Management* and Kose and Ozer Cizer (2021) who empirically document the relationship between experiential marketing, satisfaction, and loyalty update this theoretical framework within contemporary consumption dynamics. Kose and Ozer Cizer's (2021) finding that experiential satisfaction functions as a robust mediating variable between experiential stimuli and behavioral loyalty will be particularly mobilized in our analysis of results.

2.2 The Digital and Phygital Experience: From Omnichannel to AI-Driven Personalization

The digital revolution has profoundly reconfigured the nature of customer experience, introducing new touchpoints; mobile applications, online portals, AI chatbots, that coexist with traditional physical interactions.

This coexistence is no longer a simple superposition but a deep entanglement: today's customer alternates fluidly between the physical and the digital, expecting consistency of experience across the entire journey. This is the phygital logic, which transcends simple omnichannel management to target seamless experiential continuity. Kumar and Hsieh (2024) demonstrated, in an Asian context, that social media marketing activities exert a significant effect on brand loyalty, mediated by digital brand experience. This relationship is particularly salient in markets with high mobile penetration, such as Morocco, where the operator's application has become the primary touchpoint for an increasingly large share of the customer base. Onyeka et al. (2024), across digital service environments, confirm that digital experience quality has become a determinant of customer retention comparable to network quality itself. The dimension of intelligent personalization deserves particular attention. Afnen, Nedra, and Mohammad (2023) demonstrate that artificial intelligence, applied to customer experience, generates superior behavioral loyalty when perceived by the customer as a mark of individual recognition rather than as data extraction. This nuance is crucial for Moroccan operators: AI as a personalization lever is effective only when experienced by the customer as attention, rather than surveillance. The Net Promoter Score (NPS) emerges in this context as the reference indicator of digital experience quality, synthesizing both immediate satisfaction and propensity to recommend two constitutive dimensions of durable loyalty. The NPS disparities observed between operators, documented notably by Opensignal (2024) for network performance, constitute one of the analytical lenses of the benchmark developed in section four.

2.3 The Ecological Dimension and Perceived CSR: Toward Loyalty Through Trust and Authenticity

The ecological transition is no longer a distant horizon for service companies: it has become an active evaluation criterion on the part of consumers, particularly younger generations. In the telecom sector, this evolution manifests in growing demands for transparency regarding the environmental footprint of infrastructures, terminal renewal policies, and the coherence between CSR discourse and observable practices. The foundational work of Lemon and Verhoef (2016) on the customer journey and brand experience opened the way to an expanded conception of experience, integrating symbolic and ethical dimensions beyond the transactional moment alone. It is in this vein that Iglesias, Markovic, Bagherzadeh, and Singh (2020) demonstrated, in the *Journal of Business Ethics*, that value co-creation within a CSR logic generates trust, and that this trust is a robust mediator of the CSR-loyalty relationship. The key lies in the perception of authenticity: CSR performed without operational coherence produces the opposite effect, generating skepticism and trust erosion. In the specific context of the Moroccan telecommunications market, the contribution of Ribeiro, Barbosa, Moreira and Rodrigues (2024), through their study published in *SAGE Open* on bundled telecommunications services, offers particularly relevant empirical grounding. Their findings shed light on the intricate relationship between customer experience, loyalty, and churn moving beyond purely theoretical assumptions.

3. CONCEPTUAL FRAMEWORK: THE "PHYGITAL SUSTAINABLE EXPERIENCE" MODEL

The articulation of the three dimensions from the literature review sensory-emotional, digital-phygital, and ecological-CSR, leads to the proposal of an original integrative model: the "Phygital Sustainable Experience" (PSE) model. This conceptual framework aims to move beyond segmented approaches to experiential marketing, proposing a unified architecture adapted to the competitive specificities of the Moroccan telecom sector. The PSE model rests on three interdependent pillars.

The first sensory and emotional pillar (H1) postulates that the quality of the physical in-store experience (ambiance, design, reception, sensory stimuli) positively influence attitudinal loyalty through emotional engagement. The second digital and phygital pillar (H2) integrates digital experience quality, application ergonomics, omnichannel journey fluidity, AI personalization as a complementary loyalty driver, whose intensity is modulated by the customer's digital maturity. The third ecological and CSR pillar (H5) positions authentic sustainable commitments as determinants of durable attitudinal loyalty, via a double trust-perceived authenticity mediation. Overall experiential satisfaction (H3) leads to the occupation of a central mediating position in this model: it constitutes the vector through which the stimuli from the three pillars are converted into observable loyalty behavior. This architecture is completed by an inter-operator comparative dimension (H4), which comes to examine how disparities in experiential deployment between Maroc Telecom, Orange Maroc, and Inwi generate differentiated competitive positions and loyalty profiles. The model formulates five research hypotheses:

H1: The sensory and emotional experience in points of sale positively influences attitudinal loyalty;

H2: Digital experience quality constitutes a complementary loyalty driver, modulated by the customer's digital maturity;

H3: Satisfaction with experiential services exerts a positive influence on brand loyalty;

H4: Significant disparities exist in experiential deployment across the three operators, generating distinct competitive positions;

H5: Authentic ecological commitments positively influence attitudinal loyalty, mediated by trust and perceived authenticity.

4. RESEARCH METHODOLOGY

This research mobilizes a mixed bi-perspective methodology, combining two complementary instruments. This duality constitutes the study's core methodological contribution: it enables a confrontation between what customers perceive and what operators actually deploy, revealing gaps that conventional single-source studies tend to obscure.

4.1 Survey Questionnaire

The first instrument is a structured quantitative survey administered to a sample of 85 Moroccan telecom subscribers, selected through a convenience sampling method, with electronic distribution via social networks (Instagram, WhatsApp, LinkedIn). The survey covers subscribers across the three cities of Rabat, Casablanca, and Oujda, distributed across age, gender, and socioprofessional criteria. Of 150 distributed questionnaires, 85 usable responses were collected, representing a 55.3% response rate. Incomplete questionnaires were systematically eliminated after verifying the concordance of responses with the target population profile. The instrument includes closed, dichotomous, multiple-choice, and ranking questions, enabling evaluation of experiential perceptions across five axes: overall experience with the operator, the perceived impact of marketing on experience, declared loyalty, the quality of sensory stimuli in points of sale, and the digital experience. Data were analyzed through a hypothetico-deductive approach, using descriptive statistics and indicative correlation patterns based on the available dataset to examine relationships between key variables and test hypotheses H1 through H3.

4.2 Comparative Documentary Benchmark

The second instrument is a documentary benchmark of the experiential and ecological practices of Morocco's three operators, constructed from recent data covering the 2023 - 2025 period.

Sources mobilized include the ANRT (2024) annual report for market data, the Opensignal (2024) Morocco Mobile Network Experience Report for network and digital performance by operator, the Morocco Telecommunications Sector Report from the U.S. International Trade Administration (2024), and Sefraoui's (2023) case study on Inwi's digital transformation strategy. The comparative analysis covers five dimensions: sensory in-store experience, digital maturity, CSR commitments, network performance, and overall strategic positioning. The complementarity of the two instruments responds to a data triangulation logic: the survey captures perceptual reality from the customer side; the benchmark informs on strategic reality from the operator side. Their confrontation allows the identification of alignments, but above all the gaps, between declared strategic intentions and the actual perceptions of subscribers.

5. RESULTS

5.1 Sample Description

Table 1. Sample Distribution by Gender

Gender	Frequency (n)	Percentage (%)
Female	58	68.2
Male	27	31.8
Total	85	100.0

Source: Author's elaboration based on survey data

Interpretation: The sample is predominantly female (68.2%), which may slightly influence the overall perception of the results, without compromising their structural validity.

Table 2. Sample Distribution by Age Group

Age Group	Frequency (n)	Percentage (%)
18 - 26 years	52	61.2
27 - 36 years	7	8.2
37 - 46 years	14	16.5
Over 47 years	12	14.1
Total	85	100.0

Source: Author's elaboration based on survey data

Interpretation: The sample is predominantly young, with 61.2% of respondents aged between 18 and 26. This demographic structure reinforces an interpretation of the results marked by a stronger sensitivity to experiential and digital dimensions.

Table 3. Sample Distribution by Socio-Professional Category

Socio-Professional Category	Frequency (n)	Percentage (%)
Student	45	52.9
Employee	20	23.5
Public sector employee	15	17.6
Retired	2	2.4
Unemployed	2	2.4
Self-employed	1	1.2
Total	85	100.0

Source: Author's elaboration based on survey data

Interpretation: Students represent the core of the sample (52.9%). The overall profile therefore corresponds to a young, urban population that is relatively exposed to digital and experiential consumption practices.

Table 4. Sample Distribution by Telecom Operator

Operator	Frequency (n)	Percentage (%)
Maroc Telecom (IAM)	53	62.4
Orange Morocco	24	28.2
Inwi	8	9.4
Total	85	100.0

Source: Author's elaboration based on survey data

Interpretation: Maroc Telecom dominates the sample (62.4%), which may reflect both the actual market structure and the composition of the surveyed respondents.

5.2 Descriptive Statistics

Descriptive statistics were computed to provide an overview of respondents' perceptions across the key variables of the study.

Table 5. Descriptive Statistics by Variable

Code	Variable	Valid N	Missing	Mean	Std. Dev.	Median	Min	Max
Q1	Overall experience with the operator	85	0	2.718	1.031	3	1	5
Q2	Perceived influence of marketing	85	0	2.012	0.919	2	1	4
Q3	Declared loyalty toward the operator	85	0	2.165	1.163	2	1	5
Q4	Benefit from personalized services	85	0	2.071	0.813	2	1	3
Q5	Evaluation of sensory stimuli	85	0	2.176	0.848	2	1	4
Q7	Perceived improvements in points of sale	85	0	2.059	0.730	2	1	3
Q8	Satisfaction with experiential services	85	0	2.682	0.954	3	1	5

Source: Author's elaboration based on survey data

Interpretation: The mean values remain moderate across all variables, indicating a generally intermediate level of evaluation. Satisfaction with experiential services (Q8) records the highest mean (2.682), highlighting its central role in shaping customer perceptions. In contrast, the perceived influence of marketing (Q2) and improvements in points of sale (Q7) appear at comparatively lower levels. The higher standard deviation observed for declared loyalty (Q3) suggests greater heterogeneity in customer responses.

5.3 Correlation analysis

Correlation analysis was conducted to explore associative patterns between key variables of the study.

Table 6. Correlation Matrix (n = 85)

Variable	Q1	Q2	Q3	Q4	Q5	Q7	Q8
Q1	1.000	0.355	0.188	0.280	0.344	0.307	0.392
Q2	0.355	1.000	0.410	0.222	0.288	0.318	0.344
Q3	0.188	0.410	1.000	0.076	0.248	0.115	0.262
Q4	0.280	0.222	0.076	1.000	0.310	0.434	0.413
Q5	0.344	0.288	0.248	0.310	1.000	0.541	0.468
Q7	0.307	0.318	0.115	0.434	0.541	1.000	0.523
Q8	0.392	0.344	0.262	0.413	0.468	0.523	1.000

Source: Author's elaboration based on survey data

Interpretation: The correlation matrix reveals a globally positive structure across the variables. The strongest relationships are observed between perceived improvements in points of sale and satisfaction (Q7-Q8: $r = 0.523$), between sensory stimuli and improvements in points of sale (Q5-Q7: $r = 0.541$), and between sensory stimuli and satisfaction (Q5-Q8: $r = 0.468$). These patterns suggest an important role of experiential and environmental factors in shaping customer satisfaction. In contrast, the relationship between declared loyalty (Q3) and certain experiential variables remains relatively weak, indicating that loyalty cannot be explained solely by satisfaction.

5.4 Survey Analysis: Customer-Side Results (H1, H2, H3)

The survey results reveal a nuanced picture of the relationship between customer experience and loyalty in the Moroccan telecom sector. Regarding overall experience, 40% of respondents report general or very satisfying experiences, against 43.5% who express limited satisfaction signaling a structural dissonance between expectations and the experiential realities of the sector. Yet this dissatisfaction does not translate into accelerated mobility: 63.5% of respondents declare themselves loyal or very loyal to their operator, illustrating the essential distinction between behavioral loyalty 'contract maintenance' and attitudinal loyalty (genuine attachment) that Ribeiro et al. (2024) document precisely in the context of bundled telecom services. On the sensory dimension (H1), 65.8% of respondents evaluate the sensory stimuli deployed in points of sale positively or very positively 'cumulative score "effective" and "very effective"', supporting the hypothesis of a sensory influence on loyalty, even though 56.6% indicate having never experienced theatricalization in an agency. This paradox suggests that the presence of basic sensory stimuli is perceived favorably, but more elaborate forms of experiential staging remain marginal in the sector. This suggests a positive influence of sensory stimuli on customer loyalty. The digital dimension (H2) delivers the most salient results: 72% of respondents declare having benefited from personalized services (frequently or occasionally), and 78% affirm that marketing influences their experience significantly or moderately. Personalization is cited as the primary loyalty lever by 79% of respondents, who champion personalized reward programs. These results, read against the work of Afnen et al. (2023) on AI and intelligent customer experience, underline that the digital dimension is not only perceived favorably but constitutes the dominant loyalty lever in subscriber expectations. These results highlight the central role of digital experience as a dominant loyalty driver. The satisfaction mediation (H3) is strongly confirmed: the correlation between satisfaction with experiential services and declared loyalty is positive and significant.

The 40% of satisfied customers present a declared loyalty rate 25 percentage points higher than that of dissatisfied customers. This dynamic aligns with Kose and Ozer Cizer's (2021) demonstration establishing satisfaction as a central mediator in the experiential marketing-loyalty relationship. This finding reinforces the central role of satisfaction as a key driver of customer retention. Regarding post-pandemic improvements (Q7), 70.6% of respondents noticed improvements in points of sale, 23.5% of them significant. This result evidences an ongoing experiential modernization dynamic in the sector, driven notably by the introduction of interactive kiosks and contactless payment solutions. However, 29.4% perceived no improvement, signaling significant disparities across operators and territories.

5.6 Comparative Benchmark of Three Operators (H4)

The comparative documentary analysis reveals clearly differentiated experiential positions among the three Moroccan operators, validating H4.

Table 7 Comparative Benchmark of Experiential Marketing Strategies (2023-2025)

Dimension	Maroc Telecom (~45%)	Orange Maroc (~30%)	Inwi (~25%)
Sensory & In-store Experience	Historic leader: dense branch network, premium ambiance, recognized customer service training	Digital-forward challenger: modernized branches, interactive kiosks, phygital experience in development	Limited branch network; compensates through digital strategy and competitive pricing
Digital & Phygital (app, omnichannel, AI)	Well-rated app, advanced self-care, AI for complaint management, phygital transition underway	Digital excellence: strong NPS, advanced AI & data analytics, fluid omnichannel experience	Digital pioneer: inwi money, super-app, digital-first strategy (Sefraoui, 2023), best online/offline consistency
Ecological & Perceived CSR	Strong institutional CSR, annual reports, rural coverage; moderate perceived authenticity	Orange Group commitments (Digital for Good); good perceived authenticity but derived from international group	Emerging CSR, local partnerships, nascent green communication; strong differentiation potential
Network Performance (Opensignal, 2024)	Network leader: best national coverage, high data scores, integrated fixed + mobile	Strong network: competitive data performance, high voice score, solid urban coverage	Competitive network: strong 4G performance, urban focus, growing rural coverage
Dominant Loyalty Driver	Institutional trust + network quality + branch depth	Digital NPS + AI personalization + innovative brand image	Digital agility + competitive pricing + super-app + digital native youth

Sources: ANRT (2024); Opensignal (2024); U.S. ITA (2024); Sefraoui (2023); operator data.

Maroc Telecom asserts itself as the historic experiential leader: its dense branch network and mature customer service provide unmatched institutional trust, particularly valued by less digitalized segments. Its strength lies in the depth of the physical experience, but the transition to phygital experience remains in progress. Orange Maroc distinguishes itself as the digital experience champion: its mobile application is celebrated for its ergonomics, its digital NPS ranks among the sector's best, and its AI - data analytics strategy enables advanced personalization. It is the operator whose practices most closely align with the digital experiential expectations of urban subscribers identified in the survey. When it comes to Inwi, it positions itself as the digital disruptor, with an avowed digital-first strategy (Sefraoui, 2023) manifesting notably in the development of inwi money and a super-app targeting young digital natives. Its CSR remains emergent but represents a genuine differentiation opportunity in a context of growing environmental awareness.

5.7 Toward Validation of the PSE Model (H5 and Synthesis)

The ecological dimension (H5) delivers the most nuanced results. While the CSR commitments of all three operators are real notably Maroc Telecom's institutional programs and Orange Group's Digital for Good initiatives their perception among subscribers remains suboptimal. The survey reveals that ecological commitments remain barely salient in the spontaneous evaluation of the operator experience: only a minority of respondents spontaneously mention the environmental dimension as a loyalty criterion. This result, coherent with Iglesias et al. (2020) on the necessity of perceived authenticity, indicates that CSR produces its effect on loyalty only when experienced by the customer as an organic component of the brand experience, not as additional communication. H5 is partially supported. The synthesis of the five hypotheses is presented in the following summary table:

Table 8 Hypotheses Synthesis and Validation Status

H°	Dimension	Statement	Status
H1	Sensory and In-store	Proactive management of sensory and emotional dimensions in points of sale positively influences customer attitudinal loyalty.	Partially confirmed
H2	Digital & Phygital	The quality of the digital experience constitutes a complementary loyalty driver, modulated by the customer's digital maturity.	Confirmed
H3	Satisfaction → Loyalty	Satisfaction with experiential services exerts a positive and significant influence on brand loyalty.	Confirmed
H4	Comparative Benchmark	Significant disparities exist in experiential marketing deployment across the three operators, generating distinct competitive positioning.	Confirmed
H5	Ecological and Perceived CSR	Authentic ecological commitments positively influence attitudinal loyalty through the mediation of trust and perceived authenticity.	Partially confirmed

6. DISCUSSION AND IMPLICATIONS

6.1 Theoretical Contributions

This research makes three distinct theoretical contributions. First, it proposes a unified conceptual architecture: the Phygital Sustainable Experience model integrating the sensory, digital, and ecological dimensions of experiential marketing into a coherent framework adapted

to telecommunications services. This model fills a gap in the literature, where the three dimensions are typically treated sequentially rather than in an integrated manner. Second, the study provides a more nuanced empirical reading of loyalty determinants in the Moroccan telecom sector, experiential satisfaction dominates, followed by digital personalization, while the ecological dimension remains a latent lever. This hierarchy refines the results of Kose and Ozer Cizer (2021) and Ribeiro et al. (2024) within the specific context of an emerging market with high mobile penetration. Third, the bi-perspective methodology confronting customer perceptions with operator practices constitutes a methodological innovation that reveals systematic gaps between strategic intention and lived perception, particularly on the ecological dimension. This approach enriches Lemon and Verhoef's (2016) work on the holistic understanding of the customer journey.

6.2 Differentiated Managerial Implications by Operator

For Maroc Telecom, recommendations focus on phygital experience optimization and deepening RSE coherence. The institutional trust this operator commands constitutes a rare asset that should be mobilized to anchor a CSR perceived as authentic rather than institutional. For Orange Maroc, the recommended strategy consists of capitalizing on its digital excellence to build a reference phygital experience, ensuring that digital fluidity extends into physical interactions. Greater visibility of Digital for Good commitments in customers' daily experience would significantly strengthen the H5 dimension. For Inwi, the priority lies in consolidating ecological authenticity as a durable differentiation axis. Its position as an agile challenger, its anchoring among digital natives, and its super-app confer natural legitimacy to position itself as the operator of digital and ecological transition. Inwi's CSR has every potential to become its competitive signature, provided it is anchored in verifiable practices.

6.3 Limitations and Future Research Perspectives

Five academic limitations bound the scope of these findings. The convenience sample (n=85), though adequate for an exploratory study, does not enable robust statistical generalization. The inherent subjectivity in evaluating experiential dimensions, particularly sensory and ecological, introduces a perception bias difficult to control through questionnaire alone. Captive loyalty, characteristic of contractual telecom commitments, cannot be distinguished from genuine attitudinal loyalty through declarative measurement. The rapid technological evolution of the Moroccan market limits the temporal durability of results. As a final point, the transferability of physical experience effects to the digital domain is constrained by digital maturity inequalities across customer segments. To sum up, these limitations open promising research perspectives: a longitudinal study would allow measurement of the PSE model's stability over time; a structural equation modeling approach would enable precise quantification of the mediation and moderation effects identified; and an extension to other emerging African markets would evaluate the model's transferability beyond the Moroccan context.

7. CONCLUSION

At the close of this research, it appears that experiential marketing is not merely one response among others to the saturation of the Moroccan telecom market; it is the structural response. In a sector where offer convergence has neutralized product-based differentiation, it is the quality of the lived experience that determines the durability of the customer relationship. The Phygital Sustainable Experience model we propose translates this reality into an actionable strategic architecture, articulating the sensory, digital, and ecological pillars around a central mediator: experiential satisfaction. Results confirm that experiential satisfaction remains the dominant loyalty predictor, that digital personalization constitutes the lever most strongly championed by subscribers, and that the ecological dimension, promising as it is, remains an underactivated

lever due to insufficient perceived authenticity. The benchmark reveals clearly differentiated competitive positions; each operator having built a distinct experiential identity generating different loyalty profiles. The strategic challenge of the coming years will not be so much about choosing between the physical, the digital, or the ecological, but about building experiential architectures that integrate these three dimensions in a coherent and authentic way. This is, ultimately, the direction in which the PSE model is intended to evolve. Rather than offering a fixed framework, it seeks to capture a dynamic logic of experiential, one that becomes increasingly critical as the sector moves forward. In a market where the next wave of differentiation will likely be shaped by generative AI as its application to real-time personalization, the question here is no longer whether operators should invest in such technologies but instead ask whether they have built the experiential foundations necessary to make them more meaningful. In this perspective, those who have already consolidated a coherent and robust experiential base will not only adapt more easily, but will as well be in a stronger position to translate these emerging technological capabilities into tangible customer value.

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TERRITORIAL BRANDING AS A MULTI-ACTOR GOVERNANCE INSTRUMENT: A CONCEPTUAL REAPPRAISAL AND EMPIRICAL ILLUSTRATION FROM THE PROVINCE OF KÉNITRA (MOROCCO)

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ABSTRACT

This article offers a conceptual reappraisal of territorial branding as applied to the province of Kénitra, repositioning it as a multi-actor governance instrument that transcends its conventional promotional function. It examines the extent to which territorial branding can move beyond classical place branding frameworks to serve as a mechanism for institutional coordination, the legitimisation of public action, and the construction of a shared strategic vision among the various stakeholders of the territory. Drawing on a theoretical and empirical literature review that integrates perspectives from territorial marketing, brand equity theory, and the governance literature including territorial and collaborative governance the article develops an analytical framework articulating attractiveness, coordination, and collective steering. The province of Kénitra, a territory endowed with substantial industrial, logistical, and agri-food potential, serves as an empirical illustration of the tensions that arise between branding and governance. The analysis reveals that, despite significant objective assets, the province is afflicted by persistent institutional fragmentation and an absence of concerted strategic vision among its principal actors including the Regional Investment Centre, provincial authorities, chambers of commerce, civil society organisations, and local media all of which undermine the coherence and legibility of its territorial offer. The article concludes that a territorial brand can only fully discharge a governance function when it is co-constructed through a genuinely participatory approach that involves all stakeholders in the development of a coherent and unifying territorial identity.

Keywords: Territorial brand, territorial governance, place marketing, attractiveness, institutional coordination, stakeholders, Kénitra, Morocco

1. INTRODUCTION

The progressive deepening of globalisation and the financialisation of economic activity have profoundly reconfigured the locational dynamics of multinational firms. In this context, territories have become engaged in intensifying competition to attract mobile investment, retain talent, and valorise their distinctive resources. Kotler et al. (1993) were among the first to argue systematically that territories must adopt a structured marketing approach if they are to meet these challenges. Since then, territorial marketing has established itself as an indispensable field of both practice and inquiry, drawing on tools borrowed from commercial marketing: institutional communication, image management, destination brand-building, and competitive positioning strategies. At the heart of this approach, the territorial brand has progressively emerged as a central instrument. Originally conceived as a vehicle for attractiveness intended to improve the perceptions that investors, tourists, or potential residents hold of a given territory it is frequently reduced, in practice, to its communicational dimension: a logo, a slogan, a promotional campaign.

Such a reductive approach, however, is both conceptually inadequate and, in the long run, strategically ineffective. It ignores the intrinsic complexity of the territory as a multi-actor social construct, whose governance cannot be assimilated to the management of a commercial product. The territory differs fundamentally from an ordinary commercial brand by virtue of its institutional nature and the plurality of stakeholders who compose it: territorial authorities, regional investment centres (CRI), private economic actors, civil society organisations, the media, and citizens whose interests, logics of action, and representations frequently diverge. This structural heterogeneity constitutes a major challenge for any territorial branding strategy. As Houllier-Guibert (2010) has argued, the limitations of territorial branding stem precisely from the inability of purely promotional approaches to integrate the diversity of actors and to generate a coherent vision. In this context, an alternative approach has been taking shape in the recent academic literature: apprehending the territorial brand no longer as a mere communication tool, but as a governance device that is, a mechanism for coordinating actors around a shared strategic vision, capable of legitimising public action and structuring territorial development choices. This reinterpretation opens new analytical perspectives that extend well beyond the boundaries of marketing to encompass political science, organisational sociology, and theories of public governance. It is within this perspective that the present article is situated. Without constituting a replication of our earlier empirical study (Ismaili, 2018), published in the *Revue Marketing Territorial*, this article offers a theoretical and conceptual reappraisal of that work in the light of contemporary approaches to territorial governance. Mobilising the principal findings drawn from that study, we ask: to what extent can the territorial brand be apprehended as an instrument of territorial governance, beyond its marketing function alone? This central question invites a revisiting of the conceptual foundations of the territorial brand, an interrogation of the institutional conditions for its effectiveness, and an identification of the role it may play in multi-actor coordination. The article is structured in two parts. The first proposes a theoretical reappraisal of territorial branding, tracing its development from the foundations of territorial marketing through to approaches of collaborative governance and stakeholder coordination. The second part draws on the case of Kénitra to illustrate empirically the tensions between branding and governance, and discusses the conditions under which a transition from one to the other might be achieved.

2. TERRITORIAL BRANDING: TOWARDS A TERRITORIAL GOVERNANCE DEVICE

2.1. The Foundations of Territorial Marketing: Attractiveness, Image, and Territorial Brand Equity

Territorial marketing is defined by Texier and Valla (1992) as "the collective effort of local actors aimed at valorising a territory in the eyes of its target publics." This definition foregrounds two essential dimensions: the collective dimension, which implies a plurality of actors engaged in a shared endeavour, and the strategic dimension, oriented towards the differentiated valorisation of the territory. The appetite for territorial marketing has intensified under the effects of globalisation and the growing mobility of investment, leading many territories to appropriate the tools of strategic management and commercial marketing in order to improve their competitive position. Territorial attractiveness constitutes the central objective of these approaches. Hatem (2004) distinguishes three complementary levels of analysis: a macroeconomic approach grounded in the general characteristics of the territory (factor costs, infrastructure, regulatory environment); a meso-economic approach centred on the existence of local clusters and competence hubs; and a microeconomic approach that evaluates the capacity of a given site to offer the most favourable risk-return ratio for a specific project. These three levels underscore the fact that attractiveness is at once objective grounded in tangible resources and subjective constructed through the representations and perceptions of actors.

It is precisely on this subjective dimension that the territorial brand exerts its influence. Drawing on the foundational work of Aaker (1991) and Keller (1993) on commercial brand equity, the concept of territorial brand equity designates the ensemble of cognitive and affective associations that a territory generates in the minds of its target publics. Chamard (2013) proposes to measure this equity through two principal components: regional notoriety assessed through the power and richness of evocation and brand image measured through the strength, valence, and uniqueness of associations. However, however sophisticated this marketing approach may be, it reveals significant structural limitations. In the first instance, territorial branding cannot be reduced to communication: it presupposes a congruence between the projected image and the resources actually available on the territory, lest it produce negative effects on investor confidence. In the second instance, attraction alone is insufficient: the management of representations, the coordination of message-senders, and the maintenance of communicational coherence over time are equally indispensable. Yet this coordination is precisely what is lacking in the majority of Moroccan territories, as the case of Kénitra clearly demonstrates.

2.2. Towards an Approach of Territorial Governance: Coordination, Steering, and Public Management

Confronted with the limitations of purely promotional approaches, the academic literature in management science and political science has, since the late 1990s, developed an alternative conceptual framework: that of territorial governance. Leloup, Moyart, and Pecqueur (2005) define territorial governance as "a new mode of territorial coordination" that is distinguished from traditional regulatory modes market and hierarchy by its deliberative, partnership-based, and multi-scalar character. It entails the construction of a negotiation arena among actors of heterogeneous statuses, resources, and interests, with a view to producing legitimate and effective collective decisions. Territorial governance articulates several complementary concepts. Public governance designates the modalities by which political authority is exercised over a given territory, encompassing decision-making processes, the implementation of public policies, and accountability mechanisms. Collaborative governance, developed notably in the work of Ansell and Gash (2008), emphasises the mechanisms of co-production between public and private actors, resting on principles of reciprocity, trust, and deliberation. Territorial management, for its part, designates the ensemble of tools and practices aimed at steering territorial development in a context of constrained resources and growing uncertainty. Institutional coordination constitutes the common thread running through all these approaches. It designates the formal and informal mechanisms through which institutionally distinct actors succeed in aligning their objectives, sharing resources, and producing coherent courses of action. In the context of territorial development, coordination is simultaneously a condition of the effectiveness of attractiveness policies and a structural challenge, insofar as territorial institutions are characterised by strong functional and scalar fragmentation. As Camagni (2002) observes, the territory may be conceived as a local governance system that brings together a collectivity, private actors, and a system of local public administrations yet this convergence is by no means self-evident and must be actively constructed. It is here that the territorial brand may play a pivotal role: no longer as a mere promotional tool, but as a mechanism for institutional coordination and for the construction of a shared strategic vision among the territory's actors.

2.3. The coordination of stakeholders

Within this framework, the study of interactions among territorial actors constitutes a pertinent entry point for understanding the effective mechanisms of coordination. Ismaili's (2018) analysis of the provincial brand of Kénitra brings to light a central finding that serves as the

guiding thread of our reflection: the absence of a concerted strategy capable of orienting the action of actors in matters of territorial development and investment attractiveness. This insufficiency of coordination manifests itself at several levels and directly impairs the effectiveness of territorial branding. At the institutional level, the province of Kénitra is characterised by a multiplicity of actors with distinct statuses and mandates: the Regional Investment Centre (CRI), tasked with investment promotion and the support of project holders; the provincial authorities and the region, which steer planning and economic development policies; the chambers of commerce and industry, representing the interests of the private sector; and the urban agencies, competent in matters of planning and spatial development. To these must be added private economic actors, civil society organisations, and local media, whose logics of action and representations of the territory diverge considerably. The ambiguity of Kénitra's positioning caught between an industrial vocation and an agricultural anchorage may impair the legibility of its territorial image and the coherence of its communication. This situation complicates the construction of a unified discourse aimed at investors (Benko, 1999). As one respondent in the confirmatory study noted, "several stakeholders communicate without coordination, which weakens the content and reduces the effectiveness of territorial communication." Furthermore, "awareness among local actors of the role that territorial branding can play in investment attractiveness is entirely absent an observation that reflects not merely a competence gap in territorial marketing, but also a deficit of shared strategic vision. The study also reveals a deficiency in the structuring of Kénitra's territorial representation before national and regional decision-making bodies. Despite the emergence of a dynamic civil society, the lack of coordination among associations and the overlap in their objectives impede the impact of their collective action on territorial development. This fragmentation of civil society reinforces the image of a territory that struggles to speak with a single voice and to construct a coherent collective identity. These institutional dysfunctions are not without consequences for the territory's image among investors. The exploratory survey conducted among local actors reveals that Kénitra's territorial communication is perceived as "devoid of a clear strategy," insufficiently targeted, and burdened by the generic character of the information disseminated. This finding resonates with Simon's (1959) theory of bounded rationality: faced with an abundant but poorly structured information supply, firms are unable to construct the cognitive confidence necessary for their locational decisions.

2.4. The brand as an instrument of shared vision and institutional legitimacy

While traditional approaches to territorial branding tend to emphasise its external dimension the construction of an attractive image for publics external to the territory a governance-oriented reinterpretation leads us to valorise its internal dimension: its capacity to federate local actors around a shared vision and to legitimise public action. Virgo and de Chernatony (2005) stress that the brand of a territory is constructed on the basis of a common vision shared by the various stakeholders of the locality: institutional actors, economic actors, and citizens. This shared vision constitutes a prerequisite for the strategic coherence of the brand and for its long-term effectiveness. In the absence of such a vision, the discourses produced by the different spheres economic, civic, and institutional, according to Maynadier's (2010) semiotic typology tend to diverge, generating a fragmented and poorly legible territorial image for external publics. The territorial brand may thus be envisaged as a device for territorial narration that is, a structuring narrative that organises the collective representation of the territory, valorises its specific resources, and projects a desirable trajectory of development. This narrative function transcends mere promotion: it contributes to the construction of a collective identity, to the mobilisation of local energies, and to the orientation of strategic choices. It exercises, in this sense, a function of territorial leadership not in the sense of individual leadership, but of a collective capacity to commit to a shared direction.

The territorial brand also possesses a function of legitimising public action. By articulating development objectives around a valorised identity and a collective promise, it provides institutional actors with a framework for justifying their investment choices and strategic priorities. It thereby contributes to reducing the transaction costs inherent in multi-actor governance, by offering a common reference framework that facilitates deliberation and collective decision-making. In summary, the central argument of this article may be stated as follows: the territorial brand does not serve merely to promote the territory to external publics, but constitutes when conceived within a governance logic an instrument for legitimising public action, structuring development choices, and federating local actors. This dual functionality simultaneously external and internal, promotional and governmental is precisely what renders this hybrid object both rich and complex.

3. A GOVERNANCE-ORIENTED REAPPRAISAL OF THE KÉNITRA CASE

3.1. Kénitra as a High-Potential Territory: Between Structural Assets and Persistent Weaknesses

Located in the Rabat-Salé-Kénitra region, the city of Kénitra had a population of approximately 424,000 inhabitants according to the 2014 General Population and Housing Census (HCP). It developed along the left bank of the Oued Sebou, approximately twelve kilometres upstream from its mouth on the Atlantic Ocean. The city is notable for its relative youth compared to Morocco's imperial cities a characteristic that constitutes both a singular identity marker and an asset in terms of urban plasticity and adaptability to contemporary economic transformations. Geographically, Kénitra occupies an alluvial plain contiguous with the Maâmora dunes to the south, in a low-gradient topographic configuration oriented towards the banks of the Oued Sebou. This position affords it privileged access to the Casablanca-Tangier axis and to the country's principal logistical infrastructure, making it a strategic node in the exchange network between the northern, central, and Oriental regions, on the one hand, and the southern zones of the country on the other. Demographically, the city has experienced sustained growth, rising from 352,058 inhabitants in 2004 to 423,890 in 2014 an average annual growth rate of approximately 1.9% (RGPH, 2004; RGPH, 2014). This dynamic is attributable notably to rural exodus and to the recent economic and industrial transformations that have reinforced the territory's attractiveness. As Ech-Chadi (2022) notes, Kénitra draws populations in search of employment, training, or proximity to major economic poles and export-oriented free zones. Economically, the Kénitra region has established itself as a major industrial hub. Endowed with numerous industrial zones, economic activity parks, and business incubators, it offers a diverse range of investment opportunities suited to different productive segments (Laoute, 2020). The industrial fabric is particularly diversified, spanning sectors such as automotive, aeronautics, textiles, chemicals, agri-food, and electronics. This productive structure is underpinned by well-developed transport infrastructure (motorways, rail network, national roads) and an educational ecosystem encompassing public and private universities and vocational training centres (OFPPT), all of which reinforce the territory's attractiveness (Laoute, 2020). Furthermore, the province benefits from an agri-food vocation historically rooted in the fertility of the Gharb plain one of Morocco's most productive agricultural zones. The cereal, sugar, and citrus sectors form the basis of a structured agro-industrial fabric, supported by the Plan Maroc Vert since 2008 (Ministry of Agriculture, 2018). According to the High Commission for Planning (HCP, 2017), the agri-food industry accounts for the leading industrial sector in the region in terms of value added, confirming the centrality of this productive vocation. These elements invite us to move beyond a narrowly descriptive reading of territorial attractiveness, and instead to interrogate the institutional and organisational conditions that enable the conversion of this potential into effective performance.

It is precisely this challenge of coordination and collective steering that the following section addresses by examining the governance dynamics at work in Kénitra.

3.2. Institutional Coordination in Kénitra: Between Fragmented Logics and Opportunities for Convergence

The analysis of interactions among the institutional actors involved in governing Kénitra's attractiveness reveals a configuration frequently encountered in territories undergoing structuration: a multiplicity of institutions with partially complementary mandates, whose coordination has yet to reach its full degree of maturity. This situation is not peculiar to Kénitra it reflects a reality common to many developing territories engaged in ambitious institutional reforms (Leloup, Moyart and Pecqueur, 2005) but it merits close examination if its implications for branding strategy are to be properly understood. The Regional Investment Centre (CRI) occupies a central position in the apparatus for welcoming and accompanying investors. It serves as the principal interlocutor for multinational firms, together with the Moroccan Agency for Investment and Export Development (AMDIE). However, the findings of Ismaili's (2018) survey reveal that locally established medium-sized enterprises tend to turn to other interlocutors according to a sectoral logic: the ORMVAG for the agri-food sector, and the urban agency for the construction and real estate sectors. This differentiation of information flows comprehensible from the standpoint of sectoral specialization results in a multiplication of institutional interfaces that may render the territorial offer less legible for an investor in an exploratory phase. This situation invites reflection on cross-cutting coordination mechanisms capable of preserving the sectoral competence of each institution whilst offering a unified interface to project holders. Several comparable territories have developed integrated orientation desks or inter-institutional coordination platforms that respond to precisely this expectation (Camagni, 2002). In this perspective, the territorial brand could serve as a common reference framework around which these actors align their messages and harmonise their approaches. The question of trust between private economic actors and public institutions constitutes another register of coordination in Kénitra.

The survey by Ismaili (2018) and Ateilah and Mansouri (2023) demonstrates that certain foreign investors, particularly in the automotive sector, hold stereotypical representations of the local workforce, associating it with an agricultural culture perceived as incompatible with the demands of industrial labour. This finding which pertains to cultural stereotype in the sense of Tajfel and Turner (1979) reflects less an objective reality than a deficiency in mediation between entrepreneurial and territorial cultures. The presence in the AFZ of world-class industrial groups such as Delphi, Leoni, and Yazaki which have successfully integrated and trained highly qualified local teams demonstrates, on the contrary, that such compatibility is not merely possible but already a reality. Territorial branding could contribute precisely to correcting these perceptions by valorising the genuine industrial competencies of the territory. As for civil society and local media, their progressive rise to prominence represents a resource that remains under-mobilised in the construction of Kénitra's territorial identity. Putnam (1993) demonstrated that the density of horizontal cooperative networks constitutes a decisive factor in the capacity of territories to govern themselves collectively and to construct a credible image. The current dispersion of associative initiatives which owes more to the absence of a unifying framework than to any lack of dynamism represents an organisational opportunity rather than a definitive constraint. A participatory territorial branding strategy that would associate civil actors in the co-construction of the province's identity could constitute precisely such a unifying framework.

4. DISCUSSION: FROM BRANDING TO GOVERNANCE — CONDITIONS FOR A NECESSARY TRANSITION

The reappraisal of the Kénitra case leads us to transcend a narrowly marketing-oriented reading of territorial branding and to situate it within the broader perspective of territorial governance. While the initial study (Ismaili, 2018) principally highlighted the role of territorial branding in shaping investors' perceptions and influencing firms' locational decisions, a deeper analysis of the empirical material reveals that the scope of this instrument far exceeds its promotional function. Classical literature on territorial branding has long focused on the capacity of the territory to construct a differentiated and attractive image for its target publics investors, firms, tourists, and talent. Within this framework, the territorial brand is generally apprehended as a set of associations and symbolic and functional attributes intended to reinforce the territory's attractiveness and to influence locational choice behaviour favourably. While essential, this approach tends nonetheless to reduce the brand to an external communication logic and a competitive positioning exercise. Yet the case of Kénitra makes plain that territorial challenges are not confined to image management or economic attractiveness promotion. One of the principal contributions of the study lies precisely in illuminating the difficulties engendered by the absence of a concerted strategy capable of orienting the action of the territory's various actors. This absence of coordination tends to exacerbate contradictory perceptions of the territory notably the gap between its substantial industrial, logistical, and geographical potential and the sometimes less favourable representations associated with certain structural constraints. In this light, the problem is no longer primarily one of communicational deficit or territorial visibility, but rather one of strategic coherence and collective steering. The territorial brand thus emerges as a device capable of structuring a shared vision among the various stakeholders involved in local development. It becomes an instrument of convergence between institutional, economic, and social actors, contributing to the construction of a shared reference framework around the territory's priorities. This reading enables a major theoretical shift: from territorial branding as a tool of promotion to territorial branding as an instrument of governance. Within this perspective, the brand no longer merely generates positive representations for external publics; it participates in the coordination of the territory's internal actors. It contributes to aligning the discourses, actions, and strategic orientations of territorial authorities, deconcentrated services, investment support structures, firms, and other local stakeholders. The case of Kénitra illustrates this dynamic with particular clarity. The territory possesses substantial objective assets: a privileged geographical position, proximity to major economic poles, significant industrial potential, logistical accessibility, and land availability. Yet these assets can only fully bear fruit in the presence of integrated governance capable of translating them into a coherent and shared territorial vision. In this context, the territorial brand may be envisaged as an instrument of strategic mediation between the different levels of decision-making and the different actors of local development. Moreover, this approach embeds the territorial brand within a logic of collaborative governance. It fosters not only the external legibility of the territory, but also the internal mobilisation of stakeholders around a common territorial project. In this capacity, the brand becomes a lever for legitimising public choices, hierarchising development priorities, and reinforcing inter-actor trust. It contributes to the construction of a unifying territorial identity capable of sustaining the dynamics of investment and sustainable development. Thus, while the 2018 article demonstrated the role of territorial branding in engendering trust and influencing firms' locational decisions, the present discussion brings to light a dimension previously less explicitly explored: that of territorial governance. The case of Kénitra shows that the brand can constitute a genuine instrument for the strategic steering of the territory, articulating attractiveness, institutional coordination, and actor mobilisation.

This conceptual evolution thus makes it possible to propose a renewed reading of the territorial brand no longer as a tool of competitive differentiation alone, but as a mechanism of territorial governance in the service of coherence, coordination, and local development.

5. CONCLUSION

This article has proposed a new reading of the territorial brand, moving beyond its promotional dimension to situate it at the intersection of territorial marketing and public governance. Drawing on the analysis of the province of Kénitra, we have shown that the territorial brand is an object with a dual function: on the one hand, it valorises the territory for investors and other external publics; on the other, it may play an essential internal role by fostering coordination among institutional actors, legitimising public choices, and constructing a shared strategic vision. In response to the central question of this article to what extent can the territorial brand function as a governance instrument, beyond its marketing function? our analysis offers a clear but nuanced answer. Yes, the brand can exercise a governance function, but subject to one indispensable condition: that it be conceived and implemented within a collaborative framework that genuinely associates all stakeholders in the construction of a coherent territorial identity. Without this condition, the brand remains a mere communication tool, without genuine purchase on the institutional dynamics that fundamentally determine the attractiveness and development of a territory. The case of Kénitra vividly illustrates this governance deficit. Despite its significant objective assets a favourable geographical position, a diversified industrial fabric, rich agri-food resources the province suffers from institutional dispersion, an absence of concerted strategic vision, and an incoherent territorial communication, all of which undermine its legibility and credibility in the eyes of investors. These problems are not inevitable, but addressing them requires sustained and substantive effort that goes far beyond the capacities of a communications department or a branding agency. On the theoretical front, this article invites further conceptualisation of the territorial brand as a hybrid governance instrument, by more fully engaging the contributions of stakeholder theory (Freeman, 1984), neo-institutional theory (DiMaggio and Powell, 1983), and the theory of collaborative governance (Ansell and Gash, 2008). Such a multidisciplinary approach would enable a more precise characterisation of the conditions for the emergence and consolidation of an effective territorial brand across varied institutional contexts. On the research front, several avenues merit exploration. First, comparative studies between Moroccan provinces, or between territories across the Maghreb more broadly, would allow the generalisability of the findings from Kénitra to be tested and the institutional factors that facilitate or impede the development of an effective territorial brand to be identified. Second, longitudinal approaches would be necessary to analyse the temporal dynamics of the construction and evolution of territorial brands, taking into account the effects of political change, institutional reform, and economic cycles. Finally, the articulation between territorial branding and new forms of civic participation particularly through digital platforms and social networks constitutes an emergent field whose implications for territorial governance remain largely unexplored. Ultimately, if territorial branding has long been perceived as a luxury reserved for major metropolitan areas, our analysis demonstrates that it is in reality a strategic necessity for any territory in pursuit of attractiveness provided, however, that it rests on sound governance, is carried forward by a shared vision, and genuinely associates all of its actors in its construction.

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LEVERAGING UML DIAGRAMS FOR AGILE PROJECT EFFICIENCY IN GLOBAL AND SUSTAINABLE SOFTWARE DEVELOPMENT

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ABSTRACT

In an era of globalization, accelerated digital transformation, and ecological transition, software systems are increasingly developed by geographically distributed and multicultural teams operating in highly dynamic environments. Agile project management enables adaptability and rapid delivery; however, insufficient architectural transparency and communication gaps may lead to rework, inefficiencies, and increased resource consumption. These challenges are amplified in globally distributed, multicultural teams working remotely, where inefficient communication can increase time, cost, and digital resource consumption, affecting sustainability goals. This paper examines the role of Unified Modeling Language (UML) as a lightweight and iterative coordination mechanism within Agile environments. Instead of serving as static documentation, UML diagrams, particularly when implemented as Diagrams as Code and integrated into CI/CD pipelines, function as shared visual artifacts that enhance stakeholder alignment, reduce cognitive load, and support early risk detection. By minimizing architectural drift, preventing costly rework, and improving knowledge transfer in distributed teams, pragmatic UML usage contributes to sustainable software development practices. The findings suggest that UML, when applied within Agile frameworks, strengthens engineering discipline while supporting global collaboration and long-term system sustainability, thereby contributing to broader development and ecological transition objectives while improving efficiency and minimizing unnecessary compute cycles and energy usage in Agile workflows.

Keywords: Agile Project Management, UML, Sustainable Software Engineering, Global Collaboration, Diagrams as Code

1. INTRODUCTION

The contemporary software industry operates within a globalized and digitally interconnected ecosystem characterized by rapid technological change, remote collaboration, and increasingly complex cloud-native architectures. Organizations across sectors, including telecommunications, finance, and critical infrastructure, rely on Agile methodologies to respond to continuously evolving customer and regulatory demands. Digital transformation is closely intertwined with broader societal objectives related to sustainable development and ecological transition. Inefficient software practices, architectural drift, redundant development efforts, and miscommunication in distributed teams generate not only economic costs but also unnecessary resource consumption, technical debt, and operational inefficiencies. Sustainability in software engineering is increasingly conceptualized as a systemic and long-term quality concern that spans technical, economic, and environmental dimensions (Becker et al., 2015). In this context, engineering clarity and structured communication mechanisms become essential components of sustainable digital development.

Unified Modeling Language (UML), when applied pragmatically and iteratively, enhances transparency, reduces cognitive overload, and enables early risk mitigation without compromising Agile responsiveness, especially in distributed and multicultural teams facing rapidly changing requirements. The paper advocates the transition from traditional modeling to "Diagrams as Code", where UML artifacts (such as sequence and component UML diagrams) are integrated into continuous integration and continuous deployment pipelines (CI/CD, in short) and version-controlled alongside source code, within Agile projects. The conclusion asserts that the pragmatic application of UML provides the engineering discipline required to balance rapid delivery with long-term system sustainability even when agility is needed. The paper is organized as follows. Section 2 describes agile methodology and its main challenges, then Section 3 briefly introduces UML and details how UML addresses Agile challenges. Section 4 highlights the positive evidence and insights of UML usage in Agile projects, while Section 5 provides brief conclusion.

2. AGILE METHODOLOGY AND RELATED CHALLENGES

Agile project management favors small, frequent deliveries of software systems, adaptive planning, and continuous feedback (Schwaber & Sutherland, 2020). Agile teams plan work in short cycles (sprints), continuously refine product backlogs, and rely on empirical data such as velocity, lead time, and cycle time to steer delivery. Large-scale industry surveys over the past decade indicate widespread global adoption of Agile practices beyond software development, while also identifying recurring challenges related to scaling across programs and managing inter-team dependencies (Digital.ai, 2024; Schwaber & Sutherland, 2020). The primary challenges faced by Agile teams typically include: (1) evolving requirements, where continuous change can cause architectural drift if not adequately visualized and validated; (2) communication across disciplines and geographic locations, as distributed teams and cross-functional roles require a shared conceptual view to avoid misinterpretation. Remote-first organizations increasingly adopt Diagrams-as-Code (DaC) approaches, such as PlantUML and Mermaid, stored in version-controlled repositories to improve resilience, traceability, and reviewability (GitLab, 2024; ThoughtWorks, 2024), (3) right-sizing documentation, where teams must balance accuracy and currency with minimal process overhead to support onboarding and audits, and (4) dependency and risk management, as microservices, data flows, and third-party integrations introduce complex dependencies that must be identified and addressed early (Scaled Agile, Inc., 2024; ThoughtWorks, 2024). In globally distributed Agile environments, inefficiencies in communication and architectural misalignment may translate into duplicated effort, repeated builds and deployments, and prolonged infrastructure usage. From a sustainability perspective, such inefficiencies increase computational overhead and indirectly expand the energy footprint of digital systems.

3. HOW UML ADDRESSES AGILE CHALLENGES

UML is a standardized visual language for modeling software systems. Managed by the Object Management Group (OMG), UML evolved from method unification efforts (Booch, OMT, Objectory). It remains widely taught and used across industry and academia, especially when applied in a pragmatic, lightweight way aligned with Agile (Object Management Group, 2024; Fowler, 2024). There are several types of UML diagrams divided into two main groups:

- Structural (e.g., Class, Component, Deployment): Capture elements, relationships, and allocation (e.g., domain model, Application Programming Interface (API) surface, service components).

- Behavioral (e.g., Use Case, Sequence, Communication, Activity, State Machine): Capture interactions, workflows, and lifecycles over time. Agile teams often favor Use Case, Sequence, and Activity diagrams during discovery and implementation, while Class and Component diagrams support architecture, API evolution, and integration design (Ambler, 2023).

UML as a standardized visual language acts as shared visual vocabulary recognizable by developers, testers, product owners, and compliance stakeholders of different profile and heterogeneous technological background. Compared with prose, UML diagrams reduce ambiguity and accelerate review, especially in regulated domains where traceability and rationale must be demonstrated (INCOSE, 2023). The effectiveness of UML in Agile is deeply rooted in Cognitive Load Theory research. Research shows that visual representations reduce cognitive load and improve problem-solving efficiency compared to dense textual descriptions (Sweller, 1988; Sweller et al., 2011). In complex Agile sprints, where developers are often overwhelmed by intricate microservice interactions, UML diagrams, particularly Component and Sequence diagrams, reduce the cognitive load. By providing a high-level visual abstraction, developers can offload the task of memorizing system topology to the diagram, allowing them to focus their cognitive resources on the core logic and problem-solving. This reduction in cognitive load is a primary driver of the increased 'velocity' observed in modeled Agile projects. Thus, UML addresses the agile challenges in several ways, including improvement of stakeholder communication, support for evolving requirements, efficient documentation and visualization, and efficiency in development and decision-making. Benefits of using UML in Agile project management are:

- (1) **Improved Stakeholder Communication** - Stakeholder communication can be improved with UML by two means: (i) Story-to-design alignment: UML Use Case and Sequence diagrams link user intents to system behavior, clarifying acceptance criteria and test design. (ii) Executive and non-technical alignment: UML Use Cases and high-level Component diagrams communicate scope and boundaries without code-level detail (Fowler, 2024; Ambler, 2023).
- (2) **Support for Evolving Requirements** - UML diagrams should be managed as living artifacts stored alongside the source code. Text-based UML, such as PlantUML (GitLab, 2024), enables pull request -based reviews, versioning, and continuous integration validation, reducing divergence between design intent and implementation, and improving change impact analysis (GitLab, 2024; ThoughtWorks, 2024).
- (3) **Efficient Documentation and Visualization** - "Just enough" lightweight UML supports onboarding and knowledge transfer, especially in distributed teams, without introducing heavyweight documentation overhead. Activity diagrams communicate workflows (e.g., CI gates, approvals) more compactly than text (Ambler, 2023; Digital.ai, 2024).
- (4) **Efficiency in Development and Decision-Making** - Visualizing interactions (sequence diagrams) and responsibilities (Class/Component diagrams) surfaces design flaws sooner (e.g., chatty calls, cyclic dependencies), accelerating estimation and reducing rework (Fowler, 2024). In this sense, the economic essence of UML in Agile lies in the "Shift-Left" approach to quality. By utilizing Sequence or State Machine diagrams during backlog refinement, teams can identify logical conflicts, such as race conditions or integration gaps, before a single line of code is written. This drastically reduces the cost of repair, as correcting a design flaw during a 15-minute modeling session is exponentially cheaper than refactoring a feature two sprints later. UML serves as "just enough" documentation to validate the "Happy Path" and edge cases early in the lifecycle

(5) **Risk and Dependency Management** - For example, UML Component and Deployment diagrams expose coupling, data residency concerns, and third-party dependencies, enabling earlier risk identification and mitigation (Scaled Agile, Inc., 2024; INCOSE, 2023). Also, UML Sequence diagrams allow Agile teams to visualize parallel processing paths. In high-concurrency environments like 5G or cloud-native microservices, this helps developers identify potential race conditions during the design phase—risks that typical unit tests might miss until the system is under high load

(6) **Catalyst for Automated Governance and Compliance** - In high-stakes and regulated industries, such as Finance, Aerospace, and Healthcare, Agile teams often struggle with the 'compliance gap,' where rapid delivery outpaces the creation of audit trails. The transition to 'Diagrams as Code' directly addresses this by providing an automated, version-controlled audit trail. When UML artifacts (such as PlantUML or Mermaid) are integrated into the Git repository, every architectural decision is captured within a pull request. This creates a permanent, time-stamped record of design intent that is reviewed and approved by peers, satisfying regulatory requirements for traceability and architectural governance without reverting to heavyweight waterfall documentation.

(7) **Availability of metrics for Agile Efficiency through Modeling** - To quantify the impact of UML on Agile project management, organizations can track specific performance metrics such as:

- **Onboarding Lead Time:** Lightweight UML (Component and Deployment diagrams) serves as a visual map for new developers, reducing the time required to understand system topology and achieve full productivity.
- **Architectural Runway Stability:** In scaled frameworks like SAFe, modeling ensures that "Enablers" are well-defined, preventing teams from hitting technical bottlenecks caused by unforeseen dependencies.
- **Reduced Defect Leakage:** Visualizing acceptance criteria through Use Case and Activity diagrams reduces the ambiguity of requirements, leading to fewer bugs reaching the testing or production phases.
- **Cycle Time Reduction:** By clarifying complex workflows (e.g., CI/CD gates or API handshakes) visually, teams spend less time in "alignment meetings" and more time in active development. Reduced cycle time and minimized rework not only improve delivery speed but also decrease unnecessary compute cycles, redundant deployments, and infrastructure consumption, contributing to more resource-efficient digital operations.

Thus, as a conclusion to this section, Table 1 provides distinguishing points between the traditional approach (comprehensive design with detailed UML diagrams before development) and the Agile approach (only necessary and UML modeling).

Feature	Traditional UML (Heavyweight)	Agile UML (Lightweight/Modern)
Timing	Completed before coding starts.	Iterative, evolves with the code.
Purpose	Detailed blueprint for developers to follow.	Shared mental model for communication.
Format	Proprietary binary files (CASE tools).	Text-based "Diagrams as Code" (PlantUML).
Detail Level	Exhaustive (all classes/methods).	High-level (critical interactions/risks).
Maintenance	Manual, often leads to "Architectual Drift".	Automated via CI/CD pipelines.
Ownership	Defined by specialized Architects.	Shared by the entire cross-functional team.

Table 5 Comparative Analysis: Traditional vs. Agile UML Approach

4. EVIDENCE OF UML USAGE WITHIN AGILE PROJECTS

This section presents research-backed insights and industry case studies demonstrating how UML, when applied pragmatically, improves efficiency and effectiveness in Agile environments.

4.1 Evidence from academic and industry literature

Academic and practitioner-oriented literature consistently indicates that UML can effectively complement Agile practices when applied in a lightweight and iterative manner. Rather than serving as comprehensive upfront documentation, UML diagrams are most valuable when used selectively to support communication, clarify design intent, and reduce ambiguity in complex system discussions (Ambler, 2023; Fowler, 2024). Gallud and Fardoun (2018) state that UML Class and Deployment diagrams are highly recommended for use in Agile methodologies. Class diagrams are particularly relevant because Agile teams typically aim to build object-oriented solutions. Deployment diagrams are also important, as defining the architecture is one of the first steps in software development. Gallud and Fardoun (2018) further say that UML sequence diagrams play an important role when the development team is discussing some complex interaction among objects. Industry reports and large-scale practitioner surveys, such as Ozkaya and Erata survey (2020) emphasize the growing adoption of visual modeling techniques to manage architectural complexity, particularly in distributed Agile environments and large-scale systems. Practices such as “Diagrams as Code,” where UML artifacts are stored in version-controlled repositories and integrated into CI/CD pipelines, improve reviewability, traceability, and alignment between design intent and implementation (GitLab, 2024; ThoughtWorks, 2024). Empirical observations from industry studies suggest that teams using lightweight visual models as living artifacts report improved stakeholder alignment, more efficient onboarding of new team members, and reduced rework caused by misinterpretation of requirements or architectural dependencies, according to 17th State of Agile Report produced by Digital.ai (2024). These findings reinforce the view that UML, when pragmatically applied, functions primarily as a cognitive and communicative aid rather than as a rigid specification mechanism, making it compatible with Agile principles of adaptability and minimal documentation. Empirical studies on software documentation further indicate that practitioners perceive visual models and diagrams as more useful and actionable than extensive textual documentation, particularly for understanding system structure and dependencies in complex projects (Forward & Lethbridge, 2002). Therefore, evidence from industry standards, practitioner reports, and organizational documentation suggest that visual modeling techniques such as UML and SysML continue to play a significant role across diverse industrial contexts. For example, in sectors such as aerospace and automotive engineering, modeling languages including UML and SysML are employed to ensure traceability across requirements engineering, system design, verification, and validation activities. Industry bodies and standardization organizations (e.g., INCOSE, 2023; ETSI, 2014) emphasize model-based approaches to support compliance, safety assurance, and lifecycle documentation. Additionally, organizations operating large distributed systems, including streaming and e-commerce platforms, report the use of UML sequence and component diagrams to facilitate architectural communication, onboarding of new engineers, and dependency analysis within complex microservice ecosystems (e.g., AWS Prescriptive Guidance; Netflix TechBlog). Such visual artifacts support shared understanding in rapidly evolving, large-scale infrastructures. Companies adopting and promoting remote-first and distributed engineering environments, such as GitLab (2024) and GitHub (2024), propose to integrate UML diagrams into version-controlled repositories to enhance collaboration and architectural transparency.

4.2 Evidence informed by the author's practical project involvement

The first author of this paper has participated in several industrial projects where UML has been successfully used within Agile teams, improving the efficiency and effectiveness of the project. In the following subsection these projects are only shortly presented, with UML usage highlighted.

4.2.1 5G Cloud-Native Networks project

5G Core networks project was built following the service-oriented architectural approach with containerized microservices. In this project, the UML Sequence diagrams were used to define interactions between Access and Mobility Management Function (AMF) and Session Management Function (SMF), allowing Agile teams to detect race conditions and API mismatches during sprint planning.

4.2.2 NFVI - Network Function Virtualization Infrastructure project

NFVI provides compute, storage, and network resources for VNFs and CNFs. Continuous changes (OpenStack upgrades, Kubernetes versioning, hardware updates) increase complexity and risk. UML in this project offers a living model for architectural understanding, validation, and risk mitigation. UML Deployment and Component diagrams were used to capture relationships between physical hosts, virtualization layers, orchestration platforms, and network functions, serving as stable architectural baselines. Component and Deployment diagrams complement Low-Level Design (LLD) documents, capturing essential architecture without duplicating configuration details, improving transparency and reducing cognitive load. In this project, UML Activity and Sequence diagrams model CI/CD pipelines, including deployment stages, validation gates, approvals, and rollback triggers, reducing misconfiguration risk and accelerating troubleshooting. An example of UML Sequence diagram used to document NFVI CI/CD pipeline is shown in Figure 1. This sequence diagram supports pipeline transparency, early performance verification and living documentation in NFVI environments.

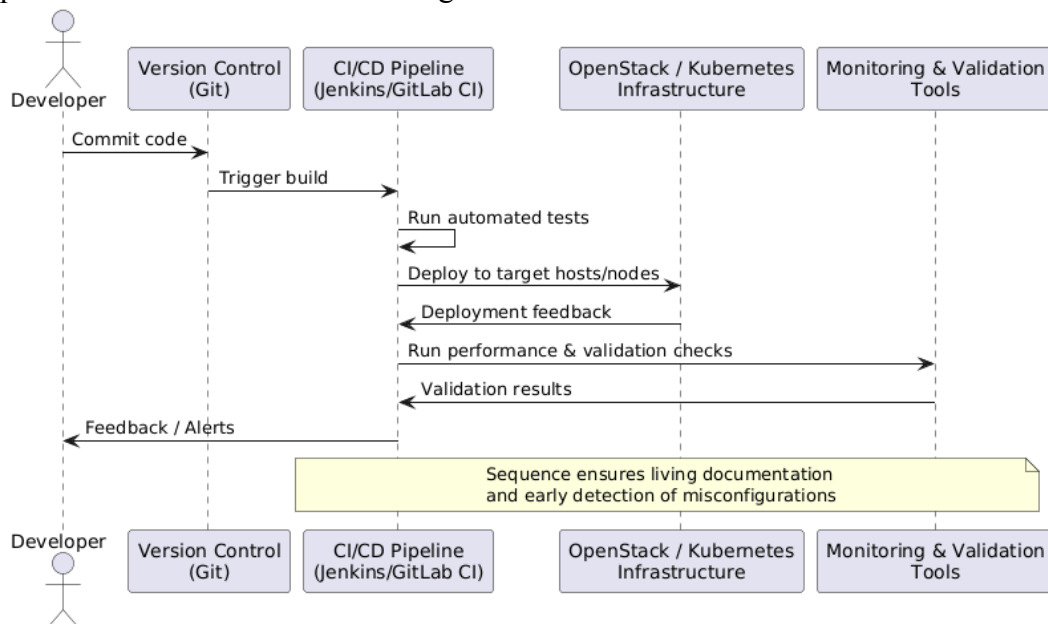


Figure 1 UML Sequence Diagram for NFVI's CI/CD Pipeline and Performance Validation

Then, Figure 2 illustrates the full-stack NFVI upgrade and rollback process, highlighting pre-checks, maintenance, upgrade execution, validation, and rollback stages.

This activity diagram visually supports controlled and repeatable operations within Agile-driven NFVI environments.

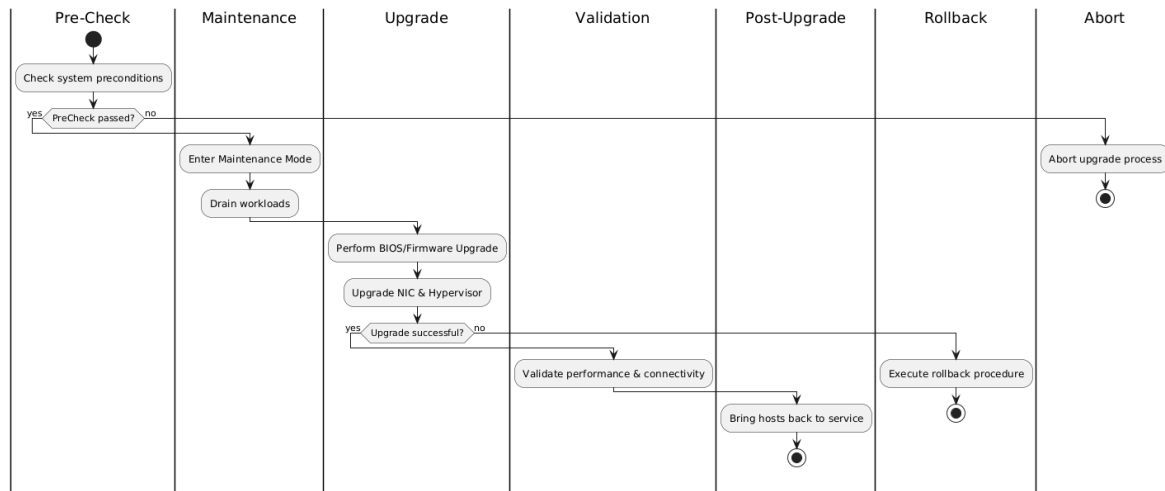


Figure 2 UML Activity Diagram for NFVI's Full-Stack Upgrade and Rollback Flow

In network and performance validation (NFVI project and similar ones), sequence diagrams can be used to map latency-critical flows (e.g., User Plane Function), distinguishing control and user plane traffic. Deployment diagrams can help to illustrate NUMA alignment, NIC binding, and acceleration paths, supporting shift-left performance engineering (ETSI, 2014). State Machine and Activity diagrams can model host and cluster lifecycle states during upgrades, including pre-checks, maintenance, validation, and rollback, enabling repeatable and reviewable processes. Deployment diagrams can further capture component relationships (BIOS, BMC, NIC, hypervisor, Kubernetes), supporting risk-aware upgrades (ETSI, 2014). From the author's experience, the UML has delivered significant value in NFVI project as a living operational artifact, where it supported architectural clarity, validation efficiency, and risk-aware decisions, balancing Agile delivery speed with mission-critical reliability.

5. CONCLUSION

In the broader context of globalization and ecological transition, lightweight UML modeling supports sustainable digital ecosystems by reducing inefficiencies, enhancing global collaboration, and strengthening long-term architectural resilience. As digital infrastructure becomes foundational across sectors and regions, structured visual modeling serves as a governance mechanism for responsible, scalable, and sustainable innovation. When pragmatically integrated into Agile environments, UML enables organizations to balance rapid delivery with architectural integrity, ensuring that agility does not compromise long-term system sustainability in increasingly complex global systems. Several emerging trends further reinforce this direction: (1) Agile and Model-Driven Engineering (MDE) hybrid approaches that use light models for critical decisions, heavier models where compliance demands traceability; code generation reserved for stable domains; (2) Scaled Agile (SAFe, LeSS) where UML supports architecture runway, enablers, and solution intent, providing shared context without heavyweight specs, (3) Diagrams as Code and Docs-as-Code, which treat diagrams like source code (reviews, tests, pipelines) continues to grow—improving accuracy and auditability; (4) AI-assisted modeling with already available tools to generate or refactor UML and PlantUML from code or prose, promising for rapid ideation, but human review remains essential to avoid propagating flawed abstractions, and (5) Digital Twins / Industry 4.0 with UML and SysML underpinning system models integrated with simulation, telemetry, and verification in cyber-physical systems.

These trends are reflected in the growing adoption of scaled agile frameworks, Diagrams as Code practices, and model-based systems engineering approaches (Scaled Agile, Inc., 2024; ThoughtWorks, 2024; INCOSE, 2023; Object Management Group, 2024).

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ARTIFICIAL INTELLIGENCE AND THE TRANSFORMATION OF MANAGEMENT CONTROL TOWARDS GREATER PREDICTIVE CAPABILITIES

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ABSTRACT

In a context marked by rapid technological change and growing economic uncertainty, organizations are increasingly required to reconsider the mechanisms used to plan, monitor, and steer their performance. Traditionally, management control systems have relied on planning practices such as budgeting, financial forecasting, and performance evaluation, which are mainly based on historical data and managerial judgment. Although these practices have long supported organizational decision-making, their effectiveness is progressively challenged by the increasing complexity of contemporary environments and the rapid expansion of available data. Within this evolving context, the emergence of artificial intelligence offers new opportunities to enhance management control practices. By enabling the processing and analysis of large volumes of data, artificial intelligence allows the development of predictive models capable of anticipating future trends with greater accuracy. Consequently, management control systems are gradually evolving from traditional planning-oriented mechanisms toward more predictive and data-driven approaches. This study aims to analyze the contribution of artificial intelligence to this transformation of management control. To address this objective, the research adopts a conceptual and analytical approach based on a review of the literature related to artificial intelligence, predictive analytics, and management control systems. This approach makes it possible to examine how predictive models supported by artificial intelligence can complement traditional planning practices and support more informed managerial decisions. For the expected results, the integration of artificial intelligence may improve forecasting accuracy, enhance the reliability of financial information, and strengthen the strategic role of management controllers. Future research could further explore empirical applications of predictive technologies and examine the organizational conditions required for their effective adoption.

Keywords: *Artificial Intelligence, Management Control, Predictive Analytics, Financial Forecasting, Decision-Making*

1. INTRODUCTION

In recent years, rapid technological change and the rise of artificial intelligence (AI) have profoundly transformed the way organizations operate and manage their performance. Companies are increasingly required to process large volumes of data, respond quickly to market changes, and make more accurate strategic decisions. In this context, management control systems play a central role in supporting planning, monitoring, and decision-making processes. However, traditional management control systems are mainly based on historical data, budgeting, and periodic reporting. While these tools have long supported managerial decision-making, they are increasingly limited in today's complex and uncertain business environment.

According to Anthony (1965), management control ensures the efficient use of resources to achieve organizational objectives, but traditional approaches often remain reactive rather than proactive. This study addresses the following research problem: **How does artificial intelligence transform management control toward predictive capabilities?** The aim is to understand how AI enables organizations to move from traditional, descriptive control systems to more predictive and data-driven approaches that improve forecasting and decision quality. The objectives of this study are to analyze the limitations of traditional management control systems, to examine the contribution of artificial intelligence to forecasting and decision-making, and to explore how AI transforms the role of management control toward a more strategic and predictive function. In addition, the study aims to illustrate these changes through real-world applications. The methodology adopted is based on a qualitative approach combining a literature review and a comparative study. The literature review covers key academic contributions on management control, artificial intelligence, and predictive analytics, while the comparative analysis focuses on two multinational companies, Microsoft and Siemens, in order to examine how AI is applied in practice and how it enhances management control systems.

2. THEORETICAL FRAMEWORK

This chapter provides the theoretical foundations of the study by exploring the key concepts related to management control and artificial intelligence. It begins by examining traditional management control systems, including their main tools and inherent limitations in today's complex and dynamic business environment. It then introduces artificial intelligence and predictive analytics, highlighting their role in transforming data processing and enhancing decision-making capabilities. Finally, the chapter discusses the evolution of management control from a descriptive and historical approach toward a more predictive and data-driven system, emphasizing the changing role of the management controller in modern organizations.

2.1. Traditional Management Control

Traditional management control refers to a set of processes and tools used by organizations to plan, monitor, and evaluate performance. Its main objective is to ensure that organizational resources are used efficiently in order to achieve strategic goals. According to Anthony (1965), management control focuses on aligning organizational activities with predefined objectives through structured monitoring systems. The main tools of traditional management control include budgeting, financial reporting, and forecasting. Budgeting helps organizations allocate resources and set financial targets, while reporting provides periodic information on performance. Forecasting is used to anticipate future results based on historical data and managerial assumptions (Kaplan and Norton, 1996). However, these traditional tools present several limitations. They are mainly based on historical data, which makes them less suitable for rapidly changing environments. In addition, they often lack real-time responsiveness, making it difficult for managers to react quickly to unexpected changes in market conditions (Davenport, 1998).

2.2. Artificial Intelligence and Predictive Analytics

Artificial intelligence (AI) refers to the ability of computer systems to perform tasks that normally require human intelligence, such as learning, reasoning, and decision-making. According to Brynjolfsson and McAfee (2014), AI represents a major technological shift that enhances the capacity of organizations to process and analyze large volumes of data efficiently. Big data plays a central role in this transformation, as it provides the massive datasets required for training predictive models. These models use advanced algorithms to identify patterns, trends, and correlations that are not easily detectable through traditional methods.

As a result, organizations can generate more accurate forecasts and simulations (McAfee and Brynjolfsson, 2012). The importance of AI for decision-making lies in its ability to transform raw data into actionable insights. It supports managers in making faster, more informed, and more reliable decisions, thereby improving overall organizational performance (Davenport, 2018).

2.3. Transformation of Management Control

The integration of artificial intelligence has led to a significant transformation of management control systems, shifting them from descriptive approaches to predictive and proactive systems. Instead of relying only on past data, organizations can now anticipate future trends and make forward-looking decisions (Kaplan and Norton, 1996). This transformation also affects the role of the management controller. Traditionally focused on reporting and analysis, the controller is now becoming a strategic partner who supports decision-making through data interpretation, predictive insights, and performance optimization (Granlund and Mouritsen, 2003). As a result, management control is increasingly becoming data-driven. Decisions are no longer based solely on intuition or historical reports but are supported by real-time analytics and predictive models, leading to more accurate and efficient organizational management (Brynjolfsson and McAfee, 2014).

3. IMPACT OF ARTIFICIAL INTELLIGENCE ON MANAGEMENT CONTROL

Artificial intelligence is progressively reshaping management control systems by making them more dynamic, responsive, and forward-looking. Unlike traditional systems that mainly rely on past data, AI enables organizations to analyze information in real time and anticipate future trends. This evolution strengthens the role of management control as a strategic tool supporting performance and decision-making. This chapter examines the main effects of AI on forecasting, automation, decision-making, as well as its key limitations.

3.1. Improvement of Financial Forecasting

Artificial intelligence improves financial forecasting by allowing organizations to process large amounts of data and identify patterns that are not visible through traditional methods. This leads to more accurate and reliable predictions, supporting better financial planning. AI-based systems enhance forecasting quality by reducing uncertainty and improving data interpretation (Davenport, 2018; McKinsey & Company, 2024).

3.2. Automation and Error Reduction

AI also contributes to the automation of many routine processes within management control, such as data collection, reporting, and analysis. This reduces the need for manual intervention and significantly decreases the risk of human error. Automation improves both efficiency and the accuracy of financial information (Brynjolfsson and McAfee, 2014; PwC, 2023).

3.3. Support for Decision-Making

Artificial intelligence enhances decision-making by providing managers with real-time insights and predictive analytics. This allows organizations to react more quickly to changes in their environment and make more informed strategic choices. Timely and relevant information is essential for effective management control and is significantly reinforced by AI-driven analytics (Kaplan and Norton, 1996; McKinsey & Company, 2024).

3.4. Challenges and Limitations

Despite its benefits, the integration of artificial intelligence into management control presents several challenges.

These include high implementation costs, cybersecurity risks, and the need for advanced technical skills. Additionally, organizations must manage resistance to change and ensure proper employee training. These factors can slow down the successful adoption of AI systems (Laudon and Laudon, 2016; Deloitte, 2023).

Dimension	Key Impact	Main Benefit	Reference
Financial forecasting	Predictive analytics and real-time data processing	Higher accuracy and reduced uncertainty	Davenport (2018)
Automation	Reduction of manual tasks	Lower error rates and higher efficiency	Brynjolfsson and McAfee (2014)
Decision-making	Real-time insights and predictive models	Faster and more informed decisions	Kaplan and Norton (1996)
Limitations	Costs, risks, skills gap	Better awareness of implementation constraints	Laudon and Laudon (2016)

*Table 1: Summary of the Impact of Artificial Intelligence on Management Control
(Source: Written by ourselves)*

4. COMPARATIVE STUDY: MICROSOFT VS SIEMENS

This chapter provides a comparative analysis of Microsoft and Siemens in order to understand how artificial intelligence is integrated into management control systems within two different industrial contexts. Microsoft represents a global technology leader strongly oriented toward cloud computing and AI-driven digital solutions, while Siemens is a major industrial group focused on engineering, automation, and digital transformation of production systems. The aim of this chapter is to evaluate how both companies use artificial intelligence to improve forecasting, performance monitoring, and decision-making, and to identify their main similarities and differences.

4.1. Company Presentation (corrigé)

Microsoft is a global technology company recognized as one of the leaders in artificial intelligence and cloud computing solutions. Its ecosystem, particularly Microsoft Azure, supports over 95% of Fortune 500 companies, highlighting its dominant position in enterprise cloud services (Microsoft, 2024). In 2024, Microsoft reported that its cloud and AI-related services represented approximately over 40% of its total revenue growth contribution, reflecting the strategic importance of AI-driven platforms (Microsoft, 2024). Siemens, on the other hand, is a multinational industrial group specializing in engineering, automation, energy systems, and digital industry solutions. Siemens operates in more than 190 countries and employs around 320,000 employees worldwide (Siemens, 2024). Its Digital Industries division has reported that digitalization solutions contribute to more than 50% of industrial productivity gains in advanced manufacturing environments (Siemens, 2024).

4.2. Use of AI in Management Control

Microsoft integrates artificial intelligence into its management control systems mainly through cloud-based platforms and advanced analytics tools.

AI-powered services in Microsoft Azure process billions of data transactions daily, enabling real-time forecasting and financial analysis (Microsoft, 2024). Machine learning models have improved forecasting accuracy by up to 20–30% compared to traditional statistical methods, according to industry benchmarks (IDC, 2023; Gartner, 2023). Siemens applies artificial intelligence in a more industrial and operational context. The company uses predictive analytics, digital twin technologies, and AI-enhanced ERP systems across more than 100 major industrial facilities worldwide (Siemens, 2024). These technologies have contributed to reducing machine downtime by approximately 20–25% in predictive maintenance applications and improving production efficiency by nearly 15–20% (McKinsey & Company, 2023; PwC, 2023).

4.3. Results and Performance

In terms of performance, Microsoft benefits from highly accurate forecasting capabilities supported by real-time data and advanced predictive models. AI-driven systems contribute to reducing financial forecasting errors by approximately 25%, enabling faster strategic decision-making (Microsoft, 2024; McKinsey & Company, 2024). Microsoft’s cloud division (Azure) has also maintained annual growth rates exceeding 25–30%, reflecting strong adoption of AI-based services (Microsoft, 2024). Siemens achieves strong results in operational efficiency, particularly in production planning and cost control. The use of AI enables reductions in operational costs by approximately 10–15%, while improving project delivery timelines by up to 20% (Siemens, 2024; McKinsey & Company, 2023). Predictive maintenance systems have also reduced unplanned equipment failures by nearly 30% (PwC, 2023).

4.4. Comparative Analysis

Both Microsoft and Siemens demonstrate a strong integration of artificial intelligence into management control systems, particularly in forecasting, performance monitoring, and decision support. Microsoft focuses on scalable digital ecosystems and cloud-based AI solutions, with AI contributing significantly to enterprise value creation (Gartner, 2023; IDC, 2023). Siemens emphasizes industrial applications such as automation and predictive maintenance, where AI has generated efficiency improvements of up to 20–25% (McKinsey & Company, 2023). A common factor is their high investment in digital transformation, with Microsoft allocating over \$50 billion annually in R&D and cloud infrastructure, while Siemens invests approximately €6–7 billion per year in digital industries and smart infrastructure (Microsoft, 2024; Siemens, 2024).

Dimension	Microsoft	Siemens
Industry focus	Technology, software, cloud computing	Industrial engineering, automation, energy systems
AI application in control	Cloud AI, predictive analytics, dashboards	Digital twins, predictive maintenance, industrial AI
Management control orientation	Strategic and financial forecasting	Operational efficiency and production control
Data usage	Global, scalable digital ecosystem	Industrial and project-based data

Main advantage	Fast strategic decision-making	High operational efficiency
Key strength	Strong AI and cloud infrastructure	Strong industrial AI integration
Efficiency improvement from AI	+20–30% forecasting accuracy	+15–25% operational efficiency
Cost reduction impact	~25% reduction in forecasting errors	~10–15% operational cost reduction
Downtime reduction	AI-based cloud optimization	~20–30% reduction in machine downtime

*Table 2: Comparative Analysis : Microsoft vs Siemens
(Source: Written by ourselves)*

5. DISCUSSION

This study investigated the impact of artificial intelligence (AI) on management control systems through a comparative analysis of Microsoft and Siemens. The findings are interpreted in light of the theoretical framework, highlighting how AI contributes to the transformation of management control from a retrospective reporting mechanism into a predictive and continuously adaptive decision-support system. The comparative evidence indicates a strong convergence between theory and empirical results. Both cases confirm that AI enhances forecasting accuracy, improves operational efficiency through automation, and strengthens decision-making via real-time analytics (McKinsey & Company, 2024; Deloitte, 2023). However, the degree and modality of impact vary according to organizational architecture, digital maturity, and industry characteristics. Microsoft exhibits a highly integrated, data-centric ecosystem where AI is embedded across strategic and operational layers. Siemens, by contrast, reflects a more incremental and industrially grounded adoption, where AI is primarily deployed in production optimization, engineering processes, and operational control. Despite these differences, both organizations illustrate the systemic role of AI in reshaping management control logics.

5.1. Main findings

The results demonstrate that AI significantly enhances the performance, scope, and strategic relevance of management control systems. Across both Microsoft and Siemens, AI contributes to improved forecasting accuracy, reduced uncertainty, and increased responsiveness of managerial systems. However, the nature of these improvements differs depending on the organizational context. First, AI-driven forecasting models improve predictive accuracy by leveraging large-scale data integration and machine learning techniques. This effect is more pronounced in Microsoft, where AI is embedded within global planning and financial systems, while Siemens demonstrates stronger gains in operational forecasting, particularly in production planning and predictive maintenance. Second, automation of repetitive and rule-based tasks increases process efficiency and reduces human error. In Microsoft, automation primarily affects financial reporting, performance monitoring, and analytical workflows, whereas in Siemens it is concentrated in industrial processes and operational execution.

Third, real-time analytics enhances the speed and quality of decision-making. Microsoft benefits from a highly centralized, real-time decision infrastructure, while Siemens improves responsiveness at the plant and supply-chain levels through localized AI applications. Finally, the findings confirm that the impact of AI is not homogeneous but structurally contingent on organizational design and sectoral constraints.

5.2. Implications for organizations

The findings suggest that AI integration requires a fundamental redesign of management control systems rather than a simple technological upgrade. The comparative analysis highlights two distinct yet complementary adoption trajectories. Microsoft illustrates a mature digital transformation model characterized by full data integration, platform-based intelligence, and enterprise-wide AI deployment. Siemens reflects a more gradual transformation path, where AI is selectively introduced into high-impact operational domains before broader scaling. These trajectories imply that successful AI adoption depends on alignment between technological capabilities, organizational readiness, and strategic objectives. From a managerial perspective, several implications emerge. First, firms must ensure coherence between AI systems and existing control architectures. Second, organizational capabilities—particularly in data governance, interoperability, and analytical skills—become critical determinants of success. Third, workforce transformation is essential, as management controllers progressively shift from data processing roles to analytical and strategic advisory functions. Thus, AI adoption in management control should be understood as an organizational transformation process rather than a purely technical implementation.

5.3. AI and the future of management control

The results indicate that AI is driving a structural shift in the nature of management control systems. Both Microsoft and Siemens are progressively moving toward predictive, automated, and real-time control environments, albeit at different speeds and levels of sophistication. Traditional control mechanisms based on periodic reporting are increasingly being replaced by continuous monitoring systems powered by predictive analytics and scenario simulation. In this context, management control evolves from a descriptive function into a prescriptive and anticipatory discipline. This transformation also redefines the role of management controllers. Rather than focusing on data compilation and variance analysis, controllers are increasingly expected to act as strategic interpreters of AI-generated insights, supporting decision-making under uncertainty. In the long term, management control systems are expected to converge toward hybrid human–AI architectures characterized by self-learning capabilities, adaptive forecasting models, and autonomous performance monitoring.

Dimension	Microsoft	Siemens	Implication for Management Control
Forecasting	Global predictive analytics integrated into enterprise systems	Operational forecasting in production and maintenance	Shift toward multi-level predictive control systems
Automation	Enterprise-wide automation of analytical workflows	Industrial process automation	Increased efficiency across strategic and operational layers
Decision-making	Real-time, centralized decision intelligence	Decentralized, plant-level responsiveness	Hybrid decision architectures

Digital maturity	High and fully integrated ecosystem	Intermediate, sector-specific adoption	AI impact depends on maturity level
Evolution trajectory	AI-native organizational model	Gradual industrial AI integration	Convergence toward intelligent adaptive systems

Table 3: Summary of Key Findings and Implications
(Source: Written by ourselves)

6. CONCLUSION

This study analyzed the impact of artificial intelligence on management control systems and their evolution toward predictive and data-driven configurations. The results indicate that AI significantly improves forecasting accuracy, enhances process automation, and strengthens real-time decision-making capabilities. The comparative analysis of Microsoft and Siemens further confirms that AI adoption leads to higher efficiency, improved performance monitoring, and greater strategic agility, while also highlighting variations in outcomes depending on organizational maturity and industry context. Overall, the findings provide a clear answer to the research question: artificial intelligence transforms management control by shifting it from a retrospective, accounting-based logic to a predictive and forward-looking system. This transformation enables a transition from reactive to proactive and anticipatory decision-making, thereby enhancing both operational control and strategic performance. From a forward-looking perspective, the development of artificial intelligence, big data analytics, and automation technologies is expected to further reshape management control systems. These technologies will reinforce predictive and prescriptive capabilities, reduce manual intervention in control processes, and elevate the role of management controllers toward strategic data interpretation. Consequently, organizations that effectively integrate these technologies will be better positioned to operate in increasingly complex and uncertain environments.

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CONSTRUCTION WASTE MANAGEMENT WITHIN THE FRAMEWORK OF CORPORATE SOCIAL RESPONSIBILITY: A CASE STUDY OF RECIKLAŽA MIŠIĆ

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ABSTRACT

Effective management and treatment of construction waste reduce the need for the exploitation of natural resources and promote environmentally responsible practices in the construction industry. The aim of this paper is to highlight the importance of construction waste management as a key element of corporate social responsibility in construction companies. Corporate social responsibility is not a passive concept that arises solely under stakeholder pressure; rather, it requires an active approach in which managers make decisions balanced between the interests of various stakeholders, environmental protection, and the company's economic objectives. In this context, waste management represents a foundation of sustainability and competitiveness, particularly in the construction sector, which is characterized by rapid urbanization and increasing volumes of waste. The purpose of the research was to identify key procedures that enable an increase in the share of recycled construction materials, a reduction in the amount of waste disposed of in landfills, and an improvement in the environmental and economic sustainability of construction companies. The research was conducted using a case study method based on the example of Reciklaža Mišić, through an analysis of the processes of collection, transportation, mechanical treatment, and recycling of construction waste, as well as laboratory testing of the quality of recycled aggregates. The research results showed that proper sorting and processing of construction waste enable the production of high-quality recycled aggregates, reduce the need for the exploitation of natural resources, and contribute to environmental protection. Furthermore, the integration of the circular economy into business processes increases company competitiveness and enables sustainable waste management. The implementation of innovative technologies and continuous employee training further ensures the quality of recycling and its broader application within the construction sector. The research confirms that systematic construction waste management represents a key strategic resource for the sustainable development of construction companies and local communities.

Keywords: *construction waste, recycled aggregates, circular economy, waste management, Reciklaža Mišić*

1. INTRODUCTION

Over the past century, the global economy has undergone profound transformations that have not been gradual but rather radical, driven by accelerated industrialization, the development of new production technologies, reduced labor costs, economies of scale, and market globalization.

The development of information and communication technologies has further accelerated the generation of new information and knowledge, which has had a strong impact on the construction sector. Today, the construction industry is characterized by trends such as the digitalization of key processes, the application of artificial intelligence and robotics, 3D printing of structural elements, and a strong focus on green and sustainable building practices. In such a business and technological environment, construction waste management is becoming a strategic imperative. Companies such as Reciklaža Mišić demonstrate how the integration of circular economy principles, including the collection, sorting, and recycling of construction waste, can contribute to environmental protection, reduce pressure on natural resources, and enhance business competitiveness.

The production of recycled aggregates, including crushed concrete, asphalt, and fill materials, enables the repeated use of resources and reduces waste disposal. The contemporary business environment poses a challenge to organizational management to achieve economic results while simultaneously safeguarding the interests of the community and the environment. The concept of corporate social responsibility (CSR) implies the voluntary integration of social and environmental aspects into business processes and stakeholder relations, with the aim of creating shared value and reducing the negative impacts of business activities (Rasche et al., 2017; European Commission, 2019d; Bačun et al., 2012). Waste management represents one of the key areas of the European Union's environmental policy, aimed at sustainable development and achieving climate neutrality by 2050 (European Commission, 2020).

The Waste Framework Directive (2008/98/EC) establishes a waste management hierarchy: prevention, preparation for reuse, recycling, energy recovery, and, as a last resort, disposal. The Croatian waste management system, regulated by the Waste Management Act (NN 84/21, 142/23) and the Environmental Protection Act (NN 80/13, 153/13, 78/15, 12/18, 118/18), implements these principles through the Waste Management Plan of the Republic of Croatia 2023–2028, aiming for 65% recycling and reducing landfill disposal to 10% by 2035 (NN 84/2023). Although implementation still faces challenges due to infrastructure limitations and high dependence on landfills, good practice examples demonstrate that recycled aggregates can successfully replace primary materials in construction, supporting the circular economy and sector sustainability (HAOP, 2023; Dalton et al., 2023; Gasparri et al., 2023; Swarnakar & Khalfan, 2024). Monitoring the achievement of waste management goals in Croatia is facilitated through the Waste Management Information System (ISGO), which includes applications such as e-ONTO and the Environmental Pollution Register (ROO). Construction waste constitutes a significant portion of urban waste, and EU directives emphasize a hierarchical approach: prevention, preparation for reuse, recycling, energy recovery, and disposal.

The new Circular Economy Action Plan (2025), part of the European Green Deal, further emphasizes extending the lifecycle of resources and reducing pressure on natural materials. According to the Waste Framework Directive (2008/98/EC), waste management is based on a priority hierarchy: prevention, preparation for reuse, recycling, energy recovery, and disposal (Figure 1). Good practice examples, such as Reciklaža Mišić, confirm that circular economy principles can be successfully applied in practice. However, they also underscore the necessity of standard harmonization, enhanced regulatory frameworks, and ongoing stakeholder education to secure long-term sustainability and efficiency in construction waste management.

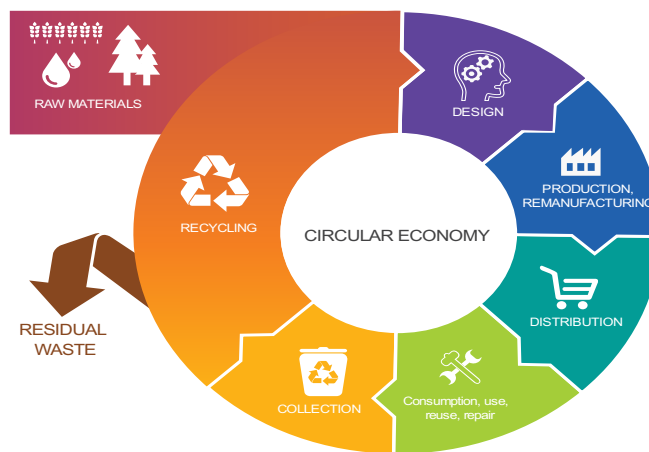


*Figure 1: Waste hierarchy and energy recovery processes
(Source: author's elaboration based on The Role of Energy Recovery from Waste in the Circular Economy, COM(2017) 34 final)*

2. CONSTRUCTION WASTE – CHARACTERISTICS AND CHALLENGES IN THE CONTEXT OF CORPORATE SOCIAL RESPONSIBILITY

In the context of the construction sector, waste management represents a key element of sustainable business and the circular economy, while simultaneously reflecting corporate social responsibility (CSR) (Ghufran et al., 2022). The European Commission defines CSR as a strategic concept in which companies voluntarily integrate social and environmental dimensions into their business activities and stakeholder relationships, with the aim of creating shared value and identifying, preventing, and mitigating potential negative impacts (European Commission, 2019d, 2020). Therefore, the long-term performance of a company depends on a positive social context, and in practice, CSR is manifested through responsible resource management and minimizing environmental impacts (Bačun et al., 2012). In Croatia, construction waste reaches approximately 1.6–2 million tons annually, of which around 95% consists of inert materials such as concrete, bricks, plaster, wood, and plastics (HAOP, 2023). Although approximately 80% of this waste is suitable for reuse or recycling, only about 7% is actually recycled or recovered. This situation highlights the need for more systematic and responsible construction waste management, which also represents an important strategic dimension of CSR. Through proper waste management, construction companies can make a significant contribution to environmental protection and the well-being of local communities. The construction waste management system in Croatia is regulated by the Ordinance on Construction Waste and Waste Containing Asbestos (NN 69/16), which defines construction waste as material generated during the construction, reconstruction, demolition, or maintenance of buildings, including excavated materials that cannot be used without prior recovery. The regulation prohibits disposal at the site of generation or in unauthorized locations, and the waste holder bears all management costs. Key elements of the system include separate collection, recovery, and disposal by authorized entities, while recycling yards enable the conversion of waste into secondary raw materials. According to the Waste Management Plan of the Republic of Croatia for 2023–2028, the target has been set to achieve 70% material recovery of non-hazardous construction waste by 2030, thereby reducing dependence on primary natural resources and promoting the development of a circular economy.

Construction waste is classified under the Waste Catalogue Ordinance (NN 90/2015) in group 17 00 00, with subgroups such as 17 01 (concrete, bricks, and ceramics) and 17 06 (asbestos-containing waste) (Štrimer et al., 2017; Srpak & Zeman, 2017; Srpak et al., 2022). Based on the source of generation, construction waste can be divided into four main categories: demolition waste, site-generated waste, waste from the construction of transport infrastructure, and excavated materials. Given its high potential for recycling and reuse, construction waste represents one of the priority waste streams within the circular economy system. Dalton et al. (2023) emphasize the importance of integrating the material life cycle into design, including design for deconstruction and modular construction, which significantly reduces the volume of generated waste. Gasparri et al. (2023) highlight the role of digital tools in tracking material flows and optimizing recycling processes, while Swarnakar and Khalfan (2024) point to the need for stricter regulatory frameworks and the development of public-private partnerships to build adequate recycling infrastructure. The example of Reciklaža Mišić demonstrates how responsible management of construction waste can simultaneously achieve CSR objectives and environmental protection goals, with a positive impact on the local community. Through systematic collection, sorting, and recycling, construction waste is transformed into a valuable resource that can be reused in construction, reducing the need for the exploitation of natural resources and further promoting the circular economy. This case illustrates how the combination of technical expertise, continuous employee training, and the application of innovative technologies enables companies to remain competitive while also being socially responsible, establishing a solid foundation for sustainable waste management in the construction sector.

3. GOOD PRACTICE EXAMPLES AND RECYCLED AGGREGATES

Construction waste represents a significant share of the total waste generated in the European Union, estimated at between 32% and 40% of total annual waste. This places it among the most important waste streams with high potential for recycling and reuse (HAOP, 2023). According to the Waste Framework Directive (2008/98/EC), EU member states were expected to achieve at least 70% recovery by weight of non-hazardous construction waste by 2020. Despite these targets, many member states did not meet them without including landfill disposal as a recovery method, significantly reducing the actual contribution to the circular economy. In the field of construction waste recovery and recycling, some member states report very high success rates. The Netherlands has achieved a recycling rate of 100%, while Italy and Slovenia have exceeded 97%, placing them among the leading countries in the European Union (HAOP, 2023; Jones, 2022; Purchase et al., 2021; Gasparri et al., 2023). In contrast, countries such as Ireland, Cyprus, Malta, Portugal, and Romania continue to record recycling rates below 50%, highlighting the need for further regulatory, infrastructural, and organizational improvements (Gasparri et al., 2023; Ferriz-Papi et al., 2024). In 2024, Croatia continues to experience growth in economic and business indicators in the construction sector, as well as in the amounts of generated, processed, and recycled waste. The recovery rate of construction waste increased by 4.3 percentage points compared to 2023, reaching 75.5% in 2024, thus still exceeding the target rate of 70% set for 2020, calculated according to the method of Commission Decision 2011/753/EU. In regions lacking adequate infrastructure for processing mineral construction waste (such as rubble, old asphalt, etc.), there is a higher proportion of waste that is not managed according to regulations, and such waste often goes unreported. A significant step toward addressing this issue has been the implementation of approximately 30 projects for the procurement of crushing equipment for construction waste recycling. These projects have increasingly produced recycled aggregates and other materials for road construction, embankments, and similar applications.

Since 2020, the implementation of these projects has had a substantial impact on achieving the set targets, and further progress is expected in the coming years, including increased recovery of mineral waste and a continued reduction in data gaps (HAOP, 2024). These data indicate a slow but visible shift toward higher levels of the waste management hierarchy, while leaving significant room for system improvement. Procedures for demonstrating compliance of recycled aggregates with relevant standards are equivalent to the procedures for assessing and verifying the consistency of properties of construction products not derived from waste. In other words, it is necessary to demonstrate that the recycled aggregates produced meet all the requirements prescribed by construction product standards. In practice, recycled aggregates confirm that construction waste can be effectively transformed into a valuable secondary resource. Good practice examples, such as Reciklaža Mišić, demonstrate that proper collection, sorting, and processing of construction waste enables the production of high-standard recycled aggregates suitable for road construction and general building applications. Recycled concrete, crushed asphalt, bricks, and mixed materials are reused for the creation of sub-bases, embankments, and other construction structures. Laboratory testing has shown that the aggregates examined meet all limit values for the release of hazardous substances, including heavy metals, polychlorinated biphenyls (PCBs), and mineral oils, thereby enabling their safe use in construction, roadworks, and embankments (Tables 1–4).

KEY CHARACTERISTICS	PROPERTIES according to EN 13242:2002+A1:2007
Particle size distribution, fines content, particle shape	aggregate fraction d/d, mm
	particle size distribution
	shape index
	fines content
Quality of fines	sand equivalent
Density and water absorption	particle density, mg/m ³
	water absorption %
Proportion of crushed particles	proportion of crushed and broken particles in coarse aggregate
Content	total sulfur content
	water-soluble sulfates
	organic matter content
Resistance to fragmentation and wear	resistance to fragmentation (los angeles)
	resistance to wear (micro-deval)
Durability	freeze-thaw resistance
	magnesium sulfate testing
Composition of coarse recycled aggregate	concrete, mortar (rc)
	concrete, unbound aggregate, natural stone, hydraulically bound aggregate, glass (rc+ru+rg)
	bituminous mixtures – asphalt (ra)
	bricks, tiles, calcium silicate boards, aerated concrete (rb)
	glass (rg)
	other (clay, soil, non-floating wood, plastics) (x)
	floating particles (fl)

*Table 1: Physical properties tested in recycled aggregates from Reciklaža Mišić
(Source: Author's elaboration)*

ACCORDING TO THE “WASTE LANDFILL ORDINANCE” (NN 4/23) AND THE “ORDINANCE ON END-OF-WASTE STATUS” (NN 55/23)	
Release of hazardous substances – eluate testing of samples	Unit of measurement
BTEX	mg/kg
Total PCBs (polychlorinated biphenyls)	mg/kg
Chlorides, Cl	mg/kg dry matter
Fluorides, F	mg/kg dry matter
Sulfates	mg/kg dry matter
Phenol index	mg/kg dry matter
Total hydrocarbons (mineral oils)	mg/kg
Sum of PAHs (polycyclic aromatic hydrocarbons)	mg/kg dry matter
Arsenic, As	mg/kg dry matter
Barium, Ba	mg/kg dry matter
Cadmium, Cd	mg/kg dry matter
Total chromium, Cr	mg/kg dry matter
Copper, Cu	mg/kg dry matter
Mercury, Hg	mg/kg dry matter
Molybdenum, Mo	mg/kg dry matter
Nickel, Ni	mg/kg dry matter
Lead, Pb	mg/kg dry matter
Antimony, Sb	mg/kg dry matter
Zinc, Zn	mg/kg dry matter
Selenium, Se	mg/kg dry matter

*Table 2: Chemical properties tested in recycled aggregates from Reciklaža Mišić
(Source: Author's elaboration)*

According to the Ordinance on End-of-Waste Status (NN 55/2023), Annex I, Section 3, limit values for eluate parameters of recycled aggregates are prescribed and must not be exceeded. The purpose of these limit values is to prevent the potentially harmful impact of recycled aggregates on the environment and human health, thereby enabling their safe use as construction and embankment materials. The limit values for eluate parameters are presented in Table 3.

PARAMETER	L/S = 10 L/kg
	mg/kg dry matter
Arsenic, As	0,5
Barium, Ba	20
Cadmium, Cd	0,04
Total Chromium, Cr	0,5
Copper, Cu	2
Mercury, Hg	0,01
Molybdenum, Mo	0,5
Nickel, Ni	0,4
Lead, Pb	0,5
Antimony, Sb	0,06
Selenium, Se	0,1
Zinc, Zn	4
Chlorides	800
Fluorides	10
Sulfates	1000
Phenol index	1

*Table 3. Limit values of eluate parameters/leaching test for recycled aggregates
(Source: Ordinance on End-of-Waste Status (NN 55/2023), Annex I, Section 3, D)*

Permitted uses of recycled aggregates and fill materials following the end-of-waste status. In addition to complying with the limit values for eluate/leaching test parameters, recycled aggregates must also meet the following additional eluate limit values, as presented in Table 4.

PARAMETER	VALUE, mg/kg
BTBTEX (benzene, toluene, ethylbenzene, and xylenes)	6
PCBs (polychlorinated biphenyls, 7 congeners)	1
Mineral oil (C10–C40)	500
PAHs (polycyclic aromatic hydrocarbons)	10

*Table 4: Additional eluate limit values for recycled aggregates
(Source: Ordinance on End-of-Waste Status (NN 55/2023), Annex I, Section 3, D)*

By applying such standardized testing and quality control procedures, companies can ensure that recycled aggregates maintain levels of quality and safety comparable to primary materials. At the same time, the need for the exploitation of natural resources is reduced, resulting in significant environmental and economic benefits and further promoting the development of a circular economy in the construction sector.

4. END-OF-WASTE PROCEDURE AND RECOMMENDATIONS FOR SUSTAINABLE DEVELOPMENT

As presented in the previous chapter, recycled aggregates produced from construction waste represent a valuable resource in the construction industry. Good practice examples, such as Reciklaža Mišić, demonstrate that proper management and processing of construction waste can reduce the need for natural resource exploitation, increase material use efficiency, and contribute to environmentally sustainable and socially responsible business practices. However, in order for recycled aggregates to be legally and safely used in construction, it is necessary to carry out the end-of-waste procedure, which ensures their technical and legal compliance (Štirmer, 2023). In accordance with the Waste Management Act, the status of waste may be removed for certain materials if they are entered into the End-of-Waste Register. An application for entry in the End-of-Waste Register is submitted to the Ministry of Environment and Green Transition, which issues a decision based on the fulfillment of the following conditions:

- The substance or object will be used for a specific purpose.
- There is a market and demand for that substance or object.
- The substance or object meets the technical requirements for its intended purpose and complies with applicable regulations and standards for products.
- The use of the substance or object will not result in overall harmful effects on the environment or human health.

The application for entry is created through the ReDGO-OGO online platform, which collects information about the applicant, the organizational unit performing the recovery, the types of waste, and technical testing. Along with the application, the applicant submits a Declaration of Properties of the Recycled Aggregate, results of physical and chemical testing, and CE marking.

The Ordinance on End-of-Waste Status specifies details of the special criteria for removing the waste status for a particular substance or object, the implementation of EU regulations establishing criteria for end-of-waste status, the producer's report on end-of-waste, and the content of the producer's declaration of conformity for the substance or object registered in the End-of-Waste Register. The special criteria include the implementation of a quality management system in the waste recovery process, which involves checks and documentation, in written or electronic form, for each individual shipment and batch of received waste. This includes:

- Visual inspection of the waste shipment and verification of the data provided in the accompanying document.
- Documentation of the inspection of incoming waste shipments and supporting documents, including the date, accompanying document number, and the name of the person performing the verification.
- Documentation of the recovery verification, which contains a link to the corresponding accompanying document and the relevant waste batch number, the date of batch formation, and the dates of measurement procedures and batch handling.

Batches that have undergone recovery are continuously monitored to ensure compliance with prescribed standards and testing/certification results. A document regulating the business relationship between the holder of the substance or object applying for entry in the End-of-Waste Register and the future user, demonstrating that a market and demand exist, is also an important special criterion. Additionally, possession of a waste management permit for the recovery activity using the appropriate procedure and waste type is required.

The final special criterion is a quality management system certificate, which must explicitly include the subject of the entry, in accordance with the international standard HRN EN ISO 9001 (Quality Management Systems). The Ordinance on End-of-Waste Status comprises the following annexes:

- Annex I – Special criteria for removing waste status
- Annex II – Declaration of conformity
- Annex III – End-of-waste report

Special criteria for the end-of-waste status of recycled aggregates also include the types of waste entering the recovery process for recycled aggregate production, as listed in Table 5.

Key Number	Waste type	Additional
01 01 02	Waste from excavation of non-metallic mineral raw materials	
01 04 08	Waste gravel and crushed stone not listed under 01 04 07*	
01 04 09	Waste sand and waste clay types	
01 04 13	Waste from cutting and sawing stone not listed under 01 04 07*	
10 11 03	Waste fibrous materials based on glass	
15 01 07	Glass packaging	

17 01 01	Concrete	
17 01 02	Bricks	
17 01 03	Tiles/ceramics	
17 01 07	Mixtures of concrete, bricks, tiles/ceramics not listed under 17 01 06*	
17 02 02	Glass	
17 03 02	Bituminous mixtures not listed under 17 03 01*	
17 05 04	Soil and stones not listed under 17 05 03* ^{pod} 17 05 03*	
17 05 06	Dredging waste not listed under 17 05 05*	
17 05 08	Crushed stone for railway embankments not listed under 17 05 07*	
17 09 04	Mixed construction and demolition waste not listed under 17 09 01*, 17 09 02*, 17 09 03*	Includes only mineral substances
19 12 05	Glass	
19 12 09	Minerals (e.g., sand, stones)	
20 01 02	Glass	
20 02 02	Soil and stones	

*Table 5: Types of waste entering the recovery process for recycled ag. production
(Source: Ordinance on End-of-Waste Status (NN 55/2023), Annex I, Section 3, A)*

Depending on the type of waste and the recovery method, the person performing the recovery must hold an appropriate waste management permit for recovery activities under R5 (Recycling/reclamation of other inorganic materials, including soil recovery and recycling of inorganic construction materials). Recovered waste may have its waste status removed and be used as recycled aggregate for the intended application if the following conditions are met:

- Evaluation and verification of the constancy of properties have been carried out according to harmonized technical specifications or Croatian technical standards (norms) and a Declaration of Properties has been issued in accordance with special regulations governing construction products. An analysis must also demonstrate that the use of recycled aggregate will not pose a higher risk in terms of hazardous properties than the risk associated with aggregates produced from natural mineral deposits.
- Compliance with project requirements or with technically recognized rules of practice is demonstrated through a test report conducted according to the relevant construction authority regulations.

- The eluate/sample or leaching test parameter values are less than or equal to the limit values shown in Tables 3 and 4.

Each registered waste type is assigned a corresponding End-of-Waste number (EoW No.), and testing of recycled aggregates is carried out for each batch. The sampling procedure for physical and chemical testing of recycled aggregates is performed by collecting samples in bags, separately by processed waste type and granulometry (Štirmer et al., 2017; Srpak et al., 2024). The procedure is illustrated in Figure 2. Recovered waste, from which a recycled aggregate has been produced and registered in the End-of-Waste Register, has its status removed either at the moment of sale to another person or at the moment of use by the same person who performed the recovery. The process of incorporating recycled aggregate into construction applications is shown in Figure 3.



*Figure 2: Sampling procedure for testing recycled aggregate
(Source: Author's elaboration of dana)*



*Figure 3: Incorporation of recycled aggregate – example of good practice
(Source: Author's elaboration of dana)*

The end-of-waste procedure concludes with the issuance of a Declaration of Conformity for each shipment of recycled aggregate, confirming compliance with all prescribed requirements and technical specifications. The producer also submits an End-of-Waste Report to the Ministry, including information on the quantity of waste, types of recycled aggregates, and recovery results, enabling systematic monitoring and transparency in construction waste management. This regulatory framework complements the good practice examples presented in the previous chapter, demonstrating how technical and administrative procedures together allow for the safe, sustainable, and socially responsible use of recycled aggregates.

It closes the loop of the circular economy and ensures the long-term sustainability of business operations in the construction sector. The implementation of these measures enables companies to achieve environmental and social benefits, reduce negative impacts on the environment, strengthen competitiveness and reputation, and integrate construction waste management as a key element of corporate social responsibility strategy. In this way, the circular economy cycle in construction is closed, contributing to sustainable development and the efficient use of resources.

5. CONCLUSION

Construction waste management represents a key element of the circular economy and socially responsible business practices in the construction sector. The volume of waste, particularly inert and non-hazardous waste (approximately 95%), serves as an indicator of society's ecological awareness and as an important target of European policies aimed at sustainability and transforming waste into a resource. The application of circular economy principles enables companies to align their operational and strategic activities with long-term sustainable models, reducing natural resource consumption and minimizing negative environmental impacts. Good practice examples, such as Reciklaža Mišić, demonstrate that proper collection, sorting, and processing of construction waste allows the production of high-quality recycled aggregates that meet technical, chemical, and legal standards. The end-of-waste procedure, as regulated by the Waste Management Act and associated ordinances, ensures the safe, lawful, and transparent use of recycled materials. The system includes monitoring market demand, regular physical and chemical testing, and certification through quality and environmental management systems, further integrating corporate social responsibility into business strategies. This approach allows companies not only to achieve environmental and social benefits but also to strengthen competitiveness and reputation, confirming that sustainability and economic feasibility can be aligned as strategic objectives. Efficient construction waste management closes the circular economy loop, promotes the reuse of materials, and reduces pressure on natural resources. In conclusion, integrating recycled materials into operational processes and long-term planning of construction companies demonstrates that circular economy and social responsibility are becoming integral components of sustainable sector development, ensuring long-term environmental, social, and economic sustainability.

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GLOCAL KNOWLEDGE: BRIDGING THE DIVIDE BETWEEN THE UNIVERSAL AND THE LOCAL IN THE MOROCCAN SYSTEM OF EDUCATION

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ABSTRACT

Within the context of School-based leadership in the education reform agenda in Morocco, and for decades of reforms before that, the globalization of education has long been driven by the pursuit of universal standards, curriculum harmonization, and the transnational circulation of knowledge. However, this approach fails to take into consideration another equally important element – local knowledge – that plays an essential role in determining the outcomes of education. In order to resolve this tension, this paper proposes the idea of glocal knowledge management practices as a means of creating a conceptual and theoretical bridge. Based on the findings of a qualitative analysis, the current research paper investigates the impact of institutional commitment to the implementation of global educational standards and its influence on the ability of localized knowledge management strategies to produce positive effects. As has been found out, there is a significant negative correlation between strict observance of universal academic standards and the integration of localized pedagogical knowledge. On the contrary, institutions implementing a flexible hybrid strategy, which involved decentralization of knowledge management, showed a 28% higher efficiency rate. This paper concludes by proposing a qualitative model for glocal knowledge management that balances the efficiencies of standardization with the adaptability required for contextual wisdom.

Keywords: Curricular Standardization; Glocalization; Higher Education Policy; Knowledge Management

1. INTRODUCTION

Globalization has largely influenced our ways of living, and our education systems as well. The push toward measurable outcomes, technological fluency, and international competition has moved fast enough that local knowledge keeps getting left behind. Indigenous practices, communal values, inherited ways of understanding the world — these tend to get treated as decoration, or quietly dropped from curricula designed around distant benchmarks. The result is students who learn content that has nothing to do with where they live. That is not just a cultural loss. It is a structural problem that undermines what education actually promises (Serrano de la Cruz Santos-Olmo et al., 2026). In classrooms, this shows up as disengagement. Students encounter material abstracted from anything in their actual experience — no connection to their neighborhoods, their communities, the problems they see around them. Local knowledge systems that carry real pedagogies of ecological understanding, mutual obligation, and moral reasoning remain almost entirely unused (Erkan et al., 2026; Karadag & Ciftci, 2026). Calling for “pluralism” does not fix this. The tension between global standards and local knowledge requires structural rethinking, not better rhetoric. The existing research is more useful as a map of the problem than as a guide out of it. Culturally responsive pedagogy makes a strong case that instruction aligned with students’s cultural backgrounds produces deeper learning — but most of this work stays at the classroom level and does not touch the institutional structures that would need to change for any of it to matter at scale (Rahmawati et

al., 2026). Indigenous knowledge integration recovers valuable situated knowledge, particularly around environmental and social learning, but rarely builds working bridges toward the competency frameworks that institutions are actually held to (Fernández-Huetos et al., 2026). Global education models promote critical thinking and collaboration while largely ignoring the local contexts that give those capacities real grounding (Samy, 2026). The strands exist; the connection between them does not. This study tries to build that connection through three mechanisms: text within local contexts or diversity with inclusion, which integrates situated cultural knowledge into disciplinary content rather than adding it as an afterthought; participatory pedagogy within classroom dynamics and institutional walls, which positions students knowledge owners, producers and as contributors whose community-based inquiry can genuinely shape what gets taught; and institutional scaffolding, which adjusts policy, assessment, and teacher development to hold complexity rather than reduce it. The core argument is that local wisdom is not a starting point to be refined by global standards — it brings its own logics of relationality and stewardship that can strengthen global competence rather than compete with it. The practical question driving this is: through what mechanisms can local culture and global knowledge be integrated into educational models that are both culturally grounded and globally relevant? The aim is something operational — not another argument for balance, but actual pathways for building learning systems that do not force educators to choose between where students come from and where they are going.

2. RESEARCH METODOLOGY

The current research investigates the Moroccan educational contexts by applying a qualitative field-based methodological strategy for formulating an educational model that considers diverse cultural backgrounds and integrates local knowledge with world knowledge. Data was gathered firsthand from the field by conducting interviews with my students, making observations, and reviewing documents in connection with teachers, community members, and policymakers involved in education-related activities. The study used a purposive sampling technique where the participants were purposely chosen for their relevance, competence, and engagement in culturally-responsive instruction and the incorporation of local and international knowledge systems. Data gathering focused on generating important themes such as culturally-responsive instruction, the use of local knowledge, and global educational strategies in the context of Moroccan schools. The collected data were analyzed through thematic and interpretive methods, which entailed data condensation, data coding, theme generation, and conceptualization. Triangulation, including interviews, observation, and document reviews, was employed to strengthen the trustworthiness and credibility of the study.

3. FINDINGS AND DISCUSSION

3.1. Rethinking the Relationship between the Local and the Global

Local culture and global knowledge do not combine—they collide, reconfigure, and generate something irreducible to either origin. The process is less a merger of systems than a continuous reconstruction of educational meaning, one that stays alert to contextual textures while refusing to abandon planetary relevance. (Hakiim, 2026) Local knowledge carries entire cosmologies: identity narratives, ethical codes, ecological attunements refined across generations. It is a living archive of adaptive behavior, not merely heritage. Global knowledge, by contrast, operates through abstraction—scientific models, technological protocols, and universal benchmarks. Neither is sufficient. The task is to engineer conditions where they chafe against each other productively, each exposing the limits of the other until something new crystallizes. A purely additive logic fails. When local and global are treated as parallel tracks, the result is epistemic segregation, not integration.

The mechanism that unlocks dialogue is the deliberate staging of tension—forcing the concrete, place-bound logic of indigenous practice into conversation with the decontextualized rigor of global frameworks. (Pakala & Guniganti, 2026) Take environmental education: traditional rotational farming or watershed management techniques, in Guercif, Zagora or Errachidia and elsewhere, encode deep relational knowledge. When entangled with climate science or systems ecology, they do not simply merge. They interrogate each other. Learners begin to see a drought not as an abstract meteorological event but as a rupture in a web of ancestral soil relationships, simultaneously graspable through modern technologies data. That cognitive friction is the point. It cultivates not just understanding but a capacity to act within layered realities, refusing the split between the local self and the global other. Context is not a backdrop; it is the engine. The same integrative move that works in a rice-growing community in Southeast Asia collapses in an urban desert setting. Variation in epistemological foundations, access asymmetries, and community readiness creates a landscape of uneven possibility. Digital literacy campaigns exemplify this: injecting standardized global modules into a context with patchy infrastructure and deep-seated skepticism toward technological mediation does more to reproduce marginalization than to dissolve it. Successful integration demands that global offerings be translated—not in the linguistic sense alone, but through the restructuring of their very premises to fit local knowledge ecologies. When scientific curricula are reshaped to treat local taxonomies as equal entry points rather than obstacles, engagement deepens. Knowledge sticks because it finds native hooks. Stasis is a fantasy. Integration decays the moment it is institutionalized as a fixed formula. Social, cultural, and technological currents keep shifting the ground. Institutions must adopt a metabolic relationship with change—continuously digesting new tensions and recalibrating the balance. (Karadag & Ciftci, 2026) A curriculum that once harmonized indigenous agroecological knowledge with modern sustainability science must later digest the shock of gene-edited seeds or blockchain-enabled supply chains. (Farouk, 2025) Pedagogies become hybrid not by design but by necessity: experiential cycles merge with digital simulation, community mentorship with online collaboration, oral testimony with data visualization. (Mika, 2025) The resulting learning environments are messy, contested, and alive. Power matters. Framing local communities as passive beneficiaries of global expertise reenacts colonial knowledge hierarchies. The communities hold analytical tools of their own—elders and practitioners who model systemic thinking, who recognize pattern languages in ecosystems that formal science only recently named. (Schäfer, 2026) When they co-design curricula or co-teach field modules, the boundary between formal and informal education blurs. Legitimacy shifts. Learners witness knowledge being made, not just consumed. That experience rewires their sense of who can theorize and whose questions count. The gap between schooling and living culture narrows, not through inclusion-as-tokenism but through participatory reconfiguration of authority. What holds these fragile alignments together? Shared values operate as dynamic stabilizers. Inclusivity, sustainability, social responsibility—they are not moral ornaments but functional bridges. They translate between the situated and the universal, preventing cultural schizophrenia. (Serrano de la Cruz Santos-Olmo et al., 2026) Sustainability, for instance, enables a simultaneous commitment to ancestral land stewardship and to global carbon-reduction targets. It reframes local fire-management practices as contributions to planetary resilience, not as charming folkways. Inclusivity, likewise, refuses the excision of marginalized voices from the design table, ensuring that the very architecture of integration does not perpetuate exclusion. (Nurhalia et al., 2026) These values are not endpoints; they are the joints that allow the system to move without snapping. The outcome is not a tidy model but a tendency: education that is culturally muscular and cognitively rigorous, that holds the dissonance between local embeddedness and global mobility instead of resolving it prematurely.

The traditional knowledge hierarchy, which always positioned the local as raw material awaiting refinement by the universal, unravels. (Ramdiah et al., 2026) In its place emerges a more volatile, more honest ecology—where different ways of knowing grate against each other, cross-fertilize, and, in their best moments, produce understanding that neither could have authored alone.

3.2. The Text and the Context or Diversity with Inclusion

Text within local contexts or diversity with inclusion operates as the binding mechanism that fuses local wisdom with global knowledge—without it, the two realms merely coexist, inert and parallel. The shift from supplementary cultural snippets to a curriculum where local knowledge forms the backbone of objectives, materials, and assessment is not cosmetic; it rewires how legitimacy flows through educational design. (Novia & Aznam, 2026) When local content is peripheral, relevance is performative. Embedded at the core, it starts to govern the logic of learning. What does this look like in practice? Traditional narratives and community practices become the raw material for abstraction. Mathematical reasoning, for instance, emerges from indigenous measurement systems, not as a quaint example but as the very vehicle for conceptual development. Environmental science, reconfigured through indigenous ecological frameworks, ceases to be about distant ecosystems and becomes a study of lived landscapes. These are not mere connections; they are epistemological realignments. Such contextual bridges must also be tensile enough to pull local rootedness into the orbit of global competency—critical thinking, creativity, collaboration. (Rosyidah et al., 2025) The mechanism here is one of calibration: the curriculum becomes a site where students continually switch codes between cultural depth and competitive, borderless skill sets. This oscillation produces a distinct cognitive agility. Integration of local knowledge defies disciplinary silos. It leaks across boundaries because cultural knowledge is itself a web of interdependent practices, stories, and ecological relationships. (Rocmah et al., 2026) Interdisciplinary frameworks, then, are not a pedagogical luxury but a structural necessity. They allow learning to mimic the tangled feedback loops of real-world problems, where applying knowledge contextually while meeting global benchmarks becomes a dynamic negotiation, not a checklist. Flexibility makes this negotiation possible. A rigid structure suffocates the constant tweaking demanded by local particularities and shifting global currents. (Sarwi et al., 2026) When curricula can bend—absorbing new innovations, answering community calls, letting educators prototype unconventional methods—they become living systems rather than static documents. That living quality feeds directly into student motivation. Seeing one's cultural identity mirrored not as a token but as the driving engine of learning generates ownership that passive reception never can. (Dewi et al., 2026) Ownership deepens engagement. It cements understanding of both local and global issues, not as separate domains but as a continuous field of inquiry.

3.3. Classroom Dynamic and Who Holds the Authority of Knowledge

Active involvement reconfigures the relationship between local knowledge and global skill demands. Rahayu et al. define participatory pedagogy as an educational approach that draws students, communities, and other stakeholders into the core of teaching and learning (Rahayu et al., 2026). Instead of receiving fixed content, learners assemble meaning from their own cultural realities—a dynamic accelerated by collaborative, project-based, and experiential designs. These designs plunge students into real-world problems where communication, teamwork, and problem-solving emerge not as abstract competencies but as necessities for task completion. The classroom becomes a laboratory for cultural translation. Communities, long treated as passive backdrops, supply intellectual substance. Kusumayanthi et al. underscore their role in embedding local expertise into teaching, fieldwork, and curriculum development (Kusumayanthi et al., 2025).

The boundary between school and lived environment thins; knowledge flows bidirectionally, enhancing relevance and building mutual respect. What takes shape is a transaction where formal education validates community wisdom while communities ground academic abstractions. This constant negotiation with diverse perspectives does more than enrich content. It forces a cognitive intimacy with difference that Lundy & Petherick associate with intercultural competence—the capacity to read and adapt to complex social terrains (Lundy & Petherick, 2025). In economies that prize cross-cultural agility, such exposure is not ornamental but operational. The machinery of participation, however, is demanding. Teachers must unlearn the habits of control and master facilitation, a transformation that Gill-Simmen et al. tie to sustained professional learning and institutional support (Gill-Simmen et al., 2026). Resources, both material and ideological, must align. Without a deliberate shift away from teacher-centered architectures, participatory pedagogy collapses into rhetoric. The challenge is less about adopting techniques than about redistributing educational authority.

3.4. Institutional Support

Without institutional scaffolds that actively reconfigure themselves, the combination of local culture and global knowledge remains a rhetorical flourish. Policies may list global competencies, learning objectives may nod to cultural heritage, yet the classroom reality defaults to a disjointed coexistence rather than a generative fusion. Institutions must not merely permit but enact—through budgeting, curricular architecture, and governance rhythms—the entanglement of these knowledge systems, creating environments where educators and learners engage synergistically (Shevchenko, 2025). When they fail to do so, the result is not neutrality but erosion: local epistemologies are quietly overwritten, and global frameworks float unmoored from context. Consider what it means for an institution to flex. Flexibility is not a property but a continuous renegotiation of curricular sequencing, teacher allocation, and material procurement in response to migratory shifts in labor markets, demographic profiles, or digital platforms (Hussain & Maloney, 2025). When a sudden influx of displaced learners enters a district, the institutional mechanism that reconfigures language support, adjusts historical narratives, and reallocates counseling resources without a three-year committee review—that is adaptive flexibility. Its absence manifests as calcified programs that keep teaching a world that no longer exists. Inclusivity operates less as a checklist of representation and more as a redistribution of epistemic authority. The mechanisms here include revising procurement protocols so that textbook selection committees are not dominated by a single cultural lens, building co-teaching arrangements where community knowledge keepers hold equal billing with certified staff, and designing assessment rubrics that reward a student’s ability to analyze a problem through their grandmother’s proverbs alongside a scientific model—ensuring that local knowledge systems are recognized and valued alongside global standards. Without such procedural redesigns, inclusivity becomes decorative—photos in a brochure, a land acknowledgement recited by rote. Responsiveness is anticipatory, not reactive. It requires data pipelines that capture early signals: which skills are depreciating in local industry, which student dialects are shifting, which global crises are redefining ethical discourse. The institutional mechanism is a standing cross-functional team that translates these signals into micro-adjustments in unit plans and teacher professional learning within weeks, not academic years. Where such a loop is absent, institutions lag, then lurch, then impose reforms that fracture the very trust they need. The resource question is not merely about money but about allocation logic. Funding streams that are earmarked for “innovation” but cannot be spent on compensating elders for curriculum design, or that require proprietary digital platforms incompatible with local languages, sabotage integration from within (Pollino et al., 2025).

Effective mechanisms invert the logic: they start with the desired cultural texture of a lesson, then cost out the translation, the multimedia production, the iterative validation with community councils, and finally secure funds along those lines. Educator development operates similarly—not as a workshop calendar of generic pedagogies, but as sustained, site-based inquiry groups where teachers deconstruct their own cultural assumptions while co-designing units that braid local taxonomy with global scientific nomenclature. Community engagement moves from consultative to constitutive when advisory boards hold veto power over curricular distortions and when budget lines are jointly governed, strengthening the authenticity and relevance of educational content. The vertical coupling between institutional micro-practices and national policy creates its own turbulence. A ministry may mandate “preservation of indigenous knowledge” while its inspection framework rewards only standardized test score gains in mathematics and science. National and regional systems must explicitly acknowledge the importance of cultural diversity, local knowledge, and heritage preservation while promoting global competencies (Mtombeni et al., 2025). The mechanism that resolves this contradiction is an intermediary translation layer: district-level frameworks that map local cultural outcomes onto national competency codes, allowing a lesson on traditional navigation to satisfy spatial reasoning standards. Without this, teachers are caught in a double bind, and institutional leaders expend political capital defending initiatives that look, to external auditors, like deviations from the core mission, encountering bureaucratic resistance, funding gaps, or inconsistencies in assessment standards (Mayberry & Nguyen, 2025). Policy alignment, therefore, is not a state to be achieved but a constant act of translation and advocacy. Assessment systems are perhaps the most stubborn gatekeeper. The standardized test item—decontextualized, monolingual, timed—functions as a filter that screens out precisely the integrative thinking the curriculum aims to cultivate. Building a countervailing mechanism means creating evidentiary panels where a student’s community-based project, oral history, or intercultural mediation are examined through consensus moderation involving teachers, external experts, and community evaluators, validating the experiences and contributions of local communities (Knight Johnson & Burwell, 2025). This generates a parallel credibility stream that gradually pressures the high-stakes system to broaden its indicators. The analytical point is that assessment does not merely measure integration; it defines it. Change the evidence portfolio, and you change what counts as knowing. Institutional culture is too often invoked as a soft attribute—values on a poster. The analytical lens demands we see it as a set of incentive structures and conversational routines. Promotion criteria that reward faculty for publishing in international journals but ignore the co-authorship of a local language primer actively suppress integration, regardless of what the mission statement professes. Institutions that cultivate collaboration, experimentation, and respect for local knowledge are more likely to succeed (Blanchard, 2025). The counter-mechanism is a revision of the institutional reward architecture: teaching portfolios that require evidence of community-embedded curriculum design, leadership pipelines that draw from those who have demonstrated cultural brokering, meeting protocols that ensure student and elder voices are not merely heard but shape the agenda. In the absence of such a supportive culture, even well-intentioned policies and resource allocations may fail to produce meaningful outcomes (Abu Hussein & Khammash, 2025). Sustainability is sabotaged not by a lack of passion but by hero dependence. When an integration initiative lives inside a single charismatic coordinator or a three-year grant cycle, its death is preprogrammed. Institutionalization demands the diffusion of expertise across multiple roles—curriculum officers, department heads, school board members—and the codification of processes into policy language that survives personnel turnover, alongside building internal capacities for ongoing curriculum development and continuous professional learning with community feedback loops (Ulla et al., 2025).

Scalability, in turn, relies on creating modular design templates that can be localized without reinvention: a framework for community-curriculum negotiation, a protocol for mapping local competencies to global benchmarks, a budgeting algorithm that weights cultural authenticity. These strategies must be embedded into the structural and operational fabric of the organization, not left dependent on individual champions or temporary funding (Drake, 2025). The networked dimension is the final amplifier. Isolated institutions, however internally sophisticated, exhaust their innovation capacity without external stimulus and comparative feedback. Cross-institutional partnerships provide access to best practices, innovative pedagogical approaches, and comparative data on effective integration of local and global knowledge (Korzhev et al., 2025). These networks function as learning accelerators when they establish shared repositories of culturally responsive units, rotate educators across sites for immersive residencies, and aggregate data on what integration designs yield durable intercultural understanding. Collaborative networks also create opportunities for joint curriculum development, educator exchange programs, and shared evaluation methodologies becoming a counter-force to the gravitational pull of standardization. Institutional frameworks are not containers but conduits: their effectiveness is a function of how rapidly and accurately they can channel signals from the community, pressures from the policy environment, and innovations from peer institutions into the daily choreography of the classroom.

4. CONCLUSION

The fusion of local epistemes with global knowledge isn't a gentle compromise—it's a generative tension. It forces education to stop choosing between rootedness and reach. What emerges is a model that breathes. Three intersecting dynamics make this possible, each a mechanism rather than a fixed pillar. A real 'glocal' textbook reweaves mental fabrics. Here, indigenous ways of knowing do not sit as token add-ons; they restructure how globally circulated competencies are encountered, owned, and questioned. Learning ceases to be a passive intake of placeless skills and becomes an act of cultural negotiation. Depth replaces coverage. Then there's classroom dynamic. Not the usual teacher-centered delivery, but a participatory engine. Knowledge stops being transmitted and starts being forged—through collaborative inquiry, experiential cycles, and community entanglements. The classroom dissolves into the village, the lab, the protest, the kitchen. Students' lived cultural repertoires become raw materials for building bridges to transnational literacies. They move between worlds not as tourists but as translators. Institutional frameworks typically stifle; here, they learn to flex. Structures that adapt are not weak. They reconfigure rules, resource flows, assessment logics, and power relations so inclusivity and sustainability aren't aspirations but operational defaults. These frameworks absorb shock, iterate, and redistribute agency. This triadic interplay operates holistically. It does not just patch holes in global standardization—it challenges the assumption that standardization is the goal. It reasserts that learners who stand firmly in their cultural memory can pivot more powerfully into planetary conversations. Social responsibility sharpens when identity isn't surrendered. Yet the model as conceptual architecture demands harder proof. Its logic is compelling; its empirical grounding across varied terrains remains thin. Without mixed-method grind and longitudinal quantitative scrutiny, claims about improved learning outcomes, engagement, and institutional performance risk echoing as beautiful abstractions. Comparative designs—spanning sharply different ecologies from Tangiers to the Moroccan Sahara—would stress-test adaptability and expose hidden fractures. The digital dimension adds another layer of complexity. Technology does not just transmit—it mediates, translates, distorts, and amplifies. How digital infrastructures accelerate or sabotage the weaving of local and global knowledge in all Moroccan regions remains an open question. Research that treats technology as a dynamic participant in meaning-making, not a neutral pipeline, will unravel new possibilities and perils.

In the end, culturally responsive education for a hyper connected world is not a tidy synthesis. It is a continual recalibration of tensions, a deliberate disequilibrium. The path forward demands fewer declarations and more disciplined, disruptive inquiry.

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INTEGRATING ARTIFICIAL INTELLIGENCE INTO RECRUITMENT IN MOROCCO: AN EXPLORATORY STUDY OF OPPORTUNITIES, BARRIERS, AND ETHICAL CHALLENGES

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ABSTRACT

Recruitment represents a strategic lever in human resource management, enabling organizations to address competency gaps and workforce needs. In a context shaped by accelerating digitalization, artificial intelligence (AI) is progressively transforming recruitment practices by automating key process stages — such as application screening and candidate profile analysis — yielding anticipated gains in operational efficiency and decision-making quality. In Morocco, the integration of AI into recruitment processes remains emergent yet steadily expanding. This paper presents an exploratory qualitative study grounded in an interpretive epistemological stance, aimed at analyzing the deployment of AI tools across various industry sectors. The study draws on semi-structured interviews conducted with HR managers and AI specialists within 14 private Moroccan companies. The findings indicate that AI contributes to the optimization of recruitment processes, particularly by reducing application processing times and enhancing candidate selection quality. However, its adoption encounters several significant challenges, including resistance to organizational change, limited awareness among senior decision-makers, and the high cost of technological solutions. Furthermore, critical ethical concerns emerge, notably regarding the protection of candidates' personal data and the risk of algorithmic discrimination in selection processes. Finally, the study underscores the importance of continuous professional development for HR practitioners in order to ensure the effective and responsible use of AI within recruitment contexts.

Keywords: *Artificial Intelligence; Recruitment; Ethics; Morocco; Human Resource Management*

1. INTRODUCTION

Over recent decades, digital transformation has profoundly reshaped organizational functioning, significantly impacting human resource management (HRM) practices. Among these developments, the emergence of artificial intelligence (AI) constitutes a pivotal turning point, particularly in the domains of recruitment and selection. AI-based tools now enable the automation of certain recruitment process stages — such as application sorting and candidate profile analysis — while simultaneously redefining the modes of interaction between recruiters and applicants (Tambe, Cappelli & Yakubovich, 2019; Upadhyay & Khandelwal, 2018). Within this context, recruitment as a strategic function is undergoing progressive transformation.

The integration of AI is not merely a technical enhancement of processes, but is embedded within a broader transformation of HRM practices and the representations of its key actors. Recruiters are thus increasingly required to work alongside intelligent systems capable of processing large volumes of data and generating decision-support recommendations (Davenport, Guha, Grewal & Bressgott, 2020). However, beyond the opportunities it offers, the use of AI in recruitment raises significant questions, particularly from an ethical standpoint. Issues pertaining to algorithmic bias, decision transparency, personal data protection, and the role of human judgment in the recruitment process have emerged as central concerns (Barocas & Selbst, 2016; Bogen & Rieke, 2018). These concerns are all the more significant given that recruitment decisions directly affect individuals' professional trajectories. In the Moroccan context, the integration of artificial intelligence into recruitment practices remains in its early stages. While certain large enterprises and multinational organizations have begun experimenting with these technologies, their diffusion remains uneven and is largely undocumented in academic literature. This emergent and evolving character necessitates a comprehensive analytical approach capable of exploring the practices, perceptions, and appropriation logics of the actors involved (Miles & Huberman, 2003). Against this backdrop, the central research question guiding this study is as follows:

How do human resource professionals in Morocco appropriate artificial intelligence within recruitment processes, and what ethical challenges emerge from these practices?

To address this question, the present research adopts an interpretive epistemological stance and employs an exploratory qualitative methodology. The objective is not to measure the impact of AI, but rather to understand its situated uses and the meanings that practitioners ascribe to them (Denzin & Lincoln, 2018). The study is accordingly grounded in semi-structured interviews conducted with HR professionals and AI specialists within Moroccan enterprises. The contributions of this research are twofold. Theoretically, it enriches the existing literature on AI integration in HRM by providing a contextualized analysis of the Moroccan case, which has received limited scholarly attention to date. Empirically, it offers deeper insight into the dynamics of technology adoption in a transforming environment, as well as the ethical implications that follow. The remainder of this paper is organized as follows: Section 2 presents the theoretical framework; Section 3 outlines the research methodology; Section 4 presents and interprets the empirical findings; Section 5 provides a discussion; and Section 6 concludes the paper.

2. LITERATURE REVIEW

2.1. Digital Transformation and the Evolution of Human Resource Management

Digital transformation has profoundly reshaped organizational practices, particularly within the field of human resource management. The integration of digital technologies — and more recently artificial intelligence — has contributed to the emergence of a so-called 'augmented' or 'data-driven' HR function (Davenport et al., 2020). This evolution rests on organizations' capacity to leverage data in order to enhance their decision-making processes. In this regard, several studies highlight that digital technologies enable HRM practices to be reconceptualized in terms of efficiency, anticipation, and personalization (Minbaeva, 2021). However, this transformation extends beyond a purely technical dimension: it also entails an evolution in the competencies, roles, and professional representations of HR practitioners.

2.2. Artificial Intelligence and Organizational Adoption

Artificial intelligence is a direct continuation of this digital transformation. It encompasses a set of technologies capable of simulating certain human cognitive functions, such as learning, reasoning, and decision-making (Russell & Norvig, 2021). The organizational adoption of AI can be analyzed through several theoretical frameworks, notably the Technology Acceptance Model (TAM), which highlights the role of perceived utility and ease of use in technology acceptance. Applied to the HRM context, this framework helps explain why some organizations adopt these tools more rapidly than others. Furthermore, Socio-Technical Systems Theory emphasizes that the integration of AI cannot be understood in isolation from the interactions between the technical and social dimensions of an organization. Accordingly, the effectiveness of these technologies depends not only on their technical performance, but also on their acceptance by human actors.

2.3. Artificial Intelligence in Recruitment

Recruitment is among the fields most significantly impacted by the introduction of AI. Intelligent systems are now deployed to automate various stages of the recruitment process, including application screening, pre-selection, and candidate profile evaluation (Upadhyay & Khandelwal, 2018). These technologies rely on the analysis of large volumes of data and enable the optimization of selection processes. They also offer the possibility of reducing human cognitive biases in decision-making by standardizing evaluation criteria. However, several scholars note that this automation fundamentally transforms the recruiter's role: rather than serving as a direct decision-maker, the recruiter increasingly becomes a supervisor and interpreter of algorithmic systems (Liem et al., 2018). This evolution implies a reconfiguration of competencies and responsibilities within HR departments.

2.4. Ethical Challenges of Artificial Intelligence

The integration of AI into recruitment raises major ethical challenges that have been widely discussed in academic literature. A first concern pertains to algorithmic bias. According to Barocas and Selbst (2016), algorithms may reproduce and amplify existing discriminatory patterns embedded in training data, thereby giving rise to issues of equity and organizational justice. A second concern relates to system transparency. Decisions generated by algorithms are often difficult to explain, limiting user comprehension and raising questions of accountability (Bogen & Rieke, 2018). The protection of personal data constitutes another major preoccupation, particularly in a context where AI systems process sensitive candidate information. These concerns are governed by international principles, notably those articulated by the OECD (2019). Finally, certain scholars highlight the risk of dehumanization in recruitment processes resulting from the excessive automation of interactions between candidates and organizations (Black & van Esch, 2020).

2.5. Specificities of the Moroccan Context

The Moroccan context presents particular characteristics that shape the integration of artificial intelligence into recruitment practices. On one hand, Morocco is engaged in a trajectory of progressive digital transformation, supported by national initiatives aimed at promoting technological innovation. Nevertheless, the level of AI adoption remains uneven across sectors and varies significantly according to enterprise size. On the other hand, the regulatory and institutional framework governing artificial intelligence and algorithmic ethics is still under development. This situation simultaneously creates opportunities for experimentation and poses challenges for technology governance. By comparison with more advanced international contexts — notably Europe and North America — Morocco is currently in a phase of progressive learning and appropriation of these technologies.

2.6. Research Positioning

The existing literature underscores the growing importance of artificial intelligence in recruitment, along with the ethical challenges it entails. However, few studies have examined this phenomenon in the Moroccan context, and even fewer from a qualitative and interpretive perspective. This research seeks to fill this gap by providing an in-depth understanding of AI integration practices in recruitment in Morocco, as well as the perceptions of the actors involved. By adopting an exploratory qualitative approach, this study is positioned to capture the logics of action, professional representations, and ethical stakes associated with AI use in a context undergoing profound transformation.

3. RESEARCH METHODOLOGY

This research is grounded in an exploratory qualitative methodology, informed by an interpretive epistemological stance. This methodological choice is justified by the objective of developing an in-depth understanding of AI use in recruitment practices in Morocco, as well as the meanings that practitioners attribute to such use. In contrast to quantitative approaches aimed at measuring statistical relationships, this study privileges the understanding of perceptions, experiences, and logics of action among HR professionals and AI specialists. This orientation is consistent with the work of Denzin and Lincoln (2018), who underscore the relevance of qualitative approaches for analyzing complex social phenomena. The research design is exploratory in nature, given the still-emergent character of AI integration in recruitment in Morocco. This approach enables the opening of new avenues of inquiry and the emergence of original analytical elements, drawing on the discourses of field practitioners. The methodological orientation is also inductive, insofar as analytical categories are not predefined but are progressively constructed from the collected data. Data were collected from 14 private Moroccan companies operating across various industry sectors. Participants were selected through purposive sampling, targeting profiles directly involved in recruitment processes or in the use of AI technologies. This selection criterion was intended to guarantee the relevance and richness of the information gathered. Respondents include primarily HR managers as well as AI specialists, thus enabling a cross-sectional perspective on the phenomenon under study. Semi-structured interviews were conducted to collect the empirical data. This interview format combines a degree of structure — provided by a pre-established interview guide — with sufficient latitude for participants to elaborate their responses freely. The interview guide was organized around several thematic axes, covering the uses of AI in recruitment, perceived benefits, encountered limitations, and associated ethical concerns.

*Table 1: Key Methodological Characteristics of the Study
(Table ends on the next Page)*

Element	Description
Methodological Approach	Qualitative and exploratory
Epistemological Stance	Interpretive
Research Type	Inductive
Data Collection Method	Semi-structured interviews
Sample	14 private Moroccan companies
Respondent Profiles	HR managers and AI specialists
Sampling Technique	Purposive (non-probabilistic)
Interview Duration	30 to 60 minutes

Collection Mode	In-person and remote
Data Processing	Thematic content analysis

Source: Authors' own elaboration

Data analysis was conducted using a thematic content analysis approach, enabling the identification, structuring, and interpretation of the principal emergent themes across the interviews. This method involved a close reading of interview transcriptions, the identification of meaning units, and their grouping into homogeneous categories. These categories were subsequently interpreted in light of the theoretical framework mobilized in this study. The analytical process gave rise to several thematic axes pertaining to AI use, the opportunities it affords, the constraints affecting its adoption, and the ethical challenges it entails. To reinforce the scientific rigor of this research, several methodological precautions were adopted. Data validity was ensured through the diversity of respondent profiles and the richness of the interviews conducted, enabling a degree of informational saturation. Analytical reliability was enhanced through faithful transcription of interviews and rigorous systematic data analysis. Finally, ethical considerations were upheld throughout the research process, notably by ensuring informed participant consent, anonymization of responses, and confidentiality of collected information.

4. RESULTS AND INTERPRETATION

Analysis of the interviews conducted with HR practitioners and AI specialists reveals a progressive yet significant integration of artificial intelligence into recruitment practices within Moroccan enterprises. The collected discourses indicate that this adoption is primarily driven by a logic of process optimization — particularly for tasks deemed repetitive and time-consuming. The findings demonstrate that AI tools are principally mobilized during the early stages of the recruitment process, notably for candidate sourcing, automated application screening, and profile pre-selection. Several respondents mention the use of specialized tools such as intelligent sourcing platforms, applicant tracking systems, and solutions incorporating semantic CV analysis capabilities. These technologies enable faster identification of relevant profiles and improve the alignment between job requirements and candidate competencies. As one HR manager stated:

"Artificial intelligence now allows us to quickly filter a large volume of applications and focus our attention on the most relevant profiles."

Table 2: Thematic Content Analysis and Interpretation

Thematic Category	Analysis of Responses
Use of AI in Recruitment	AI is widely adopted in recruitment, with specific tools enabling process automation and personalization.
Impact on Recruitment	The use of AI leads to a reduction in screening time and an improvement in the quality of applications received — time savings and increased efficiency.
Adoption Challenges	Key challenges include team buy-in, limited awareness among senior management, and high implementation costs.
Ethical Issues	Data confidentiality is a major concern, with secure practices being implemented to protect candidate information.
Training for HR Managers	Regular training is essential to support teams in adopting and effectively using AI in recruitment.

Source: Authors' own elaboration

Beyond these operational uses, the findings highlight a positive impact of AI on the overall performance of the recruitment process. Participants particularly underscore considerable time savings in application processing, improved quality of selected profiles, and enhanced structuring of recruitment workflows. This optimization contributes to strengthening the efficiency of HR teams by enabling them to focus on higher value-added tasks — such as qualitative candidate evaluation and interview facilitation.

Table 3: Most Useful AI Tools in Recruitment Processes

Area	AI Tools Used	Reported Outcomes
AI Recruitment	ChatGPT, DeepSeek, LinkedIn Talent Insights, Taylr.ai	Job posting drafting, automated CV screening, improved application quality.
	SmartRecruiter, Workable	Time savings in initial screening and improved objectivity.
	InMail Assist (Generative AI), Supernormal	Semantic CV analysis for targeted pre-selection.

Source: Authors' own elaboration

However, data analysis also reveals that the adoption of these technologies is not without difficulties. Several respondents highlight barriers related to the high cost of AI solutions, which constitutes a significant obstacle — particularly for small and medium-sized enterprises. Additionally, a degree of resistance to change is observed within teams, often attributable to unfamiliarity with the tools or concerns about their impact on professional practices. The lack of internal technical competencies and the necessity of user training also emerge as critical factors for successful AI integration within HR processes. On the ethical dimension, the findings reveal a growing awareness of the challenges associated with AI use in recruitment. Respondents express concerns regarding the protection of candidates' personal data, the transparency of automated decision-making, and the risks of algorithmic bias. Certain respondents note that, despite the apparent objectivity of AI tools, these systems may reproduce biases embedded in their training data. As one AI specialist observed:

"The tool may be high-performing, but if it is fed biased data, it can reproduce the same discriminatory patterns as a human decision-maker."

In response to these concerns, several enterprises are implementing practices designed to govern the use of AI — including internal data protection policies and human validation mechanisms for automated decisions. These practices reflect a will to reconcile technological performance with ethical responsibility. Finally, the findings underscore the importance of training and supporting HR practitioners throughout the AI integration process. Respondents emphasize the need to develop hybrid competencies that combine HR expertise with an understanding of technological tools. This upskilling is identified as a key factor in ensuring the effective and responsible deployment of artificial intelligence in recruitment. Overall, the results demonstrate that artificial intelligence constitutes a lever of innovation for recruitment practices in Morocco, while simultaneously revealing organizational, technical, and ethical challenges that warrant careful attention. The integration of these technologies thus unfolds within a progressive dynamic, characterized by the adaptation of practices and an evolution of roles within human resource functions.

5. DISCUSSION

The findings of this research demonstrate that artificial intelligence is progressively establishing itself as a lever for transforming recruitment practices in Moroccan enterprises. This evolution is consistent with the broader body of work underscoring the growing role of digital technologies in the modernization of the HR function. The automation of tasks such as application screening and candidate pre-selection confirms that AI contributes to improving the efficiency of recruitment processes — reducing processing times and facilitating decision-making. These findings are consonant with the work of Davenport et al. (2020), who highlight the emergence of an 'augmented' HR function grounded in data exploitation. Likewise, the results corroborate the analyses of Upadhyay and Khandelwal (2018), who posit that AI enables the optimization of recruitment processes by enhancing the speed and quality of decision-making. Nevertheless, beyond these contributions, the study illuminates a deeper transformation in the role of HR professionals. The integration of AI does not merely constitute a technical automation: it induces a redefinition of competencies and responsibilities. Recruiters are no longer solely decision-makers; they are increasingly becoming supervisors and interpreters of algorithmic systems. This evolution corroborates the tenets of Socio-Technical Systems Theory, which highlights the interdependence between technological and human dimensions within organizations. Furthermore, the analysis reveals that AI adoption remains contingent upon several organizational and human factors. The barriers identified — high solution costs, resistance to change, and competency gaps — illustrate the limitations of a purely technology-driven adoption approach. These elements can be interpreted through the lens of the Technology Acceptance Model, according to which technology acceptance depends on perceived utility and ease of use. In the Moroccan context, these factors appear decisive in explaining the still-progressive diffusion of AI in recruitment practices. Additionally, this research highlights that ethical considerations occupy a central place in the concerns of the actors interviewed. Questions relating to personal data protection, algorithmic transparency, and the risks of bias emerge as structuring elements in the assessment of these technologies. These findings confirm the work of Barocas and Selbst (2016), who demonstrate that algorithmic systems may reproduce existing discriminatory patterns. Similarly, the analyses of Bogen and Rieke (2018) underscore the challenges associated with the transparency and comprehension of automated decisions. In the Moroccan context, these issues take on particular significance in light of the still-emerging regulatory framework and the variable level of digital maturity among enterprises. The adoption of AI thus unfolds within a dynamic of progressive learning and experimentation, characterized by gradual tool and practice appropriation. This contextual specificity constitutes a significant contribution of this research, shedding light on the particularities of an environment in the midst of digital transition. The study thus demonstrates that AI in recruitment represents simultaneously an opportunity for innovation and a set of challenges to be addressed. It contributes to improving process efficiency while raising fundamental questions related to ethics, data governance, and the role of human judgment in decision-making. On the theoretical level, this research enriches the existing literature by proposing a contextualized analysis of AI integration in HRM practices in Morocco, from a qualitative and interpretive perspective. On the empirical level, it provides deeper insight into the logics of action of practitioners and the conditions for technology adoption in an emerging context.

6. CONCLUSION

This research sought to understand how artificial intelligence is deployed in recruitment practices in Morocco, and to identify the ethical challenges associated with its use. Drawing on an exploratory qualitative methodology based on semi-structured interviews, the study has provided a contextualized perspective on a phenomenon that remains emergent in the Moroccan

landscape. The findings demonstrate that artificial intelligence constitutes an important lever for the optimization of recruitment processes. Its use enables the automation of repetitive tasks, reduces application processing times, and improves the quality of candidate pre-selection. In so doing, AI contributes to enhancing the efficiency of HR practices while fostering better-structured recruitment workflows. However, the integration of these technologies extends beyond mere technical improvement. It is accompanied by a progressive transformation of the roles and competencies of HR professionals, who must now appropriate new tools and develop hybrid skills at the intersection of digital proficiency and talent management. Furthermore, the study identifies several challenges associated with AI adoption in the Moroccan context. The cost of technological solutions, resistance to change, and the lack of internal technical competencies emerge as significant barriers to deployment. These elements underscore that AI integration is as much contingent on organizational and human factors as it is on technological considerations. From an ethical standpoint, the findings reveal a growing attentiveness to issues related to personal data protection, algorithmic system transparency, and the risk of bias in selection processes. These concerns highlight the need to govern the use of AI in order to ensure equitable and responsible recruitment practices. In keeping with its interpretive stance, this research does not seek to generalize its findings, but rather to offer an in-depth understanding of the practices and perceptions of actors within a specific context. It thereby contributes to the literature on human resource management by providing empirical insight into AI integration in a country undergoing digital transformation. Nevertheless, this study presents certain limitations, notably with respect to sample size and the qualitative nature of the methodology, which precludes statistical generalization. Future research could adopt a quantitative approach to measure the impact of AI on recruitment performance, or undertake comparative analyses across different organizational and geographical contexts. In conclusion, artificial intelligence emerges as a strategic opportunity for Moroccan enterprises — provided it is integrated in a thoughtful and governed manner. The central challenge lies in organizations' capacity to reconcile technological innovation with ethical responsibility, in order to build recruitment practices that are simultaneously effective, transparent, and respectful of individuals.

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VIRAL TRENDS AND AUTHENTICITY: THE DILEMMA OF YOUNG PEOPLE ON SOCIAL MEDIA

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ABSTRACT

This research aims to analyze the interactions among young Moroccans, viral trends, and the construction of their digital identities on social media. Drawing on approaches related to digital identity theories, social psychology, and conformity theory, we examine how these factors influence the psychological well-being, self-perception, and interconnectedness of Moroccan youth in virtual and real life. Three hypotheses will be tested and evaluated in terms of their impact on the visibility, authenticity, psychological well-being, and self-esteem of these young people. To address this question, we opted for a mixed-methods approach (qualitative and quantitative), allowing us to examine in depth the dynamics within a sample of 110 young Moroccans on social media. The expected results will provide significant insights into the contribution of these approaches and how this complex interaction influences psychological well-being, self-perception, and the interplay between the virtual and real spheres of young people's lives.

Keywords: Digital identity, Viral trends, Psychological well-being, Social conformity, Social networks.

1. INTRODUCTION

Social networks occupy a pivotal place in daily life, particularly among young people (Moreau et al., 2012; Wallerand, 2023), and provide a dynamic platform for content creation (Emery, 2024, p. 10), social interaction (Abidi, 2024, p. 33), and the construction of a unique digital identity among users (Cardon, 2019, p. 176; Emery, 2024, pp. 9–15). However, young people face a dilemma when sharing content: either follow viral trends to increase their visibility and popularity, or remain authentic and true to themselves (Granjon and Denouël, 2010, p. 10). In this particular context, young people seek “visibility capital” (Heinich, 2005), or a way to attract the attention of the widest possible audience. This behavior can generate a low form of “micro-celebrity” (Berger, 2018, p. 69). This can encourage young people to spend a significant amount of time promoting themselves, which sometimes fosters a loss of self through the constant valorization of “posts” (Berger, 2018, p. 19). Furthermore, Déage’s (2018) study on the reputation of middle school students on Snapchat shows that online recognition is a complex and social process that requires specific strategies to shape their images. Consequently, the issue of young people and viral social media trends is a major point regarding how their identity is constructed and presented in the digital space. Viral trends are an extremely powerful force that produces social media content, which is often ephemeral and evolves over time. While their adoption can increase visibility and reach, it risks supplanting individuality and authenticity. In this research, we will explore the links that associate young people and viral trends, using a mixed methodological approach (qualitative and quantitative) allowing us to examine in depth the dynamics within a sample of 110 young Moroccans.

2. THEORETICAL FRAMEWORK

2.1. Viral Trends and the Construction of Digital Identity Among Young People

This framework draws on several concepts from social psychology, media sociology, and digital communication to develop a more robust understanding of the relationships between viral trends and the construction of young people's digital identity. Emphasis is placed on the dilemma between conforming to current trends and authentic online expression.

2.2. The Construction of Digital Identity in the Age of Social Networks

Theories of digital identity highlight the importance of online spaces, leading to an interference with youth's identity construction. Indeed, Turkle (1995) argues that online interactions facilitate the development of individuals' personalities and, consequently, their digital identities. Moliner's S.I.D.E. model expands on this observation by describing a socially intensified dimension of identity where users perceive themselves more as members of groups than as individuals. Thus, cultivating a hyper-socialized digital identity. In this context, we draw on Georges' research (2011), which reveals that the existential anxieties identified by Turkle in the 1980s and 90s are currently being replaced by an integration of the self within social networks, involving the creation and consultation of data. This view is further developed by Boyd in 2008, who highlights that young people who do not participate in online interactions with their peers exhibit self-censorship. Furthermore, Georges' research underscores that the supposed self-understanding of each individual - which is rooted in social media - demands a constant activity of information production and consumption. This implies that every comment and interaction respected the representation of others' states of mind, and that social media shaped virtual conformity. These constructions of digital identity are fluid and driven by the viral social media trends. Marwick and Boyd (2014) show that classical privacy theories cannot fully explain online privacy interactions, revealing that adaptation to digital platforms alters identity presentation, sometimes in problematic ways. Social networks actively shape digital identity, as Lampe, Ellison, and Steinfield found through Facebook's dual role: building social capital and promoting artificial identities. Anthropologically, identity intertwines with culture, molded through enculturation and adaptation, underscoring the central influence of intercultural processes in online privacy. Fanny Georges (2011) and others empirically confirm that social networks amplify stereotypes and drive ongoing digital information exchange. This amplification not only shapes identity perceptions but also influences individual behavior and affects professional inequalities (Bonnot et al., 2012). From the preceding analysis, we deduce that theories of digital identity confirm the importance of social media for the concept of digital self. A review of the work of Turkle, Boyd, Marwick, Lampe, Ellison, and Steinfield also revealed the considerable influence of digital spaces and viral trends on young people's construction of online identity, emphasizing the complexity of the process. Therefore, this article will examine the reciprocal influence of digital identity and viral trends and provide new insights into how young people navigate this evolving space.

2.3. Social Psychology and Conformity

Classic studies conducted by Solomon Asch in 1956, as cited by Serge Nicolas and Ludovic Ferrand (2011), affirm the significant impact of individuals' conformity to group opinions and behaviors on their propensity to conform. In his conformity experiments, Asch indicated that participants were sensitive to incorrect responses from their peers, demonstrating a propensity to conform rather than express their true opinions. Conformity may be relevant in the context of social networks, given that young people are exposed to a diversity of opinions and behaviors online.

Regarding authority, Stanley Milgram's experiment highlighted individuals' susceptibility to influence from authority figures, leading them to transgress their moral norms. In this situation, participants observed a third party receiving an electric shock while they were tasked with pressing the button, highlighting the propensity to obey. In this way, young people might adopt trends as norms to follow and engage with viral trends simply because of their popularity or the influence of certain influencers they regularly follow. Generally speaking, conformity and authority illustrate how young people can be easily influenced and neglect their own authenticity. The previous studies mentioned demonstrate the importance of social influence and conformity in understanding young people's online behavior. In this regard, social influence is characterized by Clauzel et al. (2016) as the modification of an individual's behavior in response to social norms. Consequently, when faced with a viral trend, individuals will adopt it in order to conform, even if it compromises their authenticity. This complex dynamic suggests the need to explore how these psychological factors influence the construction of young people's digital identity in the context of social media. Chakouk (2022) also addresses the tendency of young adolescent girls to compare themselves to Instagram and Snapchat influencers, showing how these comparisons create unrealistic expectations and influence their body image. Thus, acting at various levels, from the individual to society and culture. By integrating these concepts from social psychology, we seek to understand how conformity to viral trends can sometimes overshadow authentic self-expression online, and what implications this may have for the construction of young people's digital identity.

2.4. Viral Trends: A Social Media Phenomenon

In digital social networks, viral phenomena manifest as a powerful force, rapidly disseminating content and ideas to broad audiences (Wold, 2023). These trends, frequently fueled by a potent combination of compelling information (Shahbaznezhad et al., 2021), intense emotions (Berger & Milkman, 2013), and the visibility of influential personalities or brands (Schöne et al., 2023), transform vulgar content into cultural phenomena. The pursuit of virality is frequently associated with the search for a digital identity, in which users seek to connect with communities and develop an online presence aligned with their values and aspirations (van Doorn et al., 2010). (according to Li et al.) (2021), the study of viral trends provides valuable data on the evolution of online communication and consumer behavior, offering useful insights for marketing professionals, content creators, and researchers. Consequently, viral trends interact with current digital culture and significantly influence how young people construct their digital identities. In this regard, the research by Berger and Milkman (2012) provides valuable insights into the mechanisms underlying viral spread. Tellis et al. (2019) reveal that digital social networks have become platforms for the exponential spread of viral trends, where viral content spreads at lightning speed, captivating millions of users in a matter of hours. Furthermore, the work of Berger and Milkman (2013) concludes that viral spread depends on three main factors: novelty, emotion, and ease of sharing. Novelty evokes attention, as individuals are naturally drawn to what is new and surprising. Emotion, whether positive or negative, strengthens people's emotional engagement with the content and encourages them to share it to convey those emotions. Finally, the ease of sharing facilitates the rapid dissemination of content through social networks. Thus, applied to the context of young people and their construction of digital identity, this suggests that viral trends exhibiting these characteristics are more likely to be adopted and integrated into their own online content. Young people are motivated to participate in these trends not only because of their popularity but also because they offer an opportunity to stand out and interact meaningfully with their audience. In this regard, Chakouk (2017) confirmed the relationship between the socio-cultural integration (and also the affirmation of identity) of sub-Saharan students in Morocco and their use of social media.

We deduce that adopting these trends can sometimes lead to adjustments in how young people present their online identities. The pursuit of visibility and popularity can sometimes result in compromises of authenticity. This is explored through the examination of viral dissemination mechanisms, particularly how young people construct and present their digital identities on social media. By understanding these mechanisms, we will be able to analyze in depth how viral trends interact with the process of constructing digital identities among young people, thus offering new avenues for reflection in our study.

2.5. The Tension Between Visibility and Authenticity

In today's digital landscape, young people face the challenge of reconciling online visibility with personal authenticity. Growing up in the age of social media (Voorveld, 2019), they are subject to constant pressure to promote themselves, gain popularity, and maintain a strong image (Li, Larimo, & Leonidou, 2021). This can lead them to conform to trends and imitate others in order to fit in, sometimes jeopardizing their individuality (Arriagada & Ibáñez, 2020). Nevertheless, some young people manage to be authentic by remaining true to their values and passions, even if it means relinquishing conformity. They recognize that true visibility emerges from authenticity and genuine values (Mount & Martinez, 2014), developing through sincere actions and original contributions (Shahbaznezhad, Dolan, & Rashidirad, 2021). They strive to distinguish themselves through originality and creativity (Geyser, 2024), rather than superficial notoriety (Knossenbourg, Nogueira, & Chimenti, 2016). The tension between these poles is intensified by viral trends, which accentuate the dilemma between social conformity and authenticity, as illustrated by Marwick and Boyd (2014). Viral trends encourage rapid conformity to capture individuals' attention, thus creating a conflict between the desire to adapt and the desire to defend one's own convictions online. Classic theories in social psychology (Asch's and Milgram's theories) highlight the tendency to conform to collective opinion, including in online interactions. Furthermore, research by Berger and Milkman helps to illuminate the mechanisms by which content dissemination is influenced by our quest for novelty, our search for emotions, and the pleasure associated with sharing. By considering this dynamic, we can better understand how young people strive daily to find a balance, motivated by their quest for authenticity. Nevertheless, it is important to emphasize the significant influence of digital spaces and viral trends, as demonstrated by research by Turkle, Boyd, Marwick, Lampe, Ellison, and Steinfield. The theoretical framework described above highlights the major importance of social media in the construction of online identity by offering a detailed perspective on how young people conceive and present their identity in the digital context, thus underscoring the inherent complexity of this process. The dynamic interaction between digital identity and viral trends forms the core of our study, providing new insights into how young people navigate this ever-changing digital space.

3. PROBLEM STATEMENT

In this study, we will examine the relationship between visibility, authenticity, and the patterns of participation in viral trends, and how these dynamics contribute to the construction of young people's identities. Drawing on concepts from social psychology, we seek to understand how conformity to trends can supplant authentic online expression, thereby influencing the construction of young people's digital identity. Our overall approach aims to shed light on the mechanisms that influence their online presence and to analyze how this can sometimes shape the way young people present their identity. Thus, we hope to provide significant insights into the complex relationships between digital identity and viral trends on social media. Consequently, the question raised by this problem statement concerns navigating a digital environment characterized by virality, where adherence to viral trends can sometimes seem incompatible with self-authenticity.

This could pose a challenge for young people in constructing their online identities. Furthermore, conforming to viral trends can create dysfunctional expectations and pressures for these young people, exposing them to harmful pressures and attitudes throughout the process of conformity and seeking popularity. To study this issue, we formulate the following central question: What is the influence of young people's engagement on social media, participation in viral trends, and coping strategies on their psychological development, self-perception, and the balance between their virtual and real lives?

To address this issue, we have put forward the following three hypotheses:

- **Hypothesis 1:** Young people who actively incorporate viral trends into their online content are more likely to gain visibility and popularity, while also facing challenges in maintaining their authentic identity.
- **Hypothesis 2:** Young people who adopt a more selective approach to viral trends and emphasize their own authenticity benefit from a more engaged and loyal audience.
- **Hypothesis 3:** Excessive conformity to viral trends may be associated with higher levels of stress and anxiety among young people, due to pressure to follow norms and fear of not being socially accepted if they do not conform.

4. METHODOLOGY

Our methodological approach is primarily based on qualitative analysis, employing content analysis and examining the detailed narratives gathered during semi-structured interviews with 110 young people. These methods help us better understand the nature of their experiences, the reasons motivating these young people to follow or ignore certain trends, and how they balance their true personalities in contrast with their image on social media. On the other hand, the quantitative component relies on SPSS through the analysis of various correlations between the frequency of social media use, engagement with viral trends, and indicators of psychological well-being and self-esteem. The integration of these two qualitative and quantitative approaches results in a broader perspective, allowing us to situate personal narratives and measurable data side-by-side in a comprehensive analysis of young people's digital development.

5. PRESENTATION OF THE CORPUS

Our sample of young people comprises 110 participants aged 18 to 35, with an average age of 26. The sample is therefore relatively young, with a minimum age of 18, suggesting the inclusion of young adult participants, and a maximum age of 35, indicating age diversity within each sample. The distribution between male and female participants in the sample is roughly equal, although males are slightly more numerous than females, representing 55% versus 45%. Regarding educational level, the majority of participants have a higher education degree (40%). In addition, 35% of the sample have a secondary education (high school diploma), and 25% have completed secondary school. It is therefore possible to say that the sample is relatively educated, considering the minimum educational level. When it comes to social media use, Facebook and Instagram are the most popular, accounting for 55% of responses. TikTok, YouTube, and LinkedIn are also used, but to a much lesser extent.

Overall, we conclude that our sample is diverse in terms of age, gender, and education level. Given the power of social media for young people, it is also likely a source of pressure. Such social pressures could be linked to the desire to express individuality.

6. RESULTS AND DISCUSSION

The following table summarizes the main themes we identified in our content analysis. We focused on six themes, each subsection of which describes the specific categories used to distinguish the sub-elements linking how young people construct their online identity through social media and viral trends. Furthermore, these themes offered a detailed description of the underlying social and psychological interactions, reflecting the complexity of such processes. This in-depth analysis allows us to share important findings that highlight the influence on young people's digital identities.

Themes	Categories
Theme 1 : Use of social networks	- Category 1.1: Preferred Platforms - Category 1.2: Frequency of Use - Category 1.3: Online Goals and Objectives
Theme 2: Influence of Viral Trends	- Category 2.1: Perception of Viral Trends - Category 2.2: Participation in Trends - Category 2.3: Motivations for Following Trends
Theme 3: Conflict Between Visibility and Authenticity	- Category 3.1: Seeking Online Visibility - Category 3.2: Authenticating Online Identity - Category 3.3: Tensions Between Visibility and Authenticity
Theme 4: Psychological Repercussions	- Category 4.1: Level of Stress and Anxiety - Category 4.2: Online Self-Esteem and Confidence
Theme 5: Coping Strategies	- Category 5.1: Adjustments in Self-Presentation - Category 5.2: Maintaining Authenticity Despite Trends
Theme 6: Comparison with the Offline World	- Category 6.1: Influence of Digital Identity on Offline Identity - Category 6.2: Management of overall personal image

Table 1 : Themes and Categories analyzed

Theme 1 : Use of social networks

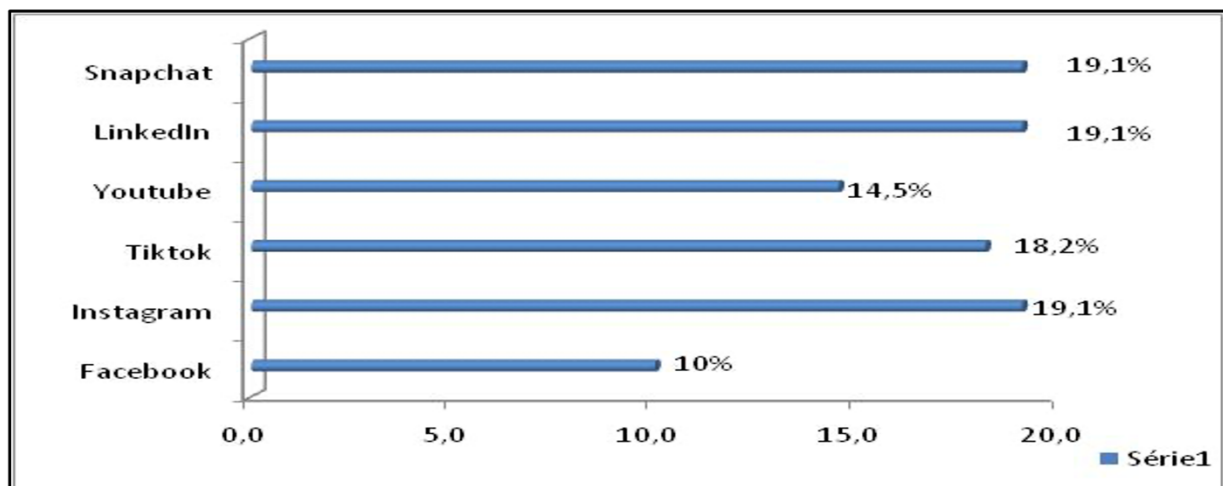


Figure 1 : Graph of preferred SM Platforms

Participants mentioned the social media platforms they used most often (Figure 1). A number of them chose visual platforms such as Instagram to share their photos and adventures with the world. Others connect with friends and family on Facebook or Twitter. In general, social media plays a significant role in the daily lives of young people. As one participant noted, “I love Instagram; it’s amazing how I can share things I love through images.” This confirms the pervasive presence of digital social platforms in the daily lives of young people.

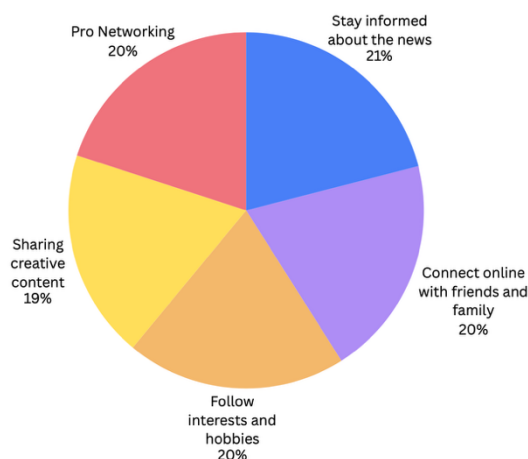


Figure 2 : Category 1.2: Frequency of Use

The data shows an even distribution between those who use social media frequently, moderately, and infrequently. This diversity in frequency indicates the different levels of engagement among participants. Many participants note that their social media activity increases with the emergence of viral trends, signifying dynamic interaction with online content. As one participant put it, "I check my social media every day, but when there's a viral trend, I can spend hours browsing content."

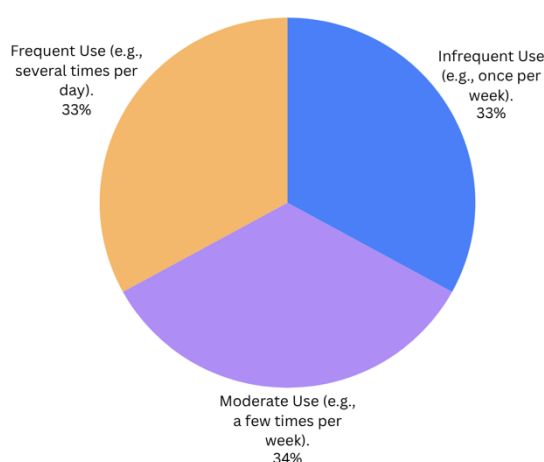


Figure 3 : Category 1.3: Online Goals and Objectives

The results show a balanced distribution of social media usage goals among participants. Each purpose category attracts approximately one-fifth (1/5) of users, highlighting the versatility of social platforms for various purposes. Participants share that they use social media for a variety of reasons, from connecting with friends and family to sharing artistic creations and searching for relevant information. One participant said: "For me, it's a way to stay connected with my friends who live abroad. I also like to share my artistic creations and see what others are doing."

Theme 2: Influence of viral trends

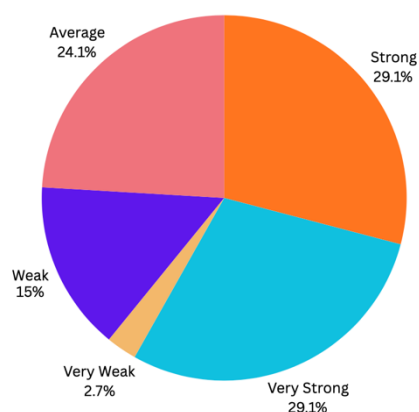


Figure 4 : Category 2.1: Perception of Viral Trends

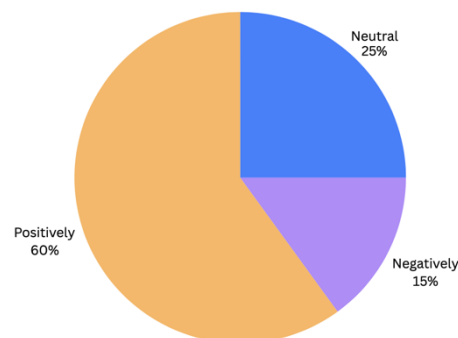


Figure 5 : Category 2.2: Engagement with Trends

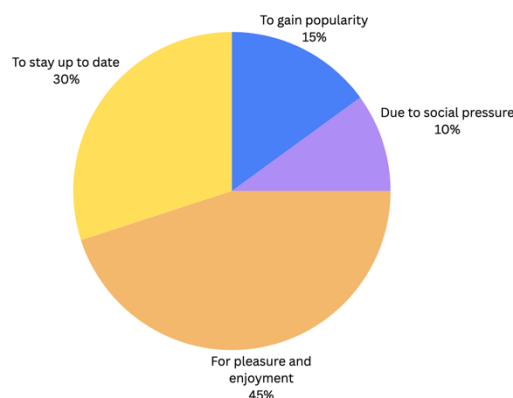


Figure 6 : Category 2.3: Motivation to follow Viral Trends

Young people's perceptions of viral trends vary: 60% find them entertaining and informative, 25% remain neutral, and 15% hold a negative view. This indicates a wide range of viewpoints on this phenomenon. Furthermore, among young people, 60% actively engage with trends, either actively seeking out those they like and following those that interest them, or less actively, simply watching. The main motivations for this engagement are enjoyment, fun, and creativity, as well as the desire to join online communities. Clearly, viral trends are important to young people online as entertainment, a form of personal growth, and a source of social connection. Summary: The influence of viral trends on social media is significant, with a majority of young people showing positive engagement and interest. These trends serve both as a means of entertainment and as vehicles for personal expression and social connectivity. The diverse perceptions and engagement behaviors reveal how personal identification and interests influence young people's participation, demonstrating the impact of viral trends on their overall digital experience.

The results show that social media is part of young people's daily lives, used for social connection, personal expression, and creative sharing, varying according to the platform and frequency of use. Viral trends significantly influence their digital experience, serving as both sources of inspiration and entertainment. To explore the hypothesis that young people who actively engage with viral trends gain visibility while maintaining their authenticity, we selected specific variables:

- ✓ Engagement with viral trends: This variable assesses the degree of participants' engagement with global trends to analyze the impact of this engagement on visibility and perceived authenticity.
- ✓ Seeking online visibility: This variable analyzes the degree of participants' motivation for online recognition. The results of this analysis provide information regarding the influence of subjects' engagement on their potential for fame and their image.
- ✓ Online identity authentication: This variable measures how genuine subjects are perceived in the digital environment to provide insight into the results of their search for visibility and their engagement with trends sought for their personal identity.

The results of the statistical tests are as follows:

Chi-Square Tests					Symmetric Measures				
SEARCH FOR VISIBILITY ONLINE:		Value	df	Approx. Sig. (two-sided)	SEARCH FOR VISIBILITY ONLINE:		Value	Approx. Significance	
Follow trends	Pearson Chi-Square	27.122	16	.040	Follow trends	Nominal by Nominal Phi	.880	.040	
	Likelihood Ratio	34.495	16	.005		Cramer's V	.440	.040	
	N of valid observations	35				N of valid observations	35		
Put authenticity first	Pearson Chi-Square	25.370	12	.013	Put authenticity first	Nominal by Nominal Phi	.796	.013	
	Likelihood Ratio	28.056	12	.005		Cramer's V	.460	.013	
	N of valid observations	40				N of valid observations	40		
Find a balance between the two	Pearson Chi-Square	31.117	12	.002	Find a balance between the two	Nominal by Nominal Phi	.943	.002	
	Likelihood Ratio	33.384	12	.001		Cramer's V	.544	.002	
	N of valid observations	35				N of valid observations	35		
Total	Pearson Chi-Square	79.318	16	.000	Total	Nominal by Nominal Phi	.849	.000	
	Likelihood Ratio	87.220	16	.000		Cramer's V	.425	.000	
	N of valid observations	110				N of valid observations	110		

The table below presents the interpretation and analysis of the results obtained from the chi-square tests, highlighting the relationship between engagement with viral trends, the search for online visibility, and the authenticity perceived by young people.

Variables	Chi-squared Tests	Interpretation
Engaging with viral trends: Following trends	Pearson's chi-squared: 27.122 (p = 0.040)	The significance (p = 0.040) shows a significant relationship between following trends and the impact on visibility and potential identity. This suggests that actively following trends is linked to a noticeable gain in visibility.
	Likelihood ratio: 34,495 (p = 0,005)	Strengthens the significant association, indicating engagement with trends contributes to online recognition.
	Symmetrical measures: Phi = 0,880, V de Cramer = 0,440	A strong association with visibility and possibly an impact on perceived authenticity.
Seeking online visibility: Highlighting authenticity	Pearson's chi-squared: 25,370 (p = 0,013)	Indicates that promoting authenticity has a significant influence on online visibility/promotion, which can balance the impacts of following trends.
	Likelihood ratio: 28,056 (p = 0,005)	Confirms the significant relationship, showing that authenticity is influenced by visibility and identity management.
	Symmetrical measures: Phi = 0,796, V de Cramer = 0,460	Strong correlation, suggesting the importance of authenticity in managing online presence.
Online identity authentication: Finding a balance between the two	Pearson's chi-squared: 31,117 (p = 0,002)	This significance (p = 0.002) shows that balancing trends and authenticity is powerful for managing identity and visibility, suggesting a trade-off between authentic and popular.
	Likelihood ratio: 33,384 (p = 0,001)	This reinforces the idea that finding a balance between aiming for visibility and maintaining authenticity brings the best of both worlds online.
	Symmetrical measures: Phi = 0,943, V de Cramer = 0,544	A strong relationship has been demonstrated. This indicates the existence of a subtle and balanced management of the two elements.
Total	Pearson's chi-squared: : 79,318 (p = 0,000)	Overall significance confirms that engagement with trends and the balance between visibility and authenticity have a considerable impact.
	Likelihood ratio: 87,220 (p = 0,000)	The overall significant relationship validates the hypothesis that viral engagement largely influences online visibility and authenticity management.
	Symmetrical measures: Phi = 0,849, V de Cramer = 0,425	Indicates that a strong and significant overall relationship exists between these behaviors and their impact on online presence.

Table 4 : Analysis of the relationship between engagement with viral trends

These results confirm that young people do indeed gain visibility when they engage with viral trends, but that these gains come with challenges related to maintaining their authentic identity.

The data shows a statistically significant association between engagement with trends and increased visibility, proving that these behaviors actively boost digital recognition. However, maintaining a balance between being visible and staying true to oneself is crucial for preserving an authentic identity. The results suggest that finding this balance maximizes the benefits of viral trends while minimizing the risks of diluting personal authenticity.

These findings highlight the strategic choices and trade-offs that young people must consider when they want to increase their digital presence while remaining true to themselves.

Theme 3: Conflict Between Visibility and Authenticity

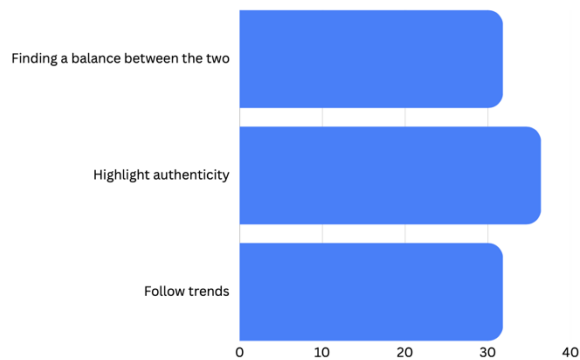


Figure 7 : Category 3.1: Seeking Online Visibility

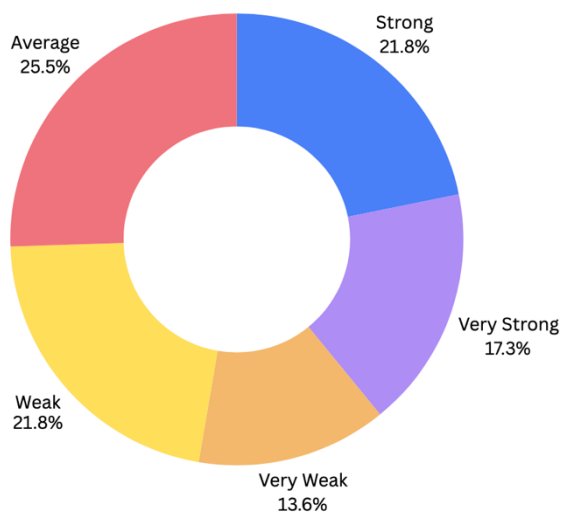


Figure 8 : Category 3.2: Authentification of online identity

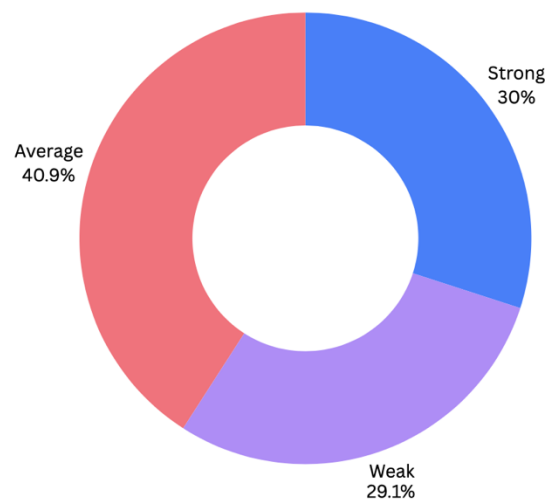


Figure 9 : Category 3.3: Tensios between visibity and authenticity

The charts illustrate the dilemma young people face when navigating between seeking online visibility and maintaining their authenticity. Indeed, 71% of respondents reported experiencing moderate to high tension between these two aspirations, highlighting how pervasive this conflict is in their digital experience.

Young people adopt multiple strategies to position themselves: some prioritize visibility by following trends (31.8%), while others prioritize expressing their authenticity (36.4%). A significant number seek a balance between these two approaches.

These strategies reflect a strong desire to maintain a digital identity that reflects their authentic personality. Furthermore, young people often face difficult choices between engaging in popular social movements and asserting their individuality, as this testimony illustrates: "I think it's a delicate balance. Sometimes I just want to be myself, but at the same time I know that to get noticed, I have to follow certain trends."

The dilemma between visibility and authenticity reflects an inherent tension between projecting an attractive public image and remaining true to their real identity, but it remains a major challenge for young people. These dynamic demands conscious personal strategies for managing their online presence while staying true to their own values.

Theme 4: Psychological Repercussions

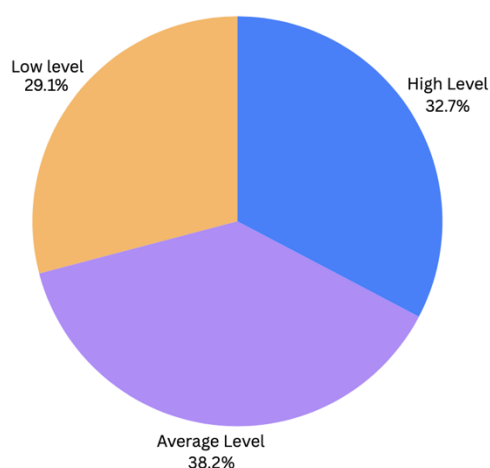


Figure 10 : Category 4.1 : Stress level

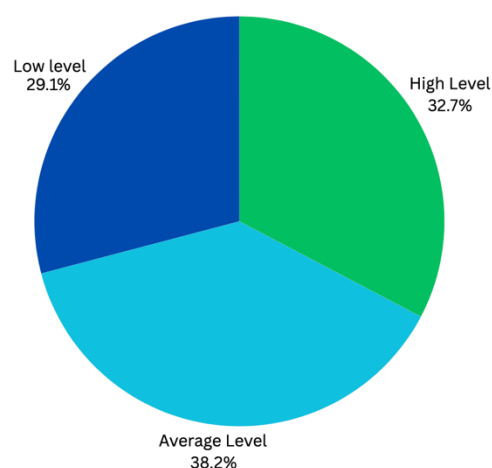


Figure 11 : Category 4.2 : Anxiety level

Stress and anxiety levels varied, with 30% of participants reporting high levels, 40% moderate levels, and 30% low levels. Several participants discussed the stress and anxiety levels associated with their online presence. Some admitted to feeling pressure to maintain an online image that meets expectations, which can be stressful. One participant shared their experience: "There are times when I feel really stressed about everything I post online. I'm afraid I won't measure up."

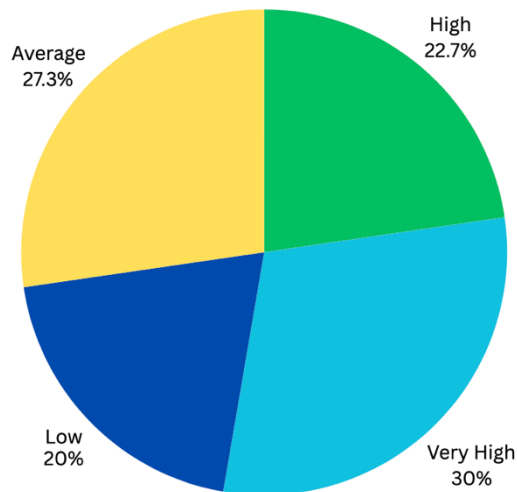


Figure 12 : Category 4.2: Online Self-Esteem and Confidence

The majority of participants (52.7%) reported average to very high levels of self-esteem and online confidence. This means that while some may experience challenges, overall, many young people feel confident on social media. Online interactions significantly influence self-esteem and self-confidence. While positive feedback boosts confidence, negative criticism or comparisons can erode self-perception. As one participant shared, "When I get likes and positive comments, it really boosts me. But sometimes, criticism can really affect my self-confidence." This analysis highlights the psychological impact of online interactions, emphasizing the delicate balance between positive feedback and negative influence. It underscores the need to guide young people in managing their image and self-esteem in the digital environment.

The validation of Hypothesis 2, which is based on the idea that young people who adopt a selective approach to viral trends while emphasizing their authenticity benefit from a more engaged and loyal audience, relies on exploring the psychological dynamics of young people related to their online presence. The analyses reveal that online visibility is an important goal for social media users, but that this goal can conflict with the desire to remain authentic. Some are willing to sacrifice their authenticity to gain visibility, while others prefer to preserve their authenticity, even at the expense of visibility. Achieving this balance between visibility and authenticity proves complex and complicated. Furthermore, young people face numerous psychological challenges online, such as the pressure to maintain an image that conforms to expectations and the difficulty of managing negative comments.

To examine this hypothesis, we selected and cross-referenced specific variables, including:

- Engagement with viral trends: This variable measures the degree of selectivity of participants in their engagement with viral trends in order to analyze the effect of selection on the audience.
- Online identity authentication: This variable measures how participants themselves perceive their online identity and the extent to which they try to present who they are, to better understand if, and how, this can attract a larger number of engaged listeners.

- Personal image management: This variable determines how participants manage their image and, more generally, how their scores for these variables affect audience engagement and loyalty.

The correlation results obtained are as follows:

Chi-Square Tests				
ENGAGEMENT_WITH_TREND_VIRAL CONTENT		Value	df	Approx. Sig. (two-sided)
Very low engagement	Pearson Chi-Square	3.000	2	.223
	Likelihood Ratio	3.819	2	.148
	N of valid observations	3		
Low engagement	Pearson Chi-Square	7.286	6	.295
	Likelihood Ratio	8.470	6	.206
	N of valid observations	17		
Medium engagement	Pearson Chi-Square	7.732	6	.258
	Likelihood Ratio	9.137	6	.166
	N of valid observations	26		
High engagement	Pearson Chi-Square	21.324	8	.006
	Likelihood Ratio	23.114	8	.003
	N of valid observations	32		
Very high engagement (often follows trends)	Pearson Chi-Square	4.960	6	.549
	Likelihood Ratio	5.386	6	.495
	N of valid observations	32		
Total	Pearson Chi-Square	20.597	8	.008
	Likelihood Ratio	22.428	8	.004
	N of valid observations	110		

Chi-Square Tests				
ENGAGEMENT_WITH_TREND_VIRAL CONTENT		Value	df	Approx. Sig. (two-sided)
AUTHENTICITY_FIRST				
Very low	Pearson Chi-Square	10.112	8	.257
	Likelihood Ratio	9.637	8	.291
	N of valid observations	15		
Low	Pearson Chi-Square	13.469	6	.036
	Likelihood Ratio	15.717	6	.015
	N of valid observations	24		
Medium	Pearson Chi-Square	8.730	6	.189
	Likelihood Ratio	9.008	6	.173
	N of valid observations	28		
High	Pearson Chi-Square	10.317	6	.112
	Likelihood Ratio	12.120	6	.059
	N of valid observations	24		
Very high	Pearson Chi-Square	.247	2	.884
	Likelihood Ratio	.401	2	.818
	N of valid observations	19		
Total	Pearson Chi-Square	18.019	8	.021
	Likelihood Ratio	19.386	8	.013
	N of valid observations	110		

Chi-Square Tests				
ENGAGEMENT_WITH_TREND_VIRAL CONTENT		Value	df	Approx. Sig. (two-sided)
Very low engagement	Pearson Chi-Square	3.000	2	.223
	Likelihood Ratio	3.819	2	.148
	N of valid observations	3		
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	N of valid observations	32		
Total	Pearson Chi-Square	20.597	8	.008
	Likelihood Ratio	22.428	8	.004
	N of valid observations	110		

Table 5 : Chi-squared tests

To interpret the results of the chi-square tests regarding the hypothesis that young people who carefully select viral trends and maintain their authenticity attract a more engaged and loyal audience, we examine the results obtained for each key variable.

Variables	Results	Interpretation
Global Personal Image Management		
Very Active and Moderately Active	High significance (p = 0,000) :	Active management of personal image improves visibility and audience engagement.
Slightly active	No significance (p = 0,055)	Passive management of personal image can reduce audience engagement.
Engagement with viral trends		
Strong Engagement	Significance (p = 0,006) :	Strong engagement with trends, combined with authenticity management, is linked to increased audience engagement.
Very strong Engagement	No signification (p = 0,549)	Simply following trends without managing authenticity does not guarantee better audience engagement.
Authentification of online identity		
Low and average authentification	No high significance	Weak authentication doesn't always maximize audience engagement.
High and very high authentification	.	Higher loyal engagement highlights the importance of high authenticity in audience retention.
Overall Significance	Significance (p = 0,021)	A significant relationship exists between perceived authenticity and engagement with viral trends.

Table 6 : Interpretation of the psychological repercussions results

Research results reveal that actively managing one's personal image and demonstrating a high level of authenticity significantly enhances audience engagement. In other words, young people who successfully manage these aspects in a more balanced way have more effective digital strategies. Furthermore, authenticity can attract and retain audiences, especially when combined with proactive image management and selective engagement. Therefore, it is crucial that students consider these three factors and find the optimal balance to encourage the greatest possible involvement from their online audience.

Theme 5: Adaptation Strategies

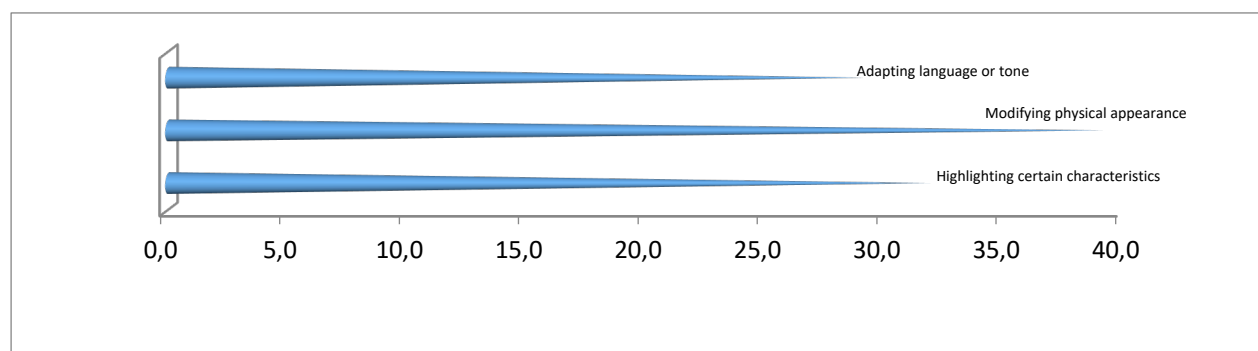


Figure 13 : Category 5.1: Adjustments in Self-Presentation

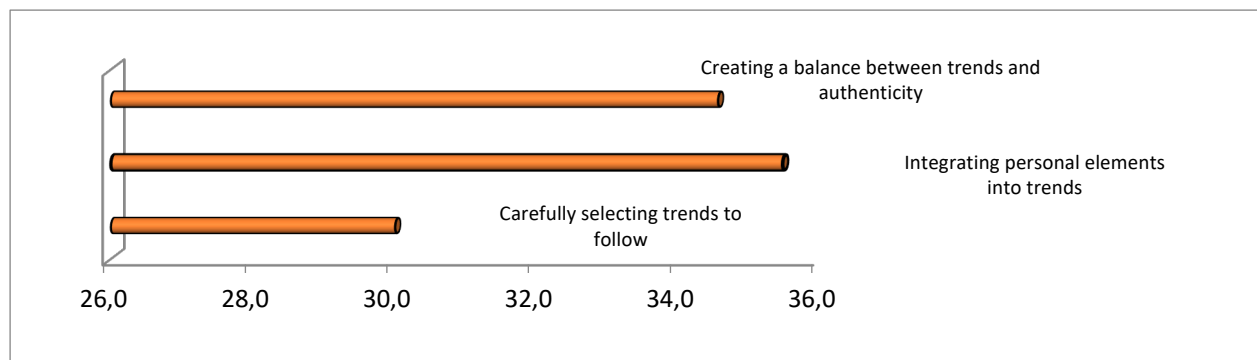


Figure 14 : Category 5.2: Maintaining authenticity despite trends

Most participants make targeted adjustments to their online presence, such as modifying their physical appearance or adapting their language, to better meet their audience's expectations while highlighting certain personal characteristics. At the same time, they place great importance on maintaining their authenticity, carefully selecting trends that resonate with their personal values. Participant testimonials emphasize the development of a precise strategy for navigating the digital space. "I know some things work better online, so I adapt a little," explained one participant, highlighting the delicate balance between adapting and preserving authenticity. Other participants stressed the importance of staying true to themselves: "I think it's possible to be fashionable without compromising who I really am."

Theme 6: Comparison with the offline world

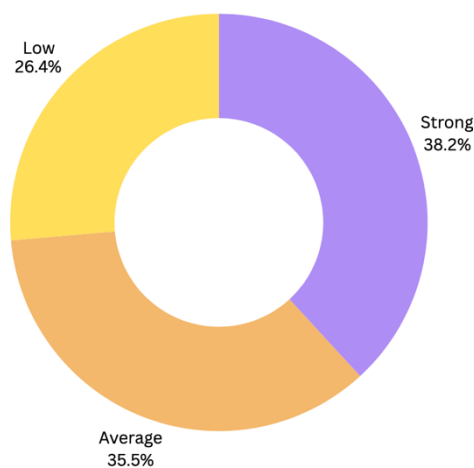


Figure 15 : Category 6.1: Influence of Digital Identity on Offline Identity

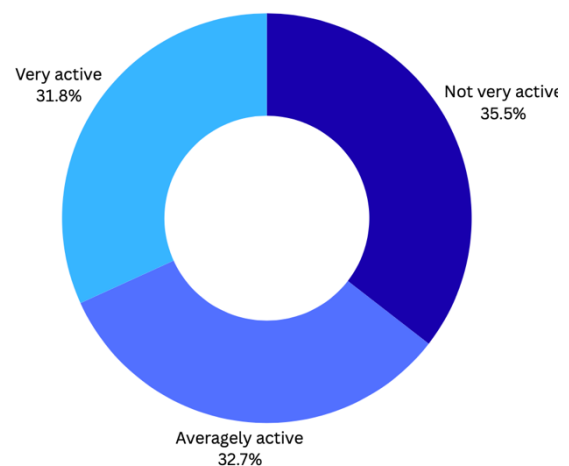


Figure 16 : Category 6.2: Management of Overall Personal Image

For 73.6% of respondents, digital identity has a moderate to strong influence on their offline identity. This highlights the interconnectedness of the online and offline worlds, where digital behaviors and perceptions impact real life. The testimonials reflect an awareness of digital identity in offline social perception. One participant stated, "What I post online represents a part of me, and the people around me see it." Regarding the management of their overall personal image, the majority of participants are active, to varying degrees, in managing their overall personal image. This demonstrates a conscious effort to maintain consistency between

their online presence and their real life. Participants strive to project a coherent image both online and offline. One participant explained, "I want to be authentic everywhere. I don't want people to see a different 'me' online and in everyday life."

This analysis underscores the importance of aligning digital and real-life identities. In their identity construction process, respondents envision an authentic image and seek harmony between their online and offline perceptions.

Validation of Hypothesis 3

Themes 5 and 6 explore how young people adapt to and manage their online identity in relation to their offline identity.

Regarding adaptation strategies (Theme 5), it appears that most participants choose to emphasize certain characteristics to better adapt online. This indicates an awareness of the importance of shaping their digital presence in a way that resonates with their audience. Furthermore, the careful selection of trends to maintain authenticity underscores participants' desire to find a balance between conforming to trends and expressing their authenticity.

Concerning the comparison between online and offline identity (see Theme 6), participants consider these two aspects to be closely linked. The majority of them strive to maintain consistency between their online and offline identities, thus highlighting the importance of authenticity in their digital presence.

To test Hypothesis 3, which states that excessive conformity to viral trends is associated with higher levels of stress and anxiety among young people, we cross-referenced the following variables:

- Level of engagement with viral trends. This variable will account for whether or not participants believe they are conforming to viral trends.
- Level of stress. This variable will help to understand the impact of believing in trend conformity on mental well-being.
- Level of anxiety. This variable will measure anxiety among participants and help us understand how pressure to conform to trends can influence young people's well-being.

Table following on the next Page

The correlation results obtained are as follows:

Chi-Square Tests						
ENGAGEMENT_WITH_TREND_VIRAL		Value	df	Asymp. Sig. (two-sided)	Exact (two-sided)	Exact Sig. (one-sided)
Very low engagement (rarely on trend).	Pearson Chi-Square					
	N of valid observations	3				
Low engagement.	Pearson Chi-Square	8.743	1	.003		
	Continuity Correction	5.102	1	.024		
	Likelihood Ratio	9.114	1	.003		
	Fisher's Exact Test				.015	.015
	N of valid observations	17				
Moderate engagement.	Pearson Chi-Square	9.974	4	.041		
	Likelihood Ratio	11.079	4	.026		
	N of valid observations	26				
High engagement.	Pearson Chi-Square	3.816	4	.431		
	Likelihood Ratio	3.791	4	.435		
	N of valid observations	32				
Very high engagement (often on trend).	Pearson Chi-Square	26.041	4	.000		
	Likelihood Ratio	16.887	4	.002		
	N of valid observations	32				
Total	Pearson Chi-Square	70.901	4	.000		
	Likelihood Ratio	71.444	4	.000		
	N of valid observations	110				

Chi-Square Tests				
STRESS LEVEL		Value	df	Asymp. Sig. (two-sided)
Low level.	Pearson Chi-Square	14.022	8	.081
	Likelihood Ratio	14.059	8	.080
	N of valid observations	32		
Moderate level	Pearson Chi-Square	2.606	6	.856
	Likelihood Ratio	3.619	6	.728
	N of valid observations	42		
High level	Pearson Chi-Square	9.797	4	.044
	Likelihood Ratio	8.707	4	.069
	N of valid observations	36		
Total	Pearson Chi-Square	53.969	8	.000
	Likelihood Ratio	56.957	8	.000
	N of valid observations	110		

Chi-Square Tests				
ANXIETY LEVEL		Value	df	Asymp. Sig. (two-sided)
Low level.	Pearson Chi-Square	15.808	8	.045
	Likelihood Ratio	16.273	8	.039
	N of valid observations	30		
Moderate level	Pearson Chi-Square	13.537	8	.095
	Likelihood Ratio	13.801	8	.087
	N of valid observations	42		
High level	Pearson Chi-Square	22.927	4	.000
	Likelihood Ratio	23.122	4	.000
	N of valid observations	38		
Total	Pearson Chi-Square	81.217	8	.000
	Likelihood Ratio	83.769	8	.000
	N of valid observations	110		

Table 7 : Chi-squared tests

The following table provides a detailed interpretation of the chi-square results, highlighting the significant relationships between stress levels, anxiety, and engagement with viral trends, illustrating how these factors interact among young people.

Table following on the next Page

Variables	Results	Interpretation
Stress level		
Low	Not significant (p = 0,081)	No clear link at this stress level with trend conformity.
Average	Not significant (p = 0,856)	No significant link between moderate stress and viral trends.
High	Significant (p = 0,044)	High stress levels are linked to excessive trend conformity.
Overall	Significant (p = 0,000)	Strong overall relationship between stress and viral engagement.
Niveau de l'Anxiété		
Weak	Significant (p = 0,045)	Indicates a link even with low anxiety levels.
Average	Not Significant (p = 0,095)	No clear correlation at this anxiety level.
High	Significant (p = 0,000)	Confirms a strong link between high anxiety and follower behavior.
Overall	Significant (p = 0,000)	Strong association between overall anxiety and high engagement with viral trends.
Engagement aux tendances virales		
Very weak Engagement	Insufficient statistics	N/A
Weak Engagement	Significant (p = 0,003)	Indicates a noticeable effect even at low levels of engagement.
Average Engagement	Significant (p = 0,041)	Suggests a link at this moderate level between engagement and stress/anxiety.
High Engagement	Not Significant (p = 0,431)	No clear association with stress or anxiety.
Very High Engagement	Significant (p = 0,000)	Strong correlation between high engagement and high stress/anxiety.

Table 8 : Analyzing the relationships between stress levels, anxiety, and engagement with viral trends

The results confirm the hypothesis that conforming to viral trends is associated with higher levels of stress and anxiety among young people. This is particularly true for high levels of engagement, which appear to exacerbate the perceived psychological pressure.

7. CONCLUSION

Our study on young people's digital identity, based on a sample of 110 individuals aged 18 to 35, reveals a deeper understanding of how young people construct their online identities through engagement with social networks and viral trends. We found that social media is a crucial part of young people's lives, allowing them to engage and express themselves, connect with one another, and share their creativity. Viral trends are used as a source of inspiration and spread significant influence while creating tensions related to visibility and authenticity.

Thus, our results indicate that viral trends can enhance visibility but require careful attention to authenticity. Young people need to be aware of and strike a balance to succeed on social media by carefully managing their image and maintaining their real-life identity.

Furthermore, our analysis revealed a high level of social media use associated with high levels of stress and anxiety related to these images. Conformity to trends appears to be a source of social bias. As a framework for better understanding these phenomena, we used theories of digital identity, social psychology, and conformity. The work of Sherry Turkle and danah Boyd, among others, was used to better understand the underlying processes related to online stereotypes, identity construction, and social pressures. In conclusion, our study provides a clearer view of how young people construct their digital identity, highlighting the need for careful balancing for anyone wishing to succeed on social media. For future research, ways in which young people can cope with the tensions they face can be explored more thoroughly.

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MONETARY POLICY TRANSMISSION MECHANISMS IN MOROCCO

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ABSTRACT

This paper investigates the transmission mechanisms of monetary policy in Morocco, with a particular focus on the bank lending channel and the asset price channel, proxied by the MASI stock market index. The study aims to assess the effectiveness of Bank Al-Maghrib's monetary policy decisions, primarily changes in the policy interest rate, in influencing real economic activity and price stability. The analysis is based on a Vector Autoregression (VAR) framework incorporating key macroeconomic and financial variables, including in-terbank rates, bank credit, the MASI index, real GDP, and the consumer price index, along with relevant exogenous controls. Impulse response functions (IRFs) are employed to evaluate the dynamic effects of monetary policy shocks and to assess the role of different transmission channels. The results provide evidence that both the credit and asset price channels play a role in the Moroccan context. However, due to the absence of structural identification, the findings do not allow for a definitive assessment of the dominance of one channel over the other. These limitations highlight the need for Structural VAR (SVAR) models to better capture monetary policy shocks and refine the analysis. Overall, this study contributes to a better empirical understanding of monetary policy transmission in an emerging economy, while emphasizing the methodological challenges associated with identifying active transmission channels using real-world data.

Keywords: Monetary policy, VAR model, Credit channel, Asset price channel, Morocco

1. INTRODUCTION

Understanding the transmission mechanisms of monetary policy is a central issue in macroeconomic analysis, particularly in emerging economies where financial structures and institutional frameworks are still evolving. The effectiveness of monetary policy depends not only on the actions of the central bank but also on the channels through which policy impulses are transmitted to the real economy. In the case of Morocco, Bank Al-Maghrib has progressively modernized its monetary policy framework, relying primarily on the policy interest rate as its main instrument to ensure price stability and support economic activity. However, the extent to which monetary policy decisions affect key macroeconomic variables—such as output and inflation—remains an empirical question. Theoretical and empirical literature identifies several transmission channels, among which the bank lending channel and the asset price channel are particularly relevant for emerging economies. Despite the growing interest in this topic, empirical evidence on monetary policy transmission in Morocco remains limited. This paper aims to contribute to this literature by analyzing the transmission mechanisms of monetary policy in Morocco, with a particular focus on the credit channel and the asset price channel proxied by the MASI stock market index. The analysis is conducted using a Vector Autoregression (VAR) model. This paper provides one of the few empirical analyses of monetary policy transmission channels in Morocco using recent data. The empirical analysis relies on impulse response functions (IRFs). While this approach provides useful insights, it does not rely on structural identification, which limits definitive conclusions. The remainder of the paper is structured as follows. Section 2 reviews the literature. Section 3 presents the methodology. Section 4 discusses the results. Section 5 concludes.

2. LITERATURE REVIEW

2.1. Theoretical Background

The transmission of monetary policy has long been considered a complex process involving multiple interacting channels, often described as a “black box.” Bernanke and Gertler (1995) emphasize the importance of the credit channel, highlighting how financial frictions amplify monetary policy effects. Cecchetti (1995) distinguishes between the “money view” and the “lending view,” stressing the role of banks in transmitting monetary shocks in credit-dependent economies. Mishkin (1996) provides a comprehensive framework integrating interest rate, credit, asset price, and exchange rate channels, emphasizing their complementarity and the role of expectations. These contributions underline the importance of credit and asset price channels and provide the theoretical foundation for this study.

2.2. Empirical Evidence

Recent empirical studies on emerging economies provide additional insights into monetary policy transmission mechanisms. For instance, Mukherjee and Bhat-tacharya (2011) show that the asset price channel may operate differently across markets, with limited effects in shallow stock markets but stronger impacts through real estate prices. Similarly, studies on Turkey highlight that while the interest rate and exchange rate channels play a significant role, the credit channel appears relatively weak despite its theoretical importance. In the case of Egypt, empirical evidence suggests that exchange rate pass-through to prices is incomplete and occurs with delays, reflecting structural rigidities in the economy. In the Moroccan context, several studies have attempted to assess the effectiveness of monetary policy transmission. Boughrara (2009), using a VAR framework, finds that the exchange rate channel is largely inactive due to the managed exchange rate regime, while the asset price channel remains weak given the dominance of bank-based financing. More recent contributions using SVAR approaches confirm that monetary policy affects output, inflation, credit, and asset prices, although the magnitude of these effects remains moderate and transmission delays are relatively long. In particular, the credit channel appears to be operative but gradual, while the asset price channel shows limited and mainly short-term effects. These findings highlight the structural characteristics of the Moroccan financial system and motivate further empirical investigation. These mixed findings highlight the need for further empirical investigation, particularly in the Moroccan context.

3. DATA AND METHODOLOGY

3.1. Monetary Policy Framework in Morocco

Morocco has progressively modernized its monetary policy framework, with Bank Al-Maghrib relying primarily on the policy interest rate as its main instrument. The transmission of monetary policy is influenced by the structural characteristics of the Moroccan economy, notably the dominance of bank-based financing and the relatively limited depth of financial markets. The banking sector plays a central role in financing economic activity, which suggests that the credit channel may be particularly relevant. At the same time, the development of the Casablanca Stock Exchange, represented by the MASI index, provides a basis for analyzing the asset price channel, although its effectiveness may remain constrained by market size and liquidity. In addition, Morocco has historically operated under a managed exchange rate regime, which may limit the role of the exchange rate channel in the transmission process. These structural features justify focusing on the credit channel and the asset price channel in the empirical analysis.

3.2. Data

The empirical analysis is based on a set of macroeconomic and financial variables commonly used in the literature on monetary policy transmission. The variables included in the model are the interbank interest rate, used as a proxy for monetary policy, bank credit to the economy, the MASI stock market index, real GDP, and the consumer price index. The analysis uses quarterly data covering the period from the first quarter of 2010 (2010Q1) to the fourth quarter of 2025 (2025Q4). The data are collected from official sources and are transformed to ensure consistency and stationarity. In particular, logarithmic transformations are applied where appropriate, and standard unit root tests are conducted to verify the integration properties of the series.

Table 1: *Stationarity Tests and Data Transformation*

Variable	Stationarity	Transformation
Interbank Rate	Non-stationary	First difference
MASI Index	Non-stationary	Detrended
Bank Credit	Non-stationary	Detrended
Real GDP	Non-stationary	First difference
Consumer Price Index	Non-stationary	Detrended

3.3. Model Specification

To analyze the transmission mechanisms of monetary policy, this study employs a Vector Autoregression (VAR) model. The VAR framework allows capturing the dynamic interactions among the selected variables without imposing strong theoretical restrictions.

The general form of the VAR model can be written as follows:

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \dots + A_p Y_{t-p} + \varepsilon_t$$

where Y_t is a vector of endogenous variables, A_i are coefficient matrices, and ε_t represents a vector of innovations.

The lag length is selected based on standard information criteria, such as the Akaike Information Criterion (AIC) and the Schwarz Criterion (SC), ensuring a balance between model fit and parsimony.

3.4. Impulse Response Analysis

The dynamic effects of monetary policy shocks are analyzed using impulse response functions (IRFs). This approach allows tracing the response of each variable in the system to a shock in the monetary policy indicator, providing insights into the transmission mechanisms over time. Impulse response functions are particularly useful in identifying the direction, magnitude, and persistence of the effects of monetary policy shocks on key macroeconomic variables, such as output, inflation, credit, and asset prices.

Limitations of the Approach

It is important to note that the VAR model used in this study is estimated in its reduced form and does not rely on structural identification. As a result, the shocks identified in the model cannot be interpreted as purely exogenous monetary policy shocks. While a Structural VAR (SVAR) framework would allow for a more precise identification of structural shocks, its implementation requires strong identifying assumptions and more detailed data. Given data limitations and the scope of this study, the VAR approach provides a useful and consistent framework for analyzing the dynamic relationships between variables. Therefore, the results should be interpreted with caution, as they provide indicative rather than definitive evidence on the relative importance of different transmission channels.

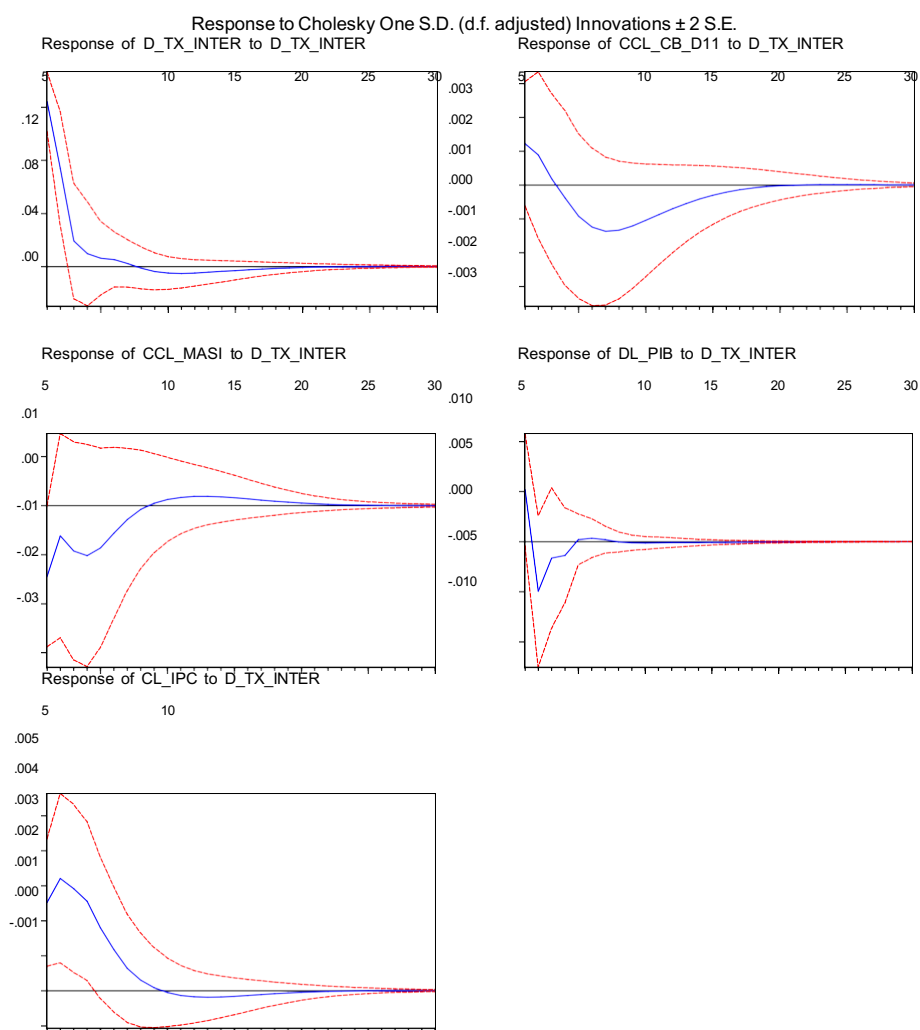
Additional estimation details and robustness checks are available upon request.

4. RESULTS AND DISCUSSION

This section presents the results obtained from the impulse response analysis following a monetary policy shock, proxied by an increase in the interbank interest rate. As shown in Figure 1, a contractionary monetary policy shock leads to a decline in bank credit and output.

Figure 1: *Impulse Response Functions Following a Monetary Policy Shock*

Source: Author's calculations



The impulse response analysis indicates that a contractionary monetary policy shock leads to a decline in bank credit, confirming the presence of a credit channel in the Moroccan economy. The negative response to credit suggests that tighter monetary conditions reduce the availability of bank lending, which is consistent with the dominance of bank-based financing. Regarding the asset price channel, the response of the MASI index shows a negative but relatively weak and short-lived effect. This finding suggests that the asset price channel plays a limited role in the transmission of monetary policy, which can be explained by the relatively shallow development of the financial markets in Morocco. The response of real GDP is negative in the short term, indicating that monetary tightening has a contractionary effect on economic activity. However, this effect appears to be temporary and dissipates relatively quickly, suggesting limited persistence of monetary policy shocks. The response of inflation exhibits a temporary increase following a monetary tightening, before gradually declining. This pattern may reflect a price puzzle, a phenomenon commonly observed in VAR models, where prices initially respond positively to a contractionary monetary policy shock. This result may be attributed to model specification issues or the omission of relevant variables capturing expectations or supply shocks. Overall, the results suggest that the credit channel is the most relevant transmission mechanism in the Moroccan context, while the asset price channel appears to be weaker. These findings are consistent with the structural characteristics of the Moroccan economy, particularly the dominance of bank financing and the limited depth of financial markets.

5. CONCLUSION

This paper investigated the transmission mechanisms of monetary policy in Morocco, with a particular focus on the credit channel and the asset price channel. Using a Vector Autoregression (VAR) framework and impulse response analysis, the study provides empirical evidence on how monetary policy shocks affect key macroeconomic and financial variables. The results indicate that the credit channel plays a significant role in the Moroccan economy. A contractionary monetary policy shock leads to a decline in bank lending, confirming the importance of the banking sector in the transmission process. In contrast, the asset price channel appears to be relatively weak, as reflected by the limited and short-lived response of the MASI index.

The analysis also shows that monetary policy has a negative but temporary effect on real economic activity, while the response of inflation reveals a short-term increase following a tightening shock, consistent with the presence of a price puzzle commonly observed in VAR models.

Overall, these findings highlight that the effectiveness of monetary policy in Morocco is shaped by structural characteristics, including the dominance of bank-based financing and the limited depth of financial markets.

However, this study has several limitations. The use of a reduced-form VAR model does not allow for the identification of structural shocks, which limits the interpretation of the results. Future research could extend this analysis by employing

Structural VAR (SVAR) models and incorporating additional variables to better capture expectations and external shocks. Despite these limitations, this paper contributes to the empirical literature on monetary policy transmission in emerging economies and provides insights that may be relevant for policymakers aiming to enhance the effectiveness of monetary policy in Morocco.

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