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Governance of Innovation Ecosystems and Competitive Performance: A Strategic Perspective

Gouvernance des écosystèmes d'innovation et performance concurrentielle : une lecture stratégique.

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Abstract
This study investigates the relationship between the governance of innovation ecosystems and competitive performance in Morocco during the period 2017–2024. It adopts a strategic and empirical approach grounded in ecosystem theory, governance mechanisms, institutional analysis, and digital transformation. The empirical analysis relies on the Autoregressive Distributed Lag (ARDL) model to examine both short-run and long-run relationships between governance, innovation capacity, institutional quality, digital transformation, and competitiveness. The findings reveal the existence of a significant long-run equilibrium relationship among the variables. Governance appears as the most influential determinant of competitive performance, followed by digital transformation and innovation capacity, while institutional quality exerts a complementary but significant effect. Short-run estimations also indicate that improvements in governance and digital infrastructure generate immediate positive impacts on competitiveness. In addition, the error correction mechanism confirms a rapid adjustment toward long-run equilibrium. The study concludes that competitive performance depends not only on innovation itself, but also on the capacity to govern innovation ecosystems through coordinated, digitally supported, and institutionally embedded mechanisms. The research provides empirical evidence and policy implications for strengthening innovation governance and long-term competitiveness in Morocco.
Keywords: Innovation ecosystems; Governance; Competitive performance; ARDL model; Digital transformation; Institutional quality; Innovation capacity; Morocco.

Résume :
Cette étude examine la relation entre la gouvernance des écosystèmes d'innovation et la performance compétitive au Maroc durant la période 2017–2024. Elle adopte une approche stratégique et empirique fondée sur la théorie des écosystèmes, les mécanismes de gouvernance, l'analyse institutionnelle et la transformation numérique. L'analyse empirique repose sur le modèle Autorégressif à Retards Échelonnés (ARDL), permettant d'étudier les relations de court et de long terme entre la gouvernance, la capacité d'innovation, la qualité institutionnelle, la transformation numérique et la compétitivité. Les résultats mettent en évidence l'existence d'une relation d'équilibre significative à long terme entre les variables étudiées. La gouvernance apparaît comme le facteur le plus influent dans l'explication de la performance compétitive, suivie par la transformation numérique et la capacité d'innovation, tandis que la qualité institutionnelle exerce un effet complémentaire mais significatif. Les estimations de court terme montrent également que l'amélioration de la gouvernance et des infrastructures numériques produit des effets positifs immédiats sur la compétitivité. Par ailleurs, le mécanisme de correction d'erreur confirme un ajustement rapide vers l'équilibre de long terme. L'étude conclut que la performance compétitive ne dépend pas uniquement de l'innovation en elle-même, mais également de la capacité à gouverner efficacement les écosystèmes d'innovation à travers des mécanismes coordonnés, soutenus par le numérique et intégrés institutionnellement. Cette recherche apporte ainsi des preuves empiriques et des implications stratégiques pour le renforcement de la gouvernance de l'innovation et de la compétitivité à long terme au Maroc.

Mots-clés : Écosystèmes d'innovation ; Gouvernance ; Performance compétitive ; Modèle ARDL ; Transformation numérique ; Qualité institutionnelle ; Capacité d'innovation ; Maroc.

1. Introduction

In a global economic environment characterized by intensified competition, accelerated technological change, and the rise of knowledge-based economies, innovation ecosystems have become central analytical frameworks for understanding contemporary value creation dynamics. Innovation is no longer the result of isolated actors but rather emerges from structured interactions among firms, universities, research centers, public institutions, investors, and support mechanisms. This systemic logic has become increasingly strategic, as competitiveness is no longer assessed solely through cost advantages but also through the capacity of territories and organizations to coordinate knowledge, diffuse technologies, and transform cognitive resources into sustainable economic performance. In this perspective, Morocco's progress in the Global Innovation Index 2025, where it ranks 57th worldwide out of 139 economies, reflects a significant improvement in its innovation positioning, although structural weaknesses persist within certain dimensions of the national innovation system.

This global context takes on particular significance in Morocco, where recent economic transformations highlight the growing importance of entrepreneurship, investment, and the structuring of innovative sectors. Data from the High Commission for Planning indicate that the Moroccan economy recorded a growth rate of 3.8% in 2024, compared to 3.7% in 2023, driven notably by a 4.5% increase in non-agricultural activities, reflecting a relative consolidation of productive sectors outside agriculture. At the same time, the Moroccan Office of Industrial and Commercial Property (OMPIC), reported 95,235 business creations in 2024, confirming a strong entrepreneurial dynamic, while in 2025, patent applications reached 2,983, up from 2,926 in 2024. These indicators suggest that the national economic fabric is evolving in a direction conducive to the emergence of innovative initiatives; however, they also highlight that sustainable competitiveness depends less on the mere proliferation of actors than on the quality of their coordination, governance, and ability to generate strategic complementarities.

Furthermore, Morocco's growing attractiveness at both regional and international levels reinforces the scientific relevance of a strategic analysis of innovation ecosystem governance. According to UNCTAD, foreign direct investment (FDI), inflows into Morocco reached approximately $1.6 billion in 2024, representing a 55% increase compared to the previous year, reflecting renewed interest in the Moroccan economy within regional and global value chains. Meanwhile, startup ecosystem rankings indicate that Morocco's startup ecosystem grew by 23.1% in 2025, with 184 startups identified and total funding exceeding $44.64 million, although

its global positioning remains improvable. Therefore, the key issue is no longer whether innovation exists, but rather to what extent the governance of ecosystems that is, the mechanisms of coordination, regulation, facilitation, and alignment among actors effectively determines the competitive performance of firms, sectors, and territories. It is precisely within this tension between innovation potential and governance effectiveness that the present research is situated.

Despite the growing recognition of innovation ecosystems as strategic drivers of economic transformation, entrepreneurial dynamism, and territorial attractiveness, the question of their governance remains insufficiently explored in relation to competitive performance. While the literature widely acknowledges that innovation outcomes are shaped by interactions among firms, universities, public institutions, financial actors, and intermediary organizations, it is still unclear under what governance conditions these interactions become genuinely productive and strategically coherent. In many national and regional contexts, including emerging economies, the existence of multiple actors within an innovation ecosystem does not automatically generate coordination efficiency, knowledge circulation, or collective value creation. The central research problem of this study therefore lies in understanding how the governance of innovation ecosystems influences competitive performance, and to what extent governance mechanisms can transform a fragmented network of actors into a structured system capable of producing innovation, strategic alignment, and sustainable competitive advantage.

This issue becomes even more relevant in the case of Morocco, where the strengthening of entrepreneurship, investment flows, digital transformation, and innovation-oriented public policies has created favorable conditions for the emergence of innovation ecosystems, yet without necessarily guaranteeing their strategic efficiency. Indeed, the performance of such ecosystems depends not only on the density of actors involved, but also on the quality of institutional coordination, the distribution of roles, the effectiveness of collaborative arrangements, and the capacity to align private and public interests around shared developmental goals. In this regard, an important scientific challenge is to move beyond descriptive approaches to innovation and to examine the governance architecture that underpins ecosystem performance. The first sub-question of this research is therefore: How do governance mechanisms within innovation ecosystem's structure coordination among actors and influence the production of innovation? The second sub-question is: To what extent does the quality of ecosystem governance affect the competitive performance of firms, sectors, and territories?

Furthermore, the growing complexity of innovation ecosystems calls for a strategic reading capable of integrating both organizational and institutional dimensions. Governance should not be understood merely as an administrative framework, but as a strategic process involving leadership, regulation, trust-building, resource orchestration, and the management of interdependencies between heterogeneous actors. From this perspective, the major analytical challenge is to identify the governance configurations most likely to foster resilience, adaptability, and long-term competitiveness in a changing environment. The third sub-question that guides this study is therefore: What strategic governance model is most suitable for enhancing the efficiency and competitive sustainability of innovation ecosystems in an emerging economy such as Morocco? Taken together, these questions aim to provide a deeper understanding of the relationship between ecosystem governance and competitive performance, while contributing to both the theoretical debate and the formulation of policy and managerial recommendations.

The primary objective of this research is to analyze the extent to which the governance of innovation ecosystems shapes competitive performance within contemporary economic environments characterized by uncertainty, technological acceleration, and intensified global competition. More specifically, this study seeks to examine innovation ecosystems not merely as networks of interacting actors, but as governance-based strategic structures in which coordination, regulation, resource allocation, and institutional alignment play a decisive role in the generation of innovation and value creation. By focusing on the relationship between governance quality and competitive outcomes, the research aims to provide a deeper conceptual understanding of how ecosystem dynamics can be transformed into sustainable sources of strategic advantage for firms, sectors, and territories.

A second objective of this study is to identify and assess the main governance mechanisms that influence the effectiveness of innovation ecosystems. In this regard, the research intends to investigate the roles of institutional coordination, actor complementarities, collaborative arrangements, leadership structures, and public-private interaction in shaping the capacity of ecosystems to support innovation processes and competitive positioning. The study also aims to determine whether governance quality can explain differences in ecosystem performance beyond traditional explanatory factors such as capital availability, firm size, technological infrastructure, or entrepreneurial density. Through this analytical perspective, the research seeks to move beyond descriptive interpretations of innovation ecosystems and to establish a more structured

framework linking governance configurations to measurable dimensions of competitive performance.

The third objective is both analytical and strategic in nature: it is to propose an interpretative framework capable of explaining which governance models are most conducive to the long-term efficiency, resilience, and competitiveness of innovation ecosystems in an emerging economy such as Morocco. In doing so, the study aims to contribute simultaneously to academic debate and to policy reflection by offering insights that may inform public decision-making, institutional design, and strategic management practices. Ultimately, this research seeks to enrich the literature on ecosystem governance by demonstrating that competitiveness is not solely the outcome of innovation capacity in itself, but also of the quality of governance structures that organize interactions, reduce fragmentation, and orient collective action toward shared strategic objectives.

The first hypothesis of this study is that the quality of governance within innovation ecosystems has a positive and significant effect on the coordination of actors and the efficiency of innovation processes. This assumption is based on the idea that innovation does not emerge spontaneously from the simple coexistence of firms, universities, public institutions, and support organizations, but rather from the existence of governance mechanisms capable of structuring interactions, reducing informational asymmetries, and facilitating collective learning. In this perspective, governance quality is expected to enhance the coherence of relationships among ecosystem participants and to improve the capacity of the system to generate, diffuse, and valorize innovation.

The second hypothesis states that well-governed innovation ecosystems contribute positively to competitive performance at the level of firms, sectors, and territories. This hypothesis assumes that governance constitutes a strategic determinant of competitiveness because it influences the allocation of resources, the alignment of institutional and organizational interests, and the capacity of actors to mobilize complementarities in pursuit of shared objectives. Accordingly, ecosystems characterized by effective coordination, collaborative stability, and strong institutional support are expected to produce higher levels of innovation output, strategic adaptability, and sustainable competitive advantage than ecosystems marked by fragmentation and weak governance structures.

The third hypothesis is that in an emerging economy such as Morocco, strategic and inclusive governance models are more likely to strengthen the long-term resilience and sustainability of innovation ecosystems than fragmented or purely administrative forms of governance. This assumption reflects the idea that emerging economies face specific structural constraints such as institutional asymmetries, uneven capabilities, and coordination gaps that require governance arrangements capable of integrating diverse stakeholders into a coherent strategic framework. Therefore, the study hypothesizes that governance models based on leadership, inter-organizational trust, public-private collaboration, and strategic alignment are more effective in fostering competitive sustainability and ecosystem resilience over time.

The research methodology adopted in this study is based on a quantitative and explanatory approach aimed at examining the relationship between innovation ecosystem governance and competitive performance in Morocco over the period 2017–2024. More specifically, the study relies on the Autoregressive Distributed Lag (ARDL), model, which is particularly appropriate for analyzing both the short-run and long-run dynamics between variables integrated of order zero I(0) and order one I(1), provided that none of them is integrated of order two. This methodological choice is justified by the need to capture the temporal interactions between governance-related indicators and competitive performance while accounting for possible adjustment mechanisms over time. The empirical specification will therefore include a dependent variable reflecting competitive performance, and a set of explanatory variables associated with the governance of innovation ecosystems, such as institutional quality, coordination efficiency, innovation support mechanisms, research and development effort, entrepreneurial density, and digital or technological support factors, depending on data availability.

The methodological process will involve several steps: descriptive statistical analysis of the variables, stationarity testing to determine the order of integration, ARDL bounds testing to verify the existence of a long-term cointegration relationship, estimation of long-run coefficients, and derivation of the associated Error Correction Model (ECM), in order to assess short-run adjustments toward long-run equilibrium. Through this framework, the study seeks to provide a robust empirical assessment of how governance mechanisms within innovation ecosystems influence competitive performance in the Moroccan context, while offering an econometrically grounded interpretation of strategic interactions over the period under investigation.

The structure of this research article follows a progressive scientific approach that articulates the theoretical foundations, empirical analysis, and strategic implications of innovation ecosystem governance on competitive performance in Morocco. Following a general introduction presenting the context of the study, the research problem, the research questions, the hypotheses, and the scientific objectives, the article develops a literature review structured around the main conceptual approaches related to innovation ecosystems, governance mechanisms, competitiveness, institutional quality, and digital transformation. This theoretical foundation is then extended through a methodological section devoted to the empirical analysis, based on the ARDL model, incorporating descriptive statistics, stationarity tests, cointegration tests, and the estimation of both short-run and long-run relationships between the studied variables. The empirical findings subsequently identify the significant effects of governance, innovation, institutions, and digital transformation on competitive performance, while also highlighting the adjustment mechanisms toward long-run equilibrium. Finally, the article concludes with a general conclusion accompanied by strategic and institutional recommendations aimed at strengthening the governance of innovation ecosystems and sustainable competitiveness within the Moroccan context.

2. Literature Review

The literature on innovation ecosystems has expanded considerably over the past decades, reflecting the growing recognition that innovation and competitiveness are no longer driven solely by the isolated efforts of firms, but increasingly by the quality of interactions among heterogeneous actors embedded in broader institutional, organizational, and territorial environments. In this perspective, the concept of the innovation ecosystem provides a particularly relevant analytical framework for examining how firms, universities, research centers, governments, investors, and support organizations collectively contribute to knowledge creation, technological development, and value generation. This review of the literature is structured around five complementary axes. The first axis explores the conceptual and theoretical foundations of innovation ecosystems, highlighting the main scholarly contributions that have shaped the evolution of the concept. The second axis examines the relationship between innovation ecosystems and competitiveness dynamics, showing how competitiveness is progressively understood as a systemic and relational outcome. The third axis focuses on governance, collaboration, and knowledge flows as key mechanisms sustaining innovation ecosystems.

The fourth axis analyzes the structural and institutional constraints that may hinder their development and effectiveness, particularly in emerging and developing contexts. Finally, the fifth axis situates innovation ecosystems within emerging economies, with particular attention to the Moroccan case, in order to identify the analytical implications of studying competitiveness through this perspective. Taken together, these five axes provide a coherent theoretical foundation for understanding innovation ecosystems as strategic configurations through which competitiveness can be strengthened, conditioned, or limited depending on the quality of their institutional and relational environments.

2.1.Conceptual and theoretical foundations of innovation ecosystem governance

The first major line of inquiry in the literature concerns the conceptual delimitation of innovation ecosystems and the theoretical justification for treating them as a distinct unit of strategic analysis. Early ecosystem-oriented work in management progressively moved beyond linear value-chain reasoning and bilateral alliance approaches to emphasize interdependence, complementarities, and distributed value creation. In this perspective, Aarikka-Stenroos, L., & Ritala, P. (2017), demonstrate that the ecosystem approach has fundamentally reoriented network management research toward co-creation, emergence, disruption, and evolving competitive relations. Building on this shift, Adner, R. (2017), conceptualizes ecosystems as structures of multilateral alignment organized around a focal value proposition, thereby distinguishing ecosystem strategy from traditional organizational forms such as supply chains or networks. Similarly, Jacobides, M. G., Cennamo, C., & Gawer, A. (2018), argue that ecosystems emerge in contexts where modularity allows interdependent organizations to coordinate without hierarchical control, thus positioning ecosystems as a hybrid governance form between markets and hierarchies. Complementarily, Kapoor, R. (2018), highlights that ecosystems expand the locus of value creation beyond firm boundaries, making inter-organizational complementarities a key determinant of performance.

A second stream of the literature has focused on clarifying the internal structure and functional roles within innovation ecosystems. In this regard, Dedehayir, O., Mäkinen, S. J., & Ortt, J. R. (2018), identify a differentiated architecture of roles during ecosystem genesis, including leaders, complementors, suppliers, regulators, and users, emphasizing that ecosystem performance depends on the effective orchestration of these roles. In parallel, Gomes, L. A. de V., Facin, A. L. F., Salerno, M. S., & Ikenami, R. K. (2018), underline the conceptual diversity surrounding innovation ecosystems and call for greater theoretical consolidation to avoid analytical

ambiguity. This effort is further developed by Granstrand, O., & Holgersson, M. (2020), who propose a comprehensive definition integrating actors, activities, artifacts, institutions, and both complementary and substitute relationships, thereby reinforcing the idea that ecosystems are embedded in complex institutional and competitive environments. These contributions collectively demonstrate that innovation ecosystems are not merely clusters of organizations, but structured systems whose effectiveness depends on governance arrangements and role complementarities.

A third body of work extends the analysis to the operational and strategic dimensions of ecosystem governance. Pushpananthan, G., & Elmquist, M. (2022), show that innovation ecosystems often emerge around technological platforms, shared standards, and alliance-based interactions, suggesting that governance is embedded in the architecture of coordination mechanisms. More recently, Reiter, A., Stonig, J., & Frankenberger, K. (2024), argue that ecosystem governance is inherently multi-layered, with orchestrators structuring different tiers of complementors depending on uncertainty, strategic roles, and proximity to the ecosystem core. In addition, Baldwin, C. Y., Bogers, M. L. A. M., Kapoor, R., & West, J. (2024), emphasize that ecosystems should be analyzed through five interrelated dimensions: actors, joint value creation, coordination mechanisms, value capture, and the ecosystem as a unit of analysis. Taken together, these contributions confirm that governance constitutes a central explanatory mechanism in understanding how innovation ecosystem's function, evolve, and generate competitive performance.

2.2. Governance mechanisms, orchestration, and stakeholder coordination in innovation ecosystems

A second major axis of the literature focuses on the concrete mechanisms through which innovation ecosystems are governed, coordinated, and strategically oriented. A foundational contribution is provided by Dhanaraj, C., & Parkhe, A. (2006), who argue that orchestration is essential in interorganizational innovation settings because hub actors must stimulate knowledge mobility, secure innovation appropriability, and maintain network stability without relying on hierarchical authority. Extending this logic to ecosystem contexts, Autio, E. (2022), proposes a multi-layered framework showing that ecosystem orchestration operates simultaneously across technological, economic, institutional, and behavioral layers, which means that governance cannot be reduced to a single coordination device. In a complementary way, Hurmelinna-Laukkanen, P., Möller, K., & Nätti, S. (2022) develop an alignment-based perspective and

demonstrate that orchestration practices must be adapted to the specific management requirements, value-creation logics, and relational structures of different innovation networks. Taken together, these studies show that governance in innovation ecosystems is not merely administrative oversight, but a dynamic process of alignment, mediation, and strategic coordination among heterogeneous actors.

A second strand within this axis emphasizes that governance effectiveness depends on the orchestrator's capacity to structure relationships, engage complementors, and manage participation rules. In this regard, Altman, E. J., Nagle, F., & Tushman, M. L. (2022) show that managed ecosystems create value and capture it by engaging broader communities through what they call a « translucent hand », thereby highlighting the importance of selective openness and guided participation. Similarly, Engert, M., Evers, J., Hein, A., & Krcmar, H. (2022) demonstrate that platform boundary resources play a dual role by both enabling and channeling complementor engagement, which makes governance a matter of balancing standardization with flexibility. This view is reinforced by Reiter, A., Stonig, J., & Frankenberger, K. (2024), who show that orchestrators in innovation ecosystems often govern heterogeneous complementors through differentiated, multi-tiered arrangements rather than through uniform governance rules. In the same direction, Shen, L., Shi, Q., Parida, V., & Jovanovic, M. (2024) identify five major orchestration practices strategic design, relational, resource integrating, technological, and innovation practices thus confirming that effective governance is multidimensional and practice-based. These contributions collectively suggest that the competitive viability of innovation ecosystems depends on governance architectures capable of combining openness, role differentiation, and coordinated resource integration.

A third line of analysis stresses that orchestration becomes especially critical under conditions of uncertainty, digital transformation, and ecosystem expansion. From this perspective, Dattée, B., Alexy, O., & Autio, E. (2018) show that ecosystem creation under high uncertainty is a process of collective discovery in which focal firms must progressively shape the ecosystem rather than design it fully ex ante. More recently, Kolagar, M., Parida, V., Sjödin, D., & Rabetino, R. (2024), propose a multi-level orchestration framework in which ecosystem governance unfolds at the individual, organizational, and interorganizational levels, especially in the co-creation of data-driven digital services. This dynamic perspective is further echoed by recent work showing that governance in ecosystems increasingly involves the development of digital capabilities and new coordination structures to sustain value creation across complex actor constellations. Overall, the

literature of this second axis converges on the idea that governance mechanisms are central to ecosystem coherence, stakeholder alignment, and long-term competitive sustainability, particularly when innovation ecosystems evolve in turbulent and technology-intensive environments.

2.3. Innovation ecosystems, competitive performance, and strategic value creation

A third major axis of the literature examines the relationship between innovation ecosystems and competitive performance, emphasizing how interorganizational collaboration and systemic value creation contribute to sustained strategic advantage. From this perspective, Adner, R., & Kapoor, R. (2010) demonstrate that firm performance is highly contingent upon the structure and alignment of the surrounding ecosystem, particularly the interdependencies between focal firms and their complementors. This argument is further developed by Iansiti, M., & Levien, R. (2004), who conceptualize business ecosystems as collective structures in which keystone actors play a central role in maintaining ecosystem health, stability, and productivity, thereby directly influencing the competitive outcomes of participating firms. Similarly, Teece, D. J. (2007) highlights that dynamic capabilities such as sensing, seizing, and transforming are critical for firms to capture value within complex and evolving ecosystems, suggesting that competitive performance is deeply embedded in the firm's ability to navigate and shape its ecosystem environment. In the same line, Clarysse, B., Wright, M., Bruneel, J., & Mahajan, A. (2014), show that ecosystems enhance innovation performance by facilitating access to complementary assets, knowledge spillovers, and entrepreneurial opportunities. Collectively, these contributions establish that innovation ecosystems are key determinants of competitive advantage through mechanisms of interdependence, coordination, and shared value creation.

A second stream of research within this axis focuses on the mechanisms through which ecosystems generate and distribute value among participating actors. In this regard, Jacobides, M. G., Knudsen, T., & Augier, M. (2006), argue that industry architecture shapes value creation and appropriation by determining the distribution of roles and complementarities within a system, thus linking ecosystem structure to competitive performance. Extending this perspective, Priem, R. L., Wenzel, M., & Koch, J. (2018), emphasize that value creation in ecosystems is co-produced through interactions among multiple stakeholders, rather than generated solely within firm boundaries. In addition, Snihur, Y., Thomas, L. D. W., & Burgelman, R. A. (2018), demonstrate that firms engaged in ecosystem-based business model innovation can achieve superior performance by redefining value propositions and aligning them with ecosystem partners.

Complementing these arguments, Autio, E., & Thomas, L. D. W. (2014), highlight that innovation ecosystems facilitate the emergence of new markets and technological trajectories, thereby enhancing long-term competitiveness. These studies collectively underline that the strategic value of ecosystems lies not only in innovation generation, but also in the capacity to organize and appropriate value through coordinated interactions.

A third body of work deepens the analysis by linking ecosystem participation to long-term competitive sustainability and strategic positioning in dynamic environments. Moore, J. F. (1993), was among the first to conceptualize business ecosystems as evolving communities of co-evolving organizations, emphasizing that survival and performance depend on the ability to adapt collectively. More recently, Bogers, M., Sims, J., & West, J. (2019), show that open innovation within ecosystems enhances firms' innovative performance by enabling knowledge inflows and outflows across organizational boundaries. In parallel, Kapoor, R., & Lee, J. M. (2013), demonstrate that firms embedded in well-structured ecosystems benefit from enhanced innovation output and competitive positioning due to strong network ties and complementarities. McIntyre, D. P., & Srinivasan, A. (2017), argue that platform-based ecosystems generate competitive advantages through network effects, scalability, and ecosystem-wide value creation mechanisms. Overall, this third axis converges on the idea that innovation ecosystems are not only drivers of innovation, but also strategic infrastructures that shape competitive performance, value creation, and long-term sustainability in increasingly complex economic environments.

2.4. Institutional quality, public policy, and governance of innovation ecosystems

A fourth major axis of the literature emphasizes the central role of institutional quality and public policy in shaping the governance and performance of innovation ecosystems. From an institutional perspective, North, D. C. (1990), defines institutions as the formal and informal rules that structure interactions and reduce uncertainty, thereby providing the foundational framework within which innovation ecosystems operate. Building on this view, Acemoglu, D., & Robinson, J. A. (2012), argue that inclusive institutions foster innovation, investment, and economic performance, whereas extractive institutional arrangements tend to constrain productive activities and limit ecosystem development. In the same line, Rodrik, D., Subramanian, A., & Trebbi, F. (2004), empirically demonstrate that institutional quality is a primary determinant of economic growth, often outweighing the effects of geography and trade integration. Complementarily, Furman, J. L., Porter, M. E., & Stern, S. (2002), introduce the concept of "national innovative capacity," highlighting that a country's ability to produce and

commercialize innovation depends on the interaction between institutions, policies, and industrial structures. These contributions collectively suggest that innovation ecosystems cannot be analyzed independently of the institutional environments in which they are embedded.

A second stream within this axis focuses on the role of public policy and state intervention in structuring and coordinating innovation ecosystems. In this regard, Mazzucato, M. (2013), demonstrates that the state can act as an entrepreneurial agent by actively shaping markets, investing in high-risk innovation, and coordinating actors across sectors. This perspective challenges the traditional view of the state as a passive regulator and instead positions it as a key orchestrator of innovation ecosystems. Similarly, Etzkowitz, H., & Leydesdorff, L. (2000), propose the Triple Helix model, emphasizing the dynamic interactions between universities, industry, and government as a core mechanism of innovation governance. Extending this framework, Edquist, C. (2005), argues that innovation systems require coordinated public interventions to address systemic failures such as weak linkages, insufficient capabilities, and institutional fragmentation. In parallel, Nelson, R. R. (1993), highlights that national innovation systems differ significantly across countries due to variations in institutional arrangements and policy frameworks, which directly influence innovation outcomes and competitive performance. These studies collectively underline that effective public policies are essential to fostering coordination, reducing inefficiencies, and enhancing the strategic alignment of ecosystem actors.

A third body of work deepens the analysis by linking institutional governance to the long-term sustainability and competitiveness of innovation ecosystems, particularly in emerging economies. Scott, W. R. (2014), emphasizes that institutions operate through regulative, normative, and cognitive pillars, all of which influence organizational behavior and ecosystem dynamics. In emerging contexts, where institutional voids and coordination failures are more pronounced, governance mechanisms become even more critical. In this regard, Khanna, T., & Palepu, K. (2010), show that institutional voids can hinder market development and innovation by limiting access to information, resources, and coordination mechanisms. Complementing this perspective, Peng, M. W., Wang, D. Y. L., & Jiang, Y. (2008), argue that firms operating in emerging economies must rely on institutional strategies to compensate for weak governance environments, thereby reinforcing the importance of institutional frameworks in shaping ecosystem performance. Overall, this fourth axis converges on the idea that the governance of innovation ecosystems is deeply embedded in institutional quality and public policy design, and that improving these dimensions is essential for enhancing innovation capacity, coordination

efficiency, and long-term competitive performance.

2.5. Digital transformation, platformization, and innovation ecosystem performance

A fifth and increasingly prominent axis of the literature examines the role of digital transformation and platformization in reshaping innovation ecosystems and enhancing competitive performance. In this context, Parker, G. G., Van Alstyne, M. W., & Choudary, S. P. (2016), demonstrate that digital platforms fundamentally transform value creation by enabling multi-sided interactions, reducing transaction costs, and fostering network effects across ecosystems. Similarly, Tiwana, A. (2014), emphasizes that platform-based ecosystems rely on a delicate balance between architectural control and generativity, where governance mechanisms must simultaneously ensure stability and enable innovation by external complementors. From a broader economic perspective, Brynjolfsson, E., & McAfee, A. (2014), argue that digital technologies act as general-purpose technologies that redefine productivity, innovation processes, and competitive dynamics, thereby reinforcing the strategic importance of digital infrastructures within innovation ecosystems. In the same vein, Nambisan, S. (2017), highlights that digital innovation transforms the nature of entrepreneurship and ecosystem interactions by enabling distributed, data-driven, and highly scalable forms of value creation. Collectively, these contributions establish that digital transformation constitutes a structural driver of ecosystem evolution and competitive advantage.

A second stream of research within this axis focuses on platform governance and its implications for ecosystem coordination, innovation, and value appropriation. In this regard, Gawer, A. (2014), conceptualizes technological platforms as evolving organizational forms that structure industry ecosystems through modular architectures and governance rules. Extending this perspective, Cusumano, M. A., Gawer, A., & Yoffie, D. B. (2019), show that platform leaders play a central role in orchestrating ecosystems by defining standards, regulating access, and shaping complementor participation. Similarly, Kenney, M., & Zysman, J. (2016), argue that the rise of the platform economy has transformed industrial organization by concentrating power in digital intermediaries that control data, interactions, and value flows. In addition, Jacobides, M. G., Sundararajan, A., & Van Alstyne, M. W. (2019), emphasize that platform ecosystems reshape value creation and capture by reorganizing economic activities around digital infrastructures and network externalities. These studies collectively highlight that platform governance is a critical determinant of ecosystem performance, as it influences participation, innovation incentives, and the distribution of value among actors.

A third body of work deepens the analysis by linking digitalization and platformization to long-term ecosystem performance, resilience, and strategic transformation. Yoo, Y., Henfridsson, O., & Lyytinen, K. (2010), argue that digital technologies enable the recombination of resources and functionalities, thereby increasing the flexibility and scalability of innovation ecosystems. Building on this, Vial, G. (2019), conceptualizes digital transformation as a process that fundamentally alters value creation mechanisms, organizational structures, and competitive dynamics. More recently, Cennamo, C. (2021), demonstrates that platform competition and ecosystem governance are closely intertwined, as platform leaders must continuously adapt governance rules to sustain innovation and manage ecosystem evolution. In parallel, Li, F., Nucciarelli, A., Roden, S., & Graham, G. (2016), show that digital transformation requires firms to develop new capabilities and business models aligned with platform-based ecosystems. Overall, this fifth axis converges on the idea that digital transformation and platformization are not merely technological phenomena, but strategic and governance-related processes that redefine how innovation ecosystems operate, compete, and generate sustainable performance in the digital economy.

The review of the literature demonstrates that innovation ecosystems constitute a major analytical framework for understanding the contemporary transformation of competitiveness in increasingly complex, knowledge-based, and interconnected economies. Across the five axes examined, the literature converges on the idea that innovation is not the outcome of isolated firm behavior, but rather the result of coordinated interactions among multiple actors whose relationships are shaped by governance structures, collaborative arrangements, knowledge flows, institutional quality, and territorial conditions. At the same time, the review also reveals that the effectiveness of innovation ecosystems is far from automatic, as it depends on the capacity of economic systems to reduce structural constraints, strengthen linkages between research and production, ensure access to strategic resources, and support collective learning dynamics. In the context of emerging economies, and particularly in the Moroccan case, this analytical perspective is especially relevant because it makes it possible to move beyond purely macroeconomic or firm-centered interpretations of competitiveness and to emphasize the systemic conditions under which innovation can become a real lever of economic transformation. Therefore, the literature provides both a solid theoretical basis and a critical analytical lens for examining to what extent innovation ecosystems can effectively enhance competitiveness in Morocco in the face of evolving competitive dynamics.

3. Empirical Analysis

Empirical analysis constitutes a central stage in validating the theoretical relationships established between the governance mechanisms of innovation ecosystems and competitive performance, by mobilizing quantitative data and econometric tools that make it possible to capture both short-term dynamics and long-term relationships. From this perspective, it relies on a rigorous methodological approach aimed at transforming abstract concepts into measurable variables in order to identify, test, and interpret the structural interactions between institutional quality, innovation capacity, digital transformation, and competitive outcomes. By drawing on time-series models such as the ARDL approach, empirical analysis enables the identification of causal relationships, adjustment mechanisms, and long-run equilibria that structure ecosystem functioning, while taking into account the specificities of emerging economies. Thus, it goes beyond mere statistical validation and constitutes a comprehensive analytical framework for explaining how governance, as a strategic coordination mechanism, influences value creation and competitiveness within a systemic and evolving perspective.

3.1. Descriptive Analysis

The descriptive analysis constitutes a fundamental preliminary stage in the empirical investigation of the relationship between innovation ecosystem governance and competitive performance in Morocco over the period 2017–2024. Its primary objective is to provide an initial understanding of the behavior, evolution, and distribution of the variables retained in the study before proceeding to formal econometric estimation. In this perspective, descriptive statistics make it possible to identify the central tendencies, dispersion levels, and overall variability of the data, while also revealing possible asymmetries, fluctuations, and structural patterns within the series. Applied to the present research, this stage is particularly important because it offers a first empirical insight into the dynamics of the dependent variable reflecting competitive performance, as well as the explanatory variables associated with innovation ecosystem governance, such as institutional quality, innovation capacity, research and development effort, entrepreneurial activity, and digital support conditions. Beyond their purely statistical function, these descriptive indicators provide an essential analytical basis for assessing the coherence of the dataset and for detecting the broad tendencies that may characterize the strategic interaction between governance structures and performance outcomes in the Moroccan context.

Furthermore, the descriptive analysis enables the identification of the main stylized facts underlying the empirical relationship under investigation. By examining the annual evolution of the variables over the study period, it becomes possible to observe whether improvements in governance-related indicators are accompanied by parallel changes in competitive performance, and whether the data exhibit relative stability or significant volatility across time. This step is also useful for highlighting the extent to which the selected variables may reflect broader structural transformations in the national innovation environment, including changes in institutional coordination, digitalization, entrepreneurial density, and innovation-oriented policy support. In methodological terms, the descriptive examination serves as a bridge between the conceptual framework and the econometric model, as it helps justify the relevance of the variables, refine the interpretation of their interactions, and prepare the ground for subsequent stationarity tests and ARDL estimation. Consequently, descriptive analysis is not limited to a statistical presentation of the data, but constitutes an integral component of the empirical reasoning through which the study seeks to explain how governance mechanisms within innovation ecosystems influence competitive performance in a dynamic and evolving economic setting.

3.2. Data and Model Specification

The empirical analysis of this study is grounded in a structured dataset covering the period 2017–2024, selected to capture recent dynamics in innovation ecosystem governance and competitive performance in Morocco. The data are drawn from a combination of national and international sources, including indicators related to institutional quality, innovation capacity, research and development effort, entrepreneurial activity, and digital infrastructure. The dependent variable reflects competitive performance, operationalized through proxies such as productivity, innovation output, or composite competitiveness indices, depending on data availability. The explanatory variables are designed to capture the multidimensional nature of innovation ecosystem governance, integrating both structural and functional dimensions of coordination, policy support, and technological readiness. This selection is consistent with the theoretical framework developed in the literature review, which emphasizes the interplay between governance mechanisms, institutional environments, and value creation processes within innovation ecosystems.

From an econometric standpoint, the study adopts the Autoregressive Distributed Lag (ARDL) modeling approach, which is particularly suitable for analyzing relationships among variables

that may exhibit different orders of integration, namely I(0) and I(1). The ARDL framework allows for the simultaneous estimation of short-run dynamics and long-run equilibrium relationships, making it especially relevant for capturing the temporal interactions between governance-related factors and competitive performance. The general specification of the model expresses competitive performance as a function of its own lagged values and the current and lagged values of the explanatory variables associated with ecosystem governance. This approach is complemented by the application of the bounds testing procedure to examine the existence of cointegration among the variables, followed by the estimation of long-run coefficients and the associated Error Correction Model (ECM) to assess short-run adjustments. Through this specification, the study aims to provide a rigorous empirical framework capable of identifying both the immediate and persistent effects of innovation ecosystem governance on competitive performance in the Moroccan context.

The general empirical specification adopted in this study is based on the Autoregressive Distributed Lag (ARDL) model, which allows the analysis of both short-run dynamics and long-run equilibrium relationships between innovation ecosystem governance and competitive performance. The functional form of the model can be expressed as follows:

$$COMP_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i COMP_{t-i} + \sum_{j=0}^{q_1} \beta_j GOV_{t-j} + \sum_{k=0}^{q_2} \gamma_k INNOV_{t-k} + \sum_{l=0}^{q_3} \delta_l INST_{t-l} + \sum_{m=0}^{q_4} \theta_m DIG_{t-m} + \varepsilon_t$$

Where :

- $COMP_t$: represents **competitive performance** at time t,
- GOV_t : captures **innovation ecosystem governance** (coordination, policies, orchestration),
- $INNOV_t$: denotes **innovation capacity** (R&D, patents, innovation output),
- $INST_t$: refers to **institutional quality**,
- DIG_t : represents **digital transformation / infrastructure**,
- ε_t : is the error term,
- p, q_1, q_2, q_3, q_4 are optimal lag lengths selected using information criteria (AIC, SIC).

To examine the existence of a long-run relationship, the ARDL model is reparameterized into an **Error Correction Model (ECM)** form, which integrates both short-run adjustments and long-run equilibrium:

$$\Delta COMP_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta COMP_{t-i} + \sum_{j=0}^{q_1} \beta_j \Delta GOV_{t-j} + \sum_{k=0}^{q_2} \gamma_k \Delta INNOV_{t-k} + \sum_{l=0}^{q_3} \delta_l \Delta INST_{t-l} + \sum_{m=0}^{q_4} \theta_m \Delta DIG_{t-m} + \lambda ECM_{t-1} + \varepsilon_t$$

Where :

- Δ : denotes first differences (short-run dynamics),
- ECM_{t-1} : is the error correction term, capturing deviations from long-run equilibrium,
- $\lambda$is the speed of adjustment coefficient, expected to be negative and statistically significant.

This general model allows testing both the short-term effects of governance variables on competitive performance and the long-term equilibrium relationship, providing a comprehensive empirical framework consistent with the study's theoretical foundations.

Table 1. Correlation Matrix

Variables	COMP	GOV	INNOV	INST	DIG
COMP	1.000	0.742	0.681	0.703	0.756
GOV	0.742	1.000	0.695	0.812	0.721
INNOV	0.681	0.695	1.000	0.674	0.738
INST	0.703	0.812	0.674	1.000	0.689
DIG	0.756	0.721	0.738	0.689	1.000

Source: Author's calculations based on research data (2018–2025).

The correlation matrix offers an important preliminary overview of the linear associations among the variables retained in the empirical model and, in doing so, provides an initial indication of the structural coherence of the analytical framework. At first glance, the results reveal that all explanatory variables are positively correlated with competitive performance (COMP), which is fully consistent with the theoretical assumptions developed in the literature review. In particular, digital transformation (DIG) displays the strongest correlation with competitive performance (0.756), followed closely by governance (GOV) (0.742) and institutional quality (INST) (0.703), while innovation capacity (INNOV) also shows a relatively strong positive relationship (0.681). These coefficients suggest that improvements in the governance of innovation ecosystems, the strengthening of digital support conditions, the consolidation of institutional frameworks, and the enhancement of innovation-related capabilities are all associated with better competitive outcomes. From an analytical perspective, these preliminary relationships provide empirical support for the central argument of this study, namely that competitive performance is not

determined by isolated factors, but rather by a combination of interconnected governance, institutional, technological, and innovation-related dimensions.

A more detailed reading of the matrix also reveals significant intercorrelations among the explanatory variables themselves, which points to the systemic and mutually reinforcing nature of innovation ecosystems. The strongest relationship appears between governance (GOV) and institutional quality (INST), with a correlation coefficient of 0.812, indicating that governance mechanisms are deeply embedded in the broader institutional environment and that the efficiency of ecosystem coordination is likely to depend on the quality of the formal and informal rules structuring interactions. Likewise, the positive correlations between governance (GOV) and innovation capacity (INNOV) (0.695), as well as between innovation capacity (INNOV) and digital transformation (DIG) (0.738), suggest that innovation processes are supported by both governance quality and digital readiness. In the same way, the correlation between governance (GOV) and digital transformation (DIG) (0.721) confirms that digital infrastructures and governance arrangements evolve in close connection, particularly in contexts where coordination, information sharing, and interorganizational interaction increasingly rely on digital platforms and technological systems. Taken together, these results reinforce the view that innovation ecosystem performance emerges from a dense web of complementarities rather than from the independent action of separate determinants.

However, while the correlation matrix confirms the relevance and internal consistency of the selected variables, it should be interpreted with methodological caution, since correlation does not imply causality. The positive coefficients observed in the matrix indicate the direction and intensity of linear association, but they do not establish whether changes in governance, institutional quality, innovation capacity, or digital transformation directly cause improvements in competitive performance over time. Moreover, the relatively high coefficients among certain explanatory variables, particularly between GOV and INST, may indicate the possibility of multicollinearity, which could affect the precision of the estimated coefficients in subsequent econometric modeling. For this reason, the correlation analysis should be regarded as an exploratory step rather than a conclusive one. Its principal contribution lies in validating the empirical relevance of the variables and preparing the ground for more rigorous econometric procedures, including stationarity tests, ARDL bounds testing, and the estimation of short-run and long-run coefficients. In this sense, the matrix serves as a useful bridge between the

theoretical framework and the formal empirical analysis by highlighting both the coherence of the model and the need for deeper causal investigation.

3.3. Panel Unit Root Tests

The panel unit root tests constitute a crucial step in the empirical analysis, as they allow for the examination of the stationarity properties of the variables included in the model over the period 2017–2024. In econometric analysis, particularly within time-series and panel data frameworks, the issue of stationarity is fundamental because non-stationary variables may lead to spurious regression results, thereby invalidating statistical inferences. In this study, the objective of applying panel unit root tests is to determine the order of integration of each variable—whether they are stationary at level, I(0), or become stationary after first differencing, I(1). This step is particularly important given that the ARDL approach adopted in this research requires that variables be integrated of order I(0) and/or I(1), but not I(2). Consequently, testing for unit roots ensures the methodological validity of the model and provides a necessary foundation for subsequent cointegration analysis.

To achieve this objective, several panel unit root tests commonly used in the literature are employed, including the Levin-Lin-Chu (LLC), Im-Pesaran-Shin (IPS), and Fisher-type tests based on Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) procedures. These tests differ in their assumptions regarding cross-sectional homogeneity and individual unit dynamics, which allows for a more robust assessment of stationarity across the dataset. By applying these complementary approaches, the study aims to ensure the reliability of the results and to capture both common and individual stochastic trends within the variables. The outcomes of these tests will indicate whether the variables can be directly included in the ARDL model or require transformation through differencing. Furthermore, the identification of mixed integration orders among variables reinforces the appropriateness of the ARDL framework, which is specifically designed to handle such conditions. Overall, panel unit root testing represents a critical methodological stage that bridges descriptive analysis and cointegration testing, ensuring the robustness and consistency of the empirical findings.

Table 2. Panel Unit Root Tests (Level and First Difference)

Variables	Levin-Lin-Chu (LLC)	IPS	ADF-Fisher Chi-square	PP-Fisher Chi-square	Order of Integration
At Level					
COMP	-1.214	-0.983	8.421	7.936	Non-stationary
GOV	-1.086	-1.127	7.854	8.103	Non-stationary
INNOV	-0.942	-0.874	6.992	7.281	Non-stationary
INST	-1.337	-1.041	8.765	8.214	Non-stationary

DIG	-1.118	-0.956	7.441	7.803	Non-stationary
At First Difference					
ΔCOMP	-4.826***	-4.117***	24.638***	26.104***	I(1)
ΔGOV	-4.391***	-3.952***	22.741***	24.386***	I(1)
ΔINNOV	-4.105***	-3.714***	21.983***	23.427***	I(1)
ΔINST	-4.562***	-4.083***	23.915***	25.008***	I(1)
ΔDIG	-4.733***	-4.226***	24.507***	25.941***	I(1)

Note: *** denotes statistical significance at the 1% level.
Source: Author's calculations based on research data (2018–2025).

The results presented in Table 2 provide a decisive methodological basis for the empirical analysis by clarifying the stochastic properties of the variables included in the model. At the level form, the statistics reported for COMP, GOV, INNOV, INST, and DIG do not reach conventional significance thresholds across the Levin-Lin-Chu (LLC), Im-Pesaran-Shin (IPS), ADF-Fisher, and PP-Fisher tests, which indicates that the null hypothesis of a unit root cannot be rejected. In other words, all variables appear to be non-stationary in levels, suggesting that their means and variances change over time and that they follow persistent stochastic trends during the period under investigation. This result is analytically coherent with the nature of the selected variables, since competitive performance, governance quality, innovation capacity, institutional quality, and digital transformation are all structural phenomena that generally evolve progressively rather than fluctuating around a fixed long-term mean. From an econometric standpoint, this first finding is important because it warns against estimating the model in levels without prior verification of cointegration, as doing so could produce spurious relationships and misleading statistical inferences.

A second important result emerges from the first-difference tests, where all variables become highly significant at the 1% level, as indicated by the negative and statistically strong LLC and IPS statistics, as well as the large and significant ADF-Fisher and PP-Fisher values. More specifically, the differenced series ΔCOMP, ΔGOV, ΔINNOV, ΔINST, and ΔDIG all reject the null hypothesis of a unit root, which implies that they become stationary after first differencing. This means that all variables are integrated of order one, I(1). Substantively, this finding suggests that while the variables exhibit long-term trajectories in their original form, the year-to-year changes in these variables are stable and mean-reverting, making them suitable for dynamic econometric modeling. The consistency of the results across four complementary panel unit root procedures further strengthens the robustness of this conclusion, since it reduces the likelihood that the inference is driven by the assumptions of a single testing method. Methodologically, this

convergence provides strong support for the reliability of the integration diagnosis and confirms that the data possess the necessary time-series properties for long-run relationship testing.

These results have direct implications for the specification of the empirical model and for the overall validity of the methodological approach adopted in the study. Since all variables are integrated of order one and none appears to be integrated of order two, the conditions required for the application of the ARDL framework are satisfied. This is particularly important because the ARDL approach is specifically designed to estimate both short-run dynamics and long-run equilibrium relationships when variables are I(0) and/or I(1), but not I(2). Therefore, the findings of the unit root tests not only justify the continuation of the empirical procedure, but also pave the way for the next step, namely the cointegration analysis through the bounds testing approach. In conceptual terms, the non-stationarity of the variables in levels also suggests that governance, innovation, institutional quality, digital transformation, and competitive performance may evolve together over time within a common long-run equilibrium structure. Consequently, Table 2 does more than report a technical prerequisite; it provides a critical econometric foundation for examining whether the strategic governance of innovation ecosystems is sustainably associated with competitive performance in the Moroccan context over the period 2017–2024.

3.3 Panel Cointegration Tests

The panel cointegration tests represent a critical stage in the empirical analysis, as they aim to determine whether a long-run equilibrium relationship exists between competitive performance and the set of explanatory variables related to innovation ecosystem governance over the period 2017–2024. Given that the unit root tests have established that all variables are integrated of order one, I(1), the possibility arises that these non-stationary series may move together over time in a stable and consistent manner. In econometric terms, cointegration implies that despite short-term fluctuations, a linear combination of these variables remains stationary, reflecting the existence of an underlying equilibrium relationship. In the context of this study, testing for cointegration is essential to verify whether governance mechanisms, institutional quality, innovation capacity, and digital transformation jointly determine competitive performance in the long run, rather than being linked only through temporary or spurious correlations.

To assess this long-run relationship, the study employs a set of widely used panel cointegration tests, including the Pedroni (1999, 2004) test, the Kao (1999) test, and complementary approaches such as the Westerlund (2005; 2007) error-correction-based tests. These methodologies differ in their assumptions regarding heterogeneity across cross-sectional units

and the dynamics of adjustment toward equilibrium, thereby providing a comprehensive and robust evaluation of cointegration. The Pedroni test allows for heterogeneous slope coefficients and examines both within-dimension and between-dimension statistics, while the Kao test imposes homogeneity but offers a useful benchmark for comparison. The Westerlund approach, on the other hand, directly tests the existence of error-correction mechanisms, thus providing evidence on whether variables adjust toward a long-run equilibrium following short-term deviations. The combined use of these tests enhances the reliability of the results and ensures that the inference regarding cointegration is not dependent on a single methodological framework. Overall, this step constitutes a fundamental bridge between unit root testing and ARDL estimation, as it confirms whether the long-run relationships required for meaningful economic interpretation are empirically supported.

Table 3: Panel Bounds Test Results

Model	Calculated F-statistic	I(0) Bound at 10%	I(1) Bound at 10%	I(0) Bound at 5%	I(1) Bound at 5%	I(0) Bound at 1%	I(1) Bound at 1%	Decision
COMP = f(GOV, INNOV, INST, DIG)	6.214	2.960	4.260	3.790	4.850	5.150	6.360	Cointegration confirmed at 10% and 5%; borderline at 1%

Source: Author's own elaboration based on econometric estimations (2017–2024).

The results reported in Table 3 provide strong empirical support for the existence of a long-run equilibrium relationship between competitive performance (COMP) and its explanatory variables, namely governance (GOV), innovation capacity (INNOV), institutional quality (INST), and digital transformation (DIG). More specifically, the calculated F-statistic of 6.214 exceeds the upper critical bound I(1) at the 10% level (4.260) and the 5% level (4.850), which allows the rejection of the null hypothesis of no cointegration at these conventional significance levels. This result indicates that the variables included in the model do not evolve independently over time, but rather follow a common long-run trajectory. In substantive terms, this finding suggests that competitive performance in Morocco is structurally linked to the quality of innovation ecosystem governance and to the broader institutional, technological, and innovation-related conditions that support it. Consequently, the relationship under investigation is not merely temporary or accidental, but reflects a stable long-term association consistent with the theoretical framework of the study.

A closer examination of the bounds test results also reveals that the calculated F-statistic remains slightly below the upper critical bound at the 1% level (6.360), which makes the result borderline at the most stringent level of significance. This does not weaken the validity of the evidence for cointegration, but rather suggests that while the long-run relationship is clearly confirmed under standard confidence levels, it should be interpreted with appropriate econometric caution when adopting a stricter threshold. In empirical research, such a result is often considered robust, particularly when the F-statistic clearly exceeds the upper bounds at both the 10% and 5% levels. From an analytical perspective, this outcome is particularly meaningful because it confirms that governance, innovation capacity, institutional quality, and digital transformation are jointly associated with competitive performance in a persistent and structured way. It also reinforces the idea that the Moroccan innovation environment can be understood as a system of interdependent variables whose interactions are sustained over time rather than limited to short-term adjustments.

From a methodological standpoint, the confirmation of cointegration has important implications for the continuation of the empirical analysis. Since the variables are cointegrated, the estimation of the ARDL long-run coefficients becomes fully justified, and the associated Error Correction Model (ECM) can be used to capture the short-run dynamics and the speed at which deviations from long-run equilibrium are corrected. In other words, Table 3 establishes the econometric foundation for distinguishing between temporary fluctuations and structural relationships in the model. This is a crucial result because it enables the study to move beyond simple correlation and stationarity analysis toward a more rigorous interpretation of causally meaningful long-run interactions. Therefore, the bounds test results not only validate the specification of the ARDL model, but also provide substantive evidence that the governance of innovation ecosystems constitutes a strategic determinant of competitive performance in Morocco over the period 2017–2024

Table 4: Results of Homogeneity Test

Test	Statistic	p-value	Decision
Pesaran and Yamagata Delta Test	2.487**	0.013	Reject (H_0) of slope homogeneity
Adjusted Delta Test	2.731***	0.006	Reject (H_0) of slope homogeneity

Note: *** and *** denote significance at the 5% and 1% levels, respectively.*
Null hypothesis (H_0): *slope coefficients are homogeneous.*
Alternative hypothesis (H_1): *slope coefficients are heterogeneous.*
Source: *Author's own elaboration based on econometric estimations.*

The results reported in Table 4 provide important evidence regarding the structural properties of the empirical model by testing whether the slope coefficients are homogeneous across the units

under consideration. More specifically, both the Pesaran and Yamagata Delta Test and the Adjusted Delta Test yield statistically significant results, with test statistics of 2.487 and 2.731, and corresponding p-values of 0.013 and 0.006, respectively. Since these p-values are lower than the conventional significance thresholds of 5% and 1%, the null hypothesis of slope homogeneity is rejected. This means that the effects of the explanatory variables on competitive performance are not identical across all observations, but rather vary according to the specific characteristics of the units analyzed. From an econometric perspective, this finding is particularly relevant because it indicates that the relationship between governance, innovation, institutional quality, digital transformation, and competitive performance is not uniform, but heterogeneous in nature.

This result has an important substantive interpretation in the context of innovation ecosystem analysis. The rejection of homogeneity suggests that the impact of governance mechanisms and related explanatory factors may differ according to contextual, institutional, or structural conditions. In other words, the way in which innovation ecosystem governance influences competitive performance is likely to depend on differences in institutional maturity, digital readiness, innovation capabilities, or strategic coordination patterns. Such a conclusion is fully consistent with the theoretical literature, which emphasizes that innovation ecosystems evolve under differentiated governance configurations and that their performance is shaped by context-specific complementarities rather than by universally identical mechanisms. Therefore, the evidence of heterogeneity reinforces the analytical relevance of adopting a framework that recognizes diversity in the functioning and strategic outcomes of innovation ecosystems, especially within emerging economic environments characterized by uneven development trajectories.

From a methodological standpoint, the homogeneity test results justify the use of estimation techniques capable of accounting for heterogeneous relationships across the sample. The rejection of slope homogeneity implies that imposing identical coefficients on all units may lead to biased or oversimplified conclusions, particularly when examining complex interactions between governance and performance variables. Consequently, these findings support the need for cautious model specification and strengthen the empirical credibility of approaches that allow for differentiated dynamics across observations. More broadly, Table 4 contributes to the robustness of the econometric analysis by confirming that the empirical structure of the data is not fully uniform, thereby encouraging a more nuanced interpretation of the estimated long-run and short-run effects. In this sense, the homogeneity test does not merely serve as a technical

diagnostic; it also provides substantive insight into the differentiated ways through which innovation ecosystem governance may affect competitive performance over the period under study.

4. Empirical Results

The empirical results section constitutes the central analytical stage of the study, as it aims to examine the extent to which the governance of innovation ecosystems influences competitive performance in Morocco over the period 2017–2024. Building on the preliminary econometric procedures namely the descriptive analysis, unit root tests, cointegration analysis, and homogeneity testing this section seeks to translate the theoretical assumptions of the research into measurable empirical evidence. In this perspective, the empirical results make it possible to assess whether the selected explanatory variables, including governance, innovation capacity, institutional quality, and digital transformation, exert statistically significant effects on competitive performance, both in the short run and in the long run. This stage is therefore essential for moving beyond conceptual reasoning and establishing whether the proposed analytical relationships are supported by the data.

From a methodological point of view, the empirical results are derived from the estimation of the ARDL model and its associated Error Correction representation, which together provide a comprehensive framework for interpreting dynamic interactions among the variables. The long-run estimators allow the identification of the structural effects of innovation ecosystem governance on competitive performance, while the short-run coefficients and the error correction term capture temporary adjustments and the speed at which disequilibria are corrected over time. Accordingly, this section is designed not only to report econometric coefficients, but also to interpret their economic and strategic meaning in light of the Moroccan context and the broader literature on innovation ecosystems. In this sense, the empirical results section serves as the pivotal link between the study's theoretical foundation and its practical contribution, by demonstrating how governance-related mechanisms shape competitive outcomes within a dynamic and evolving innovation environment.

Table 5: Panel Long-Term Estimators

Variables	Coefficient	Std. Error	t-Statistic	Prob.
GOV	0.428***	0.102	4.196	0.000
INNOV	0.315***	0.089	3.539	0.001
INST	0.276**	0.113	2.442	0.017
DIG	0.392***	0.095	4.126	0.000

Constant	1.587	0.642	2.472	0.016

Note: *** and ** denote significance at the 1% and 5% levels, respectively.
Source: Author's own elaboration based on ARDL estimations (2017–2024).

The long-run estimation results reported in Table 5 provide strong empirical evidence that the governance of innovation ecosystems and its related structural dimensions exert a positive and statistically significant influence on competitive performance in Morocco over the period 2017–2024. All the explanatory variables included in the ARDL specification display positive coefficients, which confirms the general theoretical expectation that competitive performance is enhanced when innovation ecosystems are supported by effective governance arrangements, stronger innovation capacity, sound institutional environments, and adequate digital infrastructure. More specifically, governance (GOV) records the largest long-run coefficient (0.428), significant at the 1% level, indicating that improvements in coordination mechanisms, strategic alignment, and ecosystem management generate a substantial increase in competitive performance. This result is particularly important because it empirically validates the central argument of the study, namely that governance is not a peripheral or secondary factor, but rather a structural determinant of the long-run effectiveness of innovation ecosystems. In the Moroccan context, this finding suggests that strengthening governance quality may represent one of the most decisive levers for improving the strategic positioning and competitiveness of firms, sectors, and territorial systems.

The results also show that digital transformation (DIG) and innovation capacity (INNOV) play a major long-run role in shaping competitive outcomes. The coefficient associated with DIG (0.392, significant at the 1% level) indicates that the development of digital infrastructure, technological readiness, and digitally enabled coordination mechanisms significantly enhances competitive performance over time. This confirms that digital transformation does not merely support operational efficiency, but fundamentally restructures the way innovation ecosystems function, interact, and create value. Likewise, the positive and highly significant coefficient of INNOV (0.315, significant at the 1% level) shows that research and development effort, innovation output, and broader innovation capabilities contribute meaningfully to long-run competitiveness. These findings imply that ecosystem governance becomes even more effective when it is combined with strong technological and innovative capacities, since governance alone cannot produce sustained competitive advantage in the absence of innovation-generating resources and digital support systems. Therefore, the long-run estimates reveal that competitive

performance emerges from the interaction of governance quality with a wider set of innovation-enabling conditions, rather than from isolated institutional or managerial interventions.

In addition, institutional quality (INST) also exerts a positive and statistically significant effect on competitive performance, with a coefficient of 0.276, significant at the 5% level. Although this effect is more moderate compared with governance and digital transformation, it remains analytically important because it confirms that formal institutional conditions such as regulatory effectiveness, policy coherence, and the broader quality of public governance constitute a supportive foundation for ecosystem performance. The significance of the constant term further suggests that other structural factors not explicitly included in the model may also contribute to competitive performance, but without undermining the explanatory power of the retained variables. Taken together, the long-run ARDL results demonstrate that Morocco's competitive performance is strongly associated with the strategic quality of innovation ecosystem governance and with the institutional, technological, and innovative capacities that sustain it. For publication purposes, the major contribution of these findings lies in showing that the long-run competitiveness of an emerging economy is shaped not simply by innovation in isolation, but by the ability to organize, govern, and digitally support innovation ecosystems in a coherent and sustainable manner.

Table 6: Panel Short-Term Estimators (Error Correction Model – ECM)

Variables	Coefficient	Std. Error	t-Statistic	Prob.
D(GOV)	0.214**	0.091	2.352	0.021
D(INNOV)	0.167**	0.078	2.141	0.035
D(INST)	0.143*	0.081	1.765	0.082
D(DIG)	0.236***	0.087	2.713	0.008
ECM(-1)	-0.648***	0.119	-5.445	0.000
Constant	0.924	0.381	2.425	0.018

Note: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.
Source: Author's own elaboration based on ARDL-ECM estimations (2017–2024).

The short-run estimation results reported in Table 6 provide important empirical evidence that the governance-related variables exert an immediate and positive influence on competitive performance in Morocco. All the short-run coefficients are positive, which indicates that contemporaneous improvements in governance, innovation capacity, institutional quality, and digital transformation contribute to enhancing competitive performance even before their long-run effects are fully realized. More specifically, D(DIG) records the strongest short-run coefficient (0.236), significant at the 1% level, suggesting that digital transformation produces

the most rapid effect on competitiveness among the explanatory variables retained in the model. This result is particularly meaningful because digital infrastructures, technological connectivity, and digitally enabled coordination mechanisms often generate immediate efficiency gains, accelerate information flows, and strengthen the responsiveness of innovation ecosystems. In parallel, D(GOV) also exerts a positive and statistically significant short-run effect (0.214, significant at the 5% level), confirming that improvements in coordination mechanisms and governance practices quickly translate into better competitive outcomes. Likewise, D(INNOV) displays a positive and significant coefficient (0.167, significant at the 5% level), indicating that short-term increases in innovation-related activities contribute directly to performance enhancement.

The coefficient associated with D(INST) is also positive (0.143) and significant at the 10% level, which suggests that institutional quality contributes to competitive performance in the short run, although with a comparatively more moderate degree of statistical strength. This result may be interpreted as reflecting the fact that institutional improvements often require more time to fully materialize into strong and measurable economic outcomes, even if their initial effects are already observable. In other words, while digital transformation, governance improvements, and innovation efforts may yield more immediate operational and strategic benefits, institutional reforms tend to produce progressive effects through the gradual strengthening of regulatory coherence, policy stability, and coordination frameworks. The significance of the constant term further indicates that short-run competitive performance may also be influenced by additional contemporaneous factors not explicitly captured in the model. Overall, the short-run coefficients reveal that the Moroccan innovation ecosystem reacts positively to improvements in governance-related conditions, and that competitiveness is shaped not only by long-term structural dynamics but also by more immediate adjustments in digital, managerial, innovative, and institutional variables.

The most critical result in Table 6 is the coefficient of the error correction term, ECM(-1), which is negative (-0.648) and highly significant at the 1% level. This finding is essential because it confirms the existence of a valid long-run equilibrium relationship among the variables and demonstrates that short-run deviations from equilibrium are corrected over time. The magnitude of the coefficient implies that approximately 64.8% of any short-term disequilibrium is corrected within one period, indicating a relatively rapid speed of adjustment toward the long-run path. Economically, this suggests that although shocks or temporary imbalances may affect

competitive performance in the short run, the system possesses a strong internal tendency to return to equilibrium through the combined influence of governance, innovation, institutional quality, and digital transformation. For publication purposes, this result substantially strengthens the robustness of the empirical analysis, as it shows that the Moroccan innovation ecosystem is characterized not only by significant short-run responses but also by a stable adjustment mechanism linking short-term fluctuations to long-term competitive performance. Taken together, the ECM results provide convincing evidence that innovation ecosystem governance operates as both an immediate and a structural determinant of competitiveness, thereby reinforcing the central thesis of the study.

5. Conclusions and Recommendations

The findings of this study lead to the conclusion that the governance of innovation ecosystems constitutes a decisive strategic determinant of competitive performance in Morocco over the period 2017–2024. By combining theoretical reflection with empirical investigation based on the ARDL approach, the research demonstrates that competitive performance is not merely the outcome of isolated innovation efforts, but rather the product of a broader systemic configuration in which governance, institutional quality, innovation capacity, and digital transformation interact in a dynamic and mutually reinforcing manner. The empirical results confirm the existence of a stable long-run relationship among these variables, while also showing that short-run adjustments operate through a significant error-correction mechanism. This overall consistency between the conceptual framework and the econometric evidence strengthens the central argument of the study: innovation ecosystems generate sustainable competitive outcomes only when they are governed through coherent coordination mechanisms capable of aligning heterogeneous actors, structuring complementarities, and supporting long-term strategic adaptation.

A second major conclusion emerging from the analysis is that governance itself appears as the most influential explanatory variable in the long-run estimation, which underscores its structural importance in the functioning of innovation ecosystems. This result suggests that the mere presence of innovative actors, entrepreneurial initiatives, or technological resources is insufficient to generate sustained competitiveness unless these elements are embedded within an effective governance architecture. In other words, the performance of innovation ecosystems depends not only on the availability of resources, but also on the quality of the rules, interactions, and strategic orientations that connect these resources to collective value creation. The Moroccan

case therefore illustrates a broader analytical proposition applicable to emerging economies: competitive performance is significantly enhanced when governance mechanisms reduce fragmentation, improve institutional coordination, and facilitate the circulation of knowledge, capabilities, and innovation opportunities across the ecosystem. Such a conclusion contributes to the literature by empirically confirming that governance is not a secondary contextual factor, but a core explanatory dimension of ecosystem performance.

From a policy perspective, these findings imply that strengthening Morocco's competitive performance requires a deliberate and integrated strategy aimed at improving the governance of innovation ecosystems at multiple levels. Public authorities should therefore prioritize the design of coordination mechanisms capable of enhancing synergies between firms, universities, research centers, territorial institutions, digital actors, and financial stakeholders. This involves moving beyond fragmented and sector-specific interventions toward a more systemic approach to innovation policy, in which governance structures are explicitly designed to foster collaboration, reduce institutional overlaps, and support shared strategic objectives. In practical terms, this may require the creation or consolidation of dedicated coordination platforms, the strengthening of regional innovation governance bodies, and the development of policy instruments that encourage sustained interaction among ecosystem participants. Such measures would not only improve innovation efficiency, but also reinforce the long-term resilience and competitiveness of the national innovation system.

A fourth major policy implication concerns the need to reinforce the digital foundations of innovation ecosystems, given the strong empirical effect of digital transformation on competitive performance in both the short and long run. The results of the study clearly indicate that digital infrastructure, technological readiness, and digitally enabled coordination mechanisms are no longer peripheral supporting factors, but central conditions for ecosystem efficiency and strategic adaptability. Consequently, policy recommendations should include intensified investment in digital connectivity, data-sharing architectures, interoperable innovation platforms, and smart coordination tools capable of facilitating interaction among ecosystem actors. In the Moroccan context, this also implies promoting the digitalization of public support mechanisms, innovation services, and knowledge-transfer channels in order to reduce transaction costs, accelerate collaboration, and broaden access to innovation opportunities. Strengthening the digital dimension of innovation ecosystems would therefore contribute not only to improving operational efficiency, but also to enhancing the capacity of firms and institutions to respond

strategically to changing competitive environments.

A fifth recommendation relates to the institutional environment within which innovation ecosystems evolve. Although the empirical results show that institutional quality exerts a somewhat more moderate effect than governance and digital transformation, its influence remains positive and statistically significant, which confirms its importance as a structural support for ecosystem performance. In practical terms, this means that policy efforts should focus on improving regulatory coherence, institutional stability, policy continuity, and administrative efficiency in order to create an enabling environment for innovation and collaboration. In emerging economies, institutional fragmentation and coordination failures often limit the effectiveness of otherwise promising innovation initiatives; therefore, strengthening institutional quality should be viewed as a long-term strategic priority rather than a secondary reform area. For Morocco, this may involve consolidating the alignment between industrial policy, higher education policy, digital strategy, and territorial development policy, so that innovation ecosystem governance can operate within a more coherent and predictable framework. Such reforms would not only improve the effectiveness of public intervention, but also increase the confidence of private actors and encourage stronger participation in collaborative innovation processes.

The study highlights the importance of adopting a long-term strategic vision of innovation ecosystem governance as a lever for sustainable competitiveness. The presence of a significant and negative error correction term confirms that the system possesses an internal capacity to return to equilibrium after short-term shocks, but this capacity depends on the existence of stable governance structures capable of sustaining coordination over time. Therefore, the final policy recommendation is that Morocco should move toward a strategic model of ecosystem governance that combines institutional coordination, digital modernization, innovation support, and territorial inclusion within a unified framework of competitive development. Such a model would require not only technical reforms, but also a shift in policy philosophy from fragmented intervention toward ecosystem thinking, from isolated innovation support toward systemic orchestration, and from short-term initiatives toward long-term resilience-building. In conclusion, the study demonstrates that the governance of innovation ecosystems is a central pillar of competitive performance, and that the future strengthening of Morocco's strategic position will depend on its ability to organize, coordinate, and sustain innovation ecosystems as coherent engines of economic transformation.

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