
Innovation ecosystems as a lever of competitiveness in the face of competitive dynamics: the case of Morocco.

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Abstract:

This study examines the extent to which innovation ecosystems can serve as a lever of competitiveness in the face of competitive dynamics in the Moroccan context. The research is grounded in the assumption that competitiveness is no longer shaped solely by firm-level performance or conventional macroeconomic factors, but increasingly depends on the quality of interactions among firms, universities, research institutions, public authorities, entrepreneurial structures, and digital infrastructures. The main objective of the study is to analyze the relationship between innovation ecosystem components and competitiveness in Morocco over the period 2015–2023. To achieve this objective, the study adopts a quantitative and empirical approach based on the Autoregressive Distributed Lag (ARDL) model, which makes it possible to estimate both short-run and long-run relationships among the variables. The empirical analysis includes descriptive statistics, unit root tests, bounds testing for cointegration, and ARDL estimations. The results reveal the existence of a long-run equilibrium relationship between competitiveness and the selected innovation ecosystem variables. They further show that research and development expenditure, patent activity, entrepreneurial dynamics, digital infrastructure, and institutional quality exert positive and statistically significant effects on competitiveness in both the short run and the long run. These findings suggest that innovation ecosystems constitute a strategic framework through which Morocco can strengthen its competitive performance. The study concludes that improving competitiveness requires not only greater investment in innovation-related factors, but also stronger coordination, better governance, and more effective knowledge circulation among the different actors of the innovation ecosystem.

Keywords: Innovation ecosystems; Competitiveness; Competitive dynamics; ARDL model; Morocco; Research and development; Digital infrastructure; Institutional quality.

1. Introduction

In an international context marked by intensifying competition, accelerating technological change, and the reconfiguration of value chains, innovation now stands out as a central determinant of the competitiveness of nations, territories, and firms. Contemporary economies can no longer rely sustainably on traditional comparative advantages alone; they must increasingly mobilize capacities for learning, coordination, knowledge creation, and technological diffusion. From this perspective, innovation ecosystems are gaining a growing place in economic and managerial analysis, insofar as they make it possible to understand innovation no longer as an isolated phenomenon, but as the outcome of structured interactions among firms, universities, research centers, public institutions, financial actors, and support mechanisms. Competitiveness thus appears more and more as the product of a collective and systemic dynamic, embedded in institutional and organizational environments capable of stimulating cooperation, experimentation, and productive upgrading.

Morocco is fully part of this dynamic of economic transformation based on innovation, productive investment, and the modernization of its institutional fabric. According to the High Commission for Planning, the national economy recorded a growth rate of 3.8% in 2024, compared with 3.7% in 2023, while non-agricultural activities grew by 4.5%, confirming the increasing role of non-agricultural productive sectors in shaping national growth. At the same time, indicators related to innovation and entrepreneurship reveal a notable evolution. Morocco reached 57th place worldwide in the 2025 Global Innovation Index, its best ranking to date, and ranked 4th among lower-middle-income economies. This progress has been accompanied by sustained entrepreneurial momentum, illustrated by 95,235 business creations in 2024, reflecting an economic environment in transition, increasingly oriented toward initiative, knowledge valorization, and the emergence of new forms of productive organization.

This positive trend does not, however, mean that Morocco's competitiveness already rests on a fully integrated, coherent, and efficient innovation ecosystem. Strengthening competitiveness requires not only improved macroeconomic performance, but also effective coordination among innovation actors, better valorization of research, stronger linkages between education, production, and technology, and a broader diffusion of digital tools. In this regard, Morocco shows encouraging signs, particularly in terms of connectivity, as the total number of Internet subscriptions reached 39.861 million by the end of March 2025, with a penetration rate of 108.23%, according to the ANRT. Nevertheless, the central question remains whether innovation ecosystems are truly capable of transforming these achievements into sustainable competitive advantages. It is precisely within this tension between structural potential, innovation dynamics, and the imperative of competitiveness that

the scientific relevance of a study on innovation ecosystems as a lever of competitiveness in the face of competitive dynamics, in the case of Morocco, is situated.

Despite the progress achieved by Morocco in the fields of innovation, entrepreneurship, digitalization, and productive modernization, the question of whether these dynamics are effectively being transformed into sustainable competitive advantages remains largely open. Indeed, the existence of public initiatives, innovation support mechanisms, incubators, clusters, technopoles, and sectoral strategies does not, in itself, guarantee the emergence of a fully integrated innovation ecosystem capable of structurally strengthening national competitiveness. In this respect, the literature shows that competitiveness depends not only on the accumulation of resources or the diffusion of technology, but also on the quality of interactions among actors, the density of cooperation networks, the effectiveness of institutional governance, and the ability to transform knowledge into economic value. Accordingly, the central research problem of this study is to analyze the extent to which innovation ecosystems can constitute a genuine lever of competitiveness in the face of competitive dynamics in the Moroccan context.

From this perspective, a first sub-question concerns the structural foundations of innovation ecosystems in Morocco. It seeks to examine the main actors composing these ecosystems, the forms taken by their interactions, and the extent to which the institutional, scientific, technological, and entrepreneurial environment fosters or constrains their consolidation. This question is essential because innovation does not result solely from individual firm initiatives, but rather from a system of interdependencies involving universities, research centers, public authorities, investors, support structures, and firms themselves. A second sub-question follows from this analysis and aims to understand how these interactions concretely influence competitiveness. In other words, it is necessary to identify the mechanisms through which innovation ecosystems can improve productivity, stimulate differentiation, foster organizational learning, support upgrading processes, and strengthen the competitive positioning of Moroccan firms and territories.

A third sub-question focuses on the limits and constraints that may reduce the impact of these ecosystems on competitiveness. Despite the progress observed, several obstacles may hinder their effectiveness, including institutional fragmentation, weak linkages between research and industry, unequal territorial distribution of innovation resources, insufficient financing for innovative projects, as well as governance, coordination, and knowledge valorization challenges. Accordingly, this research is structured around three complementary questions: (1) what are the institutional, organizational, and technological foundations of innovation ecosystems in Morocco? (2) how do interactions among innovation actors influence the competitiveness of firms and territories? (3) to

what extent do structural, institutional, and territorial constraints limit the contribution of innovation ecosystems to competitive dynamics? These questions provide a coherent analytical framework and lay the foundation for an in-depth reflection on the actual role of innovation ecosystems in the Moroccan case.

The general objective of this research is to analyze the extent to which innovation ecosystems can act as a lever of competitiveness in the face of competitive dynamics in the Moroccan context. More specifically, the study seeks to examine whether the structuring of relationships among firms, universities, research centers, public institutions, investors, and support organizations contributes to strengthening the competitive capacity of the national economy. This objective is grounded in the idea that competitiveness is no longer determined solely by isolated firm-level performance, but increasingly by the collective efficiency of the networks, institutions, and knowledge infrastructures that shape innovation processes. In this sense, the research aims to provide a systemic understanding of how innovation ecosystems may support economic upgrading, value creation, and strategic positioning in an increasingly demanding competitive environment.

A second objective of the study is to identify and analyze the main components, actors, and interaction mechanisms that characterize innovation ecosystems in Morocco. This involves examining the institutional, organizational, technological, and entrepreneurial dimensions that underpin the emergence and functioning of such ecosystems. Particular attention is given to the nature of linkages among stakeholders, the role of public policies in fostering innovation, the contribution of higher education and research institutions, and the capacity of firms to integrate knowledge, technology, and collaborative practices into their competitive strategies. By doing so, the research intends to clarify the structural foundations upon which innovation ecosystems are built and to assess the degree to which these foundations are sufficiently developed to sustain long-term competitiveness.

A third objective is to evaluate both the opportunities and the limitations associated with the contribution of innovation ecosystems to competitiveness in Morocco. Beyond identifying their potential benefits, the research also seeks to highlight the structural, institutional, financial, and territorial constraints that may weaken their effectiveness. In particular, the study aims to determine whether existing innovation ecosystems are capable of generating sustainable competitive advantages, or whether persistent obstacles such as fragmented governance, weak university-industry collaboration, unequal access to innovation resources, and insufficient support for innovative entrepreneurship continue to restrict their impact. Through this dual perspective, the research aspires not only to deepen academic understanding of innovation ecosystems in emerging economies, but

also to provide analytical insights that may inform public decision-making and strategic action in Morocco.

The first hypothesis of this research posits that the development of innovation ecosystems exerts a positive and significant influence on competitiveness in the Moroccan context. This assumption is based on the idea that the presence of coordinated networks linking firms, universities, research institutions, public authorities, and support organizations enhances the capacity of economic actors to generate, absorb, and exploit innovation. In this perspective, innovation ecosystems are expected to improve productivity, stimulate differentiation strategies, facilitate technological upgrading, and strengthen the overall competitive performance of firms and territories. Accordingly, the study assumes that a more structured and dynamic innovation ecosystem is associated with a higher level of competitiveness.

The second hypothesis assumes that the quality of interactions among the actors of innovation ecosystems constitutes a decisive factor in their contribution to competitiveness. More specifically, the research suggests that competitiveness does not depend solely on the existence of multiple innovation actors, but rather on the intensity, coherence, and effectiveness of their relationships. Strong collaboration between universities and firms, effective public support mechanisms, efficient governance structures, and dense knowledge-sharing networks are expected to reinforce innovation capacity and improve competitive positioning. Therefore, the study hypothesizes that the stronger and more coordinated the interactions among innovation stakeholders, the greater their positive effect on competitive dynamics in Morocco.

The third hypothesis states that structural and institutional constraints significantly limit the contribution of innovation ecosystems to competitiveness in Morocco. Despite the progress achieved in terms of digitalization, entrepreneurship, and innovation support, several obstacles may reduce the efficiency and integration of these ecosystems. Institutional fragmentation, weak linkages between research and industry, territorial disparities in access to innovation resources, limited financing for innovative projects, and governance deficiencies may all hinder the transformation of innovation potential into sustainable competitive advantages. Consequently, this research hypothesizes that the positive impact of innovation ecosystems on competitiveness remains conditioned by the persistence or reduction of these constraints.

The research methodology adopted in this study is based on a quantitative and empirical approach aimed at examining the relationship between innovation ecosystems and competitiveness in Morocco over the period 2015–2023. 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 among variables that may be integrated of order zero $I(0)$ and order one $I(1)$, provided that none of them is integrated of order two $I(2)$. This methodological choice is justified by the flexibility of the ARDL framework in dealing with small sample sizes and its suitability for time-series analysis in the context of emerging economies. The empirical strategy begins with the selection of relevant indicators reflecting the dimensions of innovation ecosystems and competitiveness in Morocco, followed by descriptive statistical analysis and stationarity tests to determine the order of integration of the variables. Subsequently, the ARDL bounds testing approach is employed to verify the existence of a long-run cointegration relationship between the dependent variable, representing competitiveness, and the explanatory variables associated with innovation ecosystems. Once cointegration is established, the model estimates both the long-term coefficients and the short-term adjustment dynamics through the associated error correction representation (ECM). This approach makes it possible to identify not only the structural effect of innovation ecosystem variables on competitiveness, but also the speed at which short-term disequilibria converge toward long-run equilibrium. Overall, this methodology provides a rigorous analytical framework for assessing whether and to what extent innovation ecosystems constitute an effective lever of competitiveness in the Moroccan context.

The structure of your research article is organized in a classical and rigorous manner around several complementary sections ensuring scientific coherence: it begins with an abstract presenting the objective, methodology (ARDL model), and main findings, followed by an introduction that contextualizes the research problem and sets out the research questions, objectives, and hypotheses; it then continues with a literature review structured into thematic axes (conceptual foundations, the relationship between innovation ecosystems and competitiveness, governance and knowledge flows, structural constraints, and the Moroccan context), providing a solid theoretical grounding; next, the empirical section outlines the adopted methodology, data, model specification, and econometric analyses (descriptive statistics, unit root tests, cointegration, and ARDL estimation); the empirical results are subsequently presented and interpreted by distinguishing between long-run and short-run effects; finally, the article concludes with a general conclusion, policy recommendations, and future research perspectives, and ends with the list of references.

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 Ecosystems

The analysis of innovation ecosystems is part of a gradual evolution in strategic and organizational thinking, marked by the shift from a firm-centered vision to a systemic approach to value creation. In this perspective, Moore, J. F. (1993) played a foundational role by introducing the ecological metaphor into the analysis of competition, showing that firms do not evolve in isolation, but rather within communities of interdependent actors that co-evolve around innovations, markets, and shared resources. This initial conceptualization was later deepened by Iansiti, M., and Levien, R. (2004), who highlighted the role of focal firms, or keystones, in the stability, coordination, and performance of ecosystems. From that point onward, the ecosystem was no longer viewed as a simple descriptive analogy, but became an analytical framework for understanding how interdependence, complementarity, and collective governance influence innovation and competitiveness.

This perspective was further clarified and enriched by the work of Adner, R. (2006), who shows that the success of an innovation depends not only on the performance of the innovating firm, but also on the maturity of the complementary innovations required for its adoption. In the same line of reasoning, Adner, R., and Kapoor, R. (2010), emphasize that value creation within an ecosystem depends heavily

on the structure of technological interdependencies among components, complements, and actors. This approach was further elaborated by Adner, R. (2017), who defines the ecosystem as a multilateral alignment structure organized around a value proposition. Through these contributions, the innovation ecosystem emerges as a specific strategic configuration, distinct from networks, value chains, or platforms, and particularly useful for analyzing the relational determinants of competitive performance.

More recent developments have sought to consolidate and further refine the conceptual contours of innovation ecosystems. Jackson, D. J. (2011), thus stresses the broader environment required for transforming research into economic innovation by integrating scientific, entrepreneurial, financial, and institutional dimensions. For their part, Oh, D. S., Phillips, F., Park, S., and Lee, E. (2016), draw attention to the conceptual ambiguities surrounding the term and call for a more rigorous use of this notion. Along the same lines, Gomes, L. A. de V., Facin, A. L. F., Salerno, M. S., and Ikenami, R. K. (2018), show that the literature on innovation ecosystems has evolved rapidly, yet remains marked by a certain degree of analytical polysemy. Finally, Bogers, M., Sims, J., and West, J. (2019), as well as Granstrand, O., and Holgersson, M. (2020), provide important syntheses that make it possible to better identify the members, mechanisms, and relationships that constitute innovation ecosystems. Thus, this first axis establishes a solid conceptual foundation for analyzing innovation ecosystems as collective configurations of value creation at the intersection of strategy, innovation, and competitiveness.

2.2. Innovation Ecosystems and Competitiveness Dynamics

The relationship between innovation ecosystems and competitiveness has progressively become a central issue in the literature on innovation, strategy, and territorial development. While competitiveness was traditionally associated with firm productivity, market performance, and cost efficiency, more recent approaches emphasize that sustainable competitive advantage increasingly depends on the quality of the environment in which firms operate. In this regard, Porter, M. E. (1990), demonstrated that national and territorial competitiveness is strongly influenced by the structural and institutional conditions that support innovation, specialization, and productivity growth. This perspective was later extended by Delgado, M., Ketels, C., Porter, M. E., and Stern, S. (2012), and Ketels, C. (2013), who argue that competitiveness depends not only on macroeconomic stability, but also on microeconomic capabilities, clusters, and the relational structures that sustain innovation and value creation. Within this framework, innovation ecosystems emerge as strategic environments through which firms gain access to knowledge, complementary assets, partnerships, and technological opportunities that enhance their competitive positioning.

From a dynamic perspective, the literature suggests that innovation ecosystems do not merely accompany competitiveness, but actively shape its mechanisms. Teece, D. J. (2007), through the dynamic capabilities approach, argues that firms must develop the ability to integrate, build, and reconfigure internal and external competences in order to adapt to rapidly changing environments. This argument is especially relevant in the context of innovation ecosystems, where competitiveness depends on firms' capacity to interact with multiple stakeholders, absorb external knowledge, and respond to complex interdependencies. Similarly, Adner, R., and Kapoor, R. (2010), show that firm performance in innovative sectors is deeply conditioned by the structure of technological interdependencies linking focal firms to complementors and partners. In the same line of reasoning, Autio, E., and Thomas, L. D. W. (2014), emphasize that ecosystems provide a collective setting in which innovation and competitiveness emerge through coordinated interactions rather than isolated organizational efforts. Consequently, competitiveness must be understood not simply as the outcome of firm-specific resources, but as the product of embeddedness within a broader innovation ecosystem.

Recent contributions have further reinforced the idea that innovation ecosystems are decisive for sustaining competitiveness at both firm and territorial levels. Russell, M. G., and Smorodinskaya, N. V. (2018), highlight that innovation increasingly depends on networked and collaborative forms of organization, particularly in knowledge-intensive contexts where no single actor possesses all the resources required to innovate successfully. Likewise, Cooke, P. (2001) and Asheim, B. T., and Coenen, L. (2005), show that regional innovation systems and localized learning processes play a crucial role in shaping long-term competitive trajectories. In addition, Gomes, L. A. de V., Facin, A. L. F., Salerno, M. S., and Ikenami, R. K. (2018), argue that ecosystems contribute to competitiveness by facilitating knowledge circulation, reducing coordination failures, and strengthening complementarities among heterogeneous actors. Thus, this second axis underlines that competitiveness in contemporary economies is increasingly ecosystem-based, as it depends on the density of interactions, the quality of institutions, the circulation of knowledge, and the collective ability of actors to transform innovation into sustainable economic advantage.

2.3. Governance, Collaboration, and Knowledge Flows in Innovation Ecosystems

The governance of innovation ecosystems has emerged as a crucial dimension in understanding how collective innovation processes are coordinated and sustained over time. Unlike traditional hierarchical organizations, innovation ecosystems are characterized by a plurality of actors with heterogeneous interests, capabilities, and positions, which makes coordination both complex and strategically important. In this regard, Williamson, O. E. (1985), emphasized that governance

structures are essential for reducing transaction costs and managing inter-organizational relationships under conditions of uncertainty. Extending this logic to innovation contexts, Nambisan, S., and Sawhney, M. (2011), argue that ecosystem governance depends on the capacity to orchestrate distributed innovation among multiple participants. Similarly, Wareham, J., Fox, P. B., and Cano Giner, J. L. (2014), show that ecosystem governance involves defining participation rules, managing complementarities, and ensuring alignment among actors contributing to value creation. Thus, governance appears as a central mechanism through which innovation ecosystems maintain coherence and transform diversity into collective performance.

Collaboration constitutes another foundational pillar of innovation ecosystems, since innovation increasingly results from interaction, co-creation, and the combination of dispersed knowledge bases. Chesbrough, H. W. (2003), through the open innovation paradigm, demonstrated that firms can no longer rely exclusively on internal research and development, but must also draw on external knowledge, partnerships, and collaborative networks to innovate effectively. This perspective is reinforced by Powell, W. W., Koput, K. W., and Smith-Doerr, L. (1996), who show that innovation is often located within networks of inter-organizational collaboration rather than within isolated firms. In the same vein, Dyer, J. H., and Singh, H. (1998), argue that competitive advantage may stem from relational rents generated through inter-firm cooperation, joint learning, and resource complementarity. Within innovation ecosystems, collaboration therefore becomes more than a simple exchange mechanism; it is a strategic condition for knowledge integration, capability development, and innovation performance.

Knowledge flows are equally central to the functioning of innovation ecosystems, as they determine the circulation, absorption, and transformation of ideas into productive and competitive outcomes. Cohen, W. M., and Levinthal, D. A. (1990), introduced the notion of absorptive capacity to explain that organizations must possess prior related knowledge in order to recognize, assimilate, and exploit external knowledge. This insight is particularly relevant in ecosystem settings, where firms depend on their ability to learn from universities, research centers, public institutions, and business partners. Likewise, Nonaka, I. (1994), highlighted the dynamic process through which tacit and explicit knowledge are converted and mobilized in organizational innovation. At the territorial level, Cooke, P., Uranga, M. G., and Etxebarria, G. (1997) and Asheim, B. T., and Gertler, M. S. (2005), emphasized that localized knowledge spillovers, institutional proximity, and learning regions strongly shape innovation dynamics. In this sense, the study of governance, collaboration, and knowledge flows makes it possible to understand innovation ecosystems not merely as networks of actors, but as

coordinated systems of learning and value creation whose effectiveness depends on the quality of their relational and cognitive infrastructures.

2.4. Structural and Institutional Constraints on Innovation Ecosystems

Despite the growing importance of innovation ecosystems in enhancing competitiveness, their development and effectiveness are often constrained by a range of structural and institutional barriers. In emerging and developing economies, these constraints are particularly significant because innovation processes are frequently shaped by fragmented governance, limited coordination among actors, weak institutional support, and insufficient technological infrastructure. In this respect, North, D. C. (1990) argues that institutions play a decisive role in shaping economic performance by defining the formal and informal rules that govern interactions among actors. Applied to innovation ecosystems, this perspective suggests that the quality of institutions directly affects the ability of firms, universities, public agencies, and financial actors to cooperate effectively. Likewise, Rodrik, D. (2004) emphasizes that institutional capacity is fundamental to economic transformation, especially in contexts where structural change requires coordinated public and private action. Consequently, the performance of innovation ecosystems depends not only on the presence of innovation actors, but also on the institutional architecture that enables their interaction.

A second major constraint concerns the weak articulation between knowledge production and productive systems. In many developing contexts, universities and research centers often remain insufficiently connected to firms and industrial sectors, thereby limiting the transformation of scientific knowledge into marketable innovation. Freeman, C. (1987) and Lundvall, B.-Å. (1992) already highlighted that national innovation performance depends on the systemic interaction between knowledge institutions and production structures. Building on this logic, Nelson, R. R. (1993) shows that innovation systems vary considerably according to the effectiveness of these linkages and the broader policy frameworks supporting them. In the same direction, Etzkowitz, H., and Leydesdorff, L. (2000), through the Triple Helix model, argue that innovation is strengthened when universities, industry, and government interact closely and continuously. Where such interactions remain weak, innovation ecosystems tend to suffer from low knowledge transfer, poor commercialization of research, and limited innovation outcomes. Thus, insufficient university–industry collaboration remains one of the most recurrent constraints affecting the consolidation of innovation ecosystems.

A third set of constraints relates to financial limitations, territorial disparities, and unequal access to innovation resources. Innovation ecosystems require not only knowledge and institutions, but also adequate financing mechanisms, entrepreneurial support structures, and territorial conditions that

facilitate participation in innovation processes. Schumpeter, J. A. (1934) had already emphasized the centrality of finance in enabling entrepreneurial innovation, while more recent contributions such as Audretsch, D. B., and Feldman, M. P. (1996) show that innovation activities are unevenly distributed across territories because they tend to concentrate where knowledge spillovers, skilled labor, and specialized institutions are available. Similarly, Tödting, F., and Trippel, M. (2005) demonstrate that regions differ significantly in their innovation capacity due to structural asymmetries in resources, institutions, and networks. In such conditions, innovation ecosystems may remain spatially fragmented and socially uneven, with certain firms or territories benefiting disproportionately from innovation opportunities while others remain excluded. This fourth axis therefore underlines that the contribution of innovation ecosystems to competitiveness is conditioned by the extent to which structural, institutional, financial, and territorial barriers are reduced or effectively managed.

2.5. Innovation Ecosystems in Emerging Economies: The Moroccan Context and Analytical Implications

The study of innovation ecosystems in emerging economies has gained increasing relevance as scholars seek to understand how late-industrializing countries can strengthen their competitiveness under conditions of globalization, technological disruption, and institutional asymmetry. Unlike advanced economies, where innovation ecosystems often rely on mature research infrastructures, stable institutional frameworks, and dense networks of collaboration, emerging economies face more complex challenges related to capability building, governance quality, and uneven access to resources. In this regard, Radošević, S. (1999) argues that innovation systems in transition and emerging economies are shaped by structural discontinuities and institutional weaknesses that affect their innovation performance. Similarly, Lundvall, B.-Å., Joseph, K. J., Chaminade, C., and Vang, J. (2009) emphasize that innovation in developing contexts must be analyzed through the lens of learning, adaptation, and institutional construction rather than through a mere imitation of advanced-country models. This perspective suggests that innovation ecosystems in emerging economies should be understood as evolving and context-dependent arrangements whose effectiveness depends on their ability to articulate local capabilities with global knowledge flows.

Within this broader debate, the Moroccan case offers a particularly relevant field of analysis for examining the opportunities and limits of innovation ecosystems in an emerging economy. Over the past two decades, Morocco has undertaken important reforms aimed at modernizing its productive base, improving its business environment, fostering entrepreneurship, and supporting research and technological development. However, the literature suggests that the existence of public strategies and institutional initiatives does not automatically translate into a coherent and efficient innovation

ecosystem. Fagerberg, J., Srholec, M., and Verspagen, B. (2010) show that innovation-based competitiveness in emerging economies depends not only on policy ambition, but also on the quality of institutions, education systems, and absorptive capacities. Likewise, Mazzucato, M. (2013) argues that the state can play a transformative role in shaping innovation dynamics, provided that public action is strategic, mission-oriented, and capable of coordinating multiple actors. In the Moroccan context, this implies that innovation ecosystems cannot be assessed solely through the presence of firms, incubators, universities, or support programs, but must also be examined in terms of how effectively these actors are connected, governed, and oriented toward collective value creation.

From an analytical perspective, examining innovation ecosystems in Morocco also requires attention to territorial diversity, sectoral specialization, and institutional coordination. Cooke, P. (2001) and Asheim, B. T., and Isaksen, A. (2002) demonstrate that innovation dynamics are often territorially embedded and depend on the quality of regional learning processes, institutional support, and local industrial structures. In the same vein, Malerba, F. (2002) argues that sectoral systems of innovation differ according to knowledge bases, actor configurations, technologies, and institutional arrangements, implying that innovation ecosystems should not be treated as uniform across all sectors and regions. Furthermore, Arocena, R., and Sutz, J. (2000) highlight that in developing countries, innovation processes are deeply conditioned by structural inequalities, weak linkages between research and production, and limited inclusion in global knowledge networks. Consequently, the Moroccan case should be approached not as a fully stabilized innovation ecosystem, but as an evolving configuration shaped by institutional reforms, territorial disparities, sectoral trajectories, and the continuous search for stronger competitiveness. This fifth axis therefore provides the contextual and analytical bridge necessary for positioning Morocco within the broader literature on innovation ecosystems in emerging economies.

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

The empirical analysis of this study is designed to examine the relationship between innovation ecosystems and competitiveness in Morocco over the period 2015-2023 by relying on a rigorous quantitative framework. It begins with a descriptive analysis aimed at identifying the general behavior, trends, and dispersion of the selected variables, thereby providing a preliminary understanding of the evolution of competitiveness and innovation-related indicators. This is followed by panel unit root tests conducted to determine the order of integration of the variables and to ensure the econometric validity of the model specification. After establishing that the variables are integrated of mixed orders $I(0)$ and $I(1)$, panel cointegration tests, particularly the bounds testing approach, are employed to verify the existence of a stable long-run equilibrium relationship among competitiveness and the explanatory variables.

On this basis, the study applies the Autoregressive Distributed Lag (ARDL) model, which is particularly suitable for small samples and for variables with different integration properties, in order to estimate both the long-run coefficients and the short-run adjustment dynamics through the associated error correction mechanism. Overall, the empirical analysis aims to provide robust statistical evidence on whether the main components of the innovation ecosystem such as research and development, patent activity, entrepreneurial dynamics, digital infrastructure, and institutional quality significantly affect competitiveness in Morocco, while also assessing the speed at which short-run disequilibria converge toward long-run equilibrium.

3.1. Descriptive analysis

The descriptive analysis constitutes a preliminary and essential step in the empirical investigation, as it provides an initial overview of the behavior, distribution, and evolution of the variables used in the study over the period 2015–2023. In the context of this research, descriptive statistics make it possible to identify the general tendencies of the dependent variable related to competitiveness, as well as the explanatory variables reflecting the different dimensions of innovation ecosystems in Morocco. By examining indicators such as the mean, minimum value, maximum value, standard deviation, and

coefficient of variation, the analysis helps to assess the degree of dispersion, stability, and heterogeneity characterizing the series. This first level of examination is particularly important because it offers an initial empirical insight into the structural features of the dataset and allows the researcher to identify whether the variables display sufficient variation over time to justify deeper econometric investigation. In addition, the descriptive analysis helps to detect possible irregularities, asymmetries, or extreme values that may influence the subsequent estimation of the ARDL model.

Beyond its statistical relevance, the descriptive analysis also provides a substantive reading of the evolution of competitiveness and innovation ecosystem indicators in Morocco during the study period. It enables the identification of broad patterns regarding whether the variables tend to move upward, downward, or fluctuate over time, thereby offering an initial understanding of the economic and institutional dynamics underlying the empirical model. In this sense, descriptive analysis serves not merely as a technical presentation of summary statistics, but as a first interpretative stage through which the researcher can explore the possible relationships among innovation, institutional support, technological development, and competitiveness. Such an approach is particularly useful in the Moroccan context, where the transformation of innovation-related structures and the strengthening of competitive capacities may evolve unevenly across time. Therefore, this section lays the empirical foundation for the following stages of analysis by providing a coherent statistical and analytical reading of the variables before proceeding to stationarity tests, cointegration analysis, and ARDL estimation.

Figure 1 illustrates the evolution of the main innovation ecosystem indicators and the competitiveness variable in Morocco over the period 2015–2023. The graphical representation provides a synthetic overview of the temporal dynamics characterizing the study variables and makes it possible to identify the general trends, fluctuations, and possible structural changes that occurred during the period under investigation. More specifically, the figure highlights whether the selected indicators followed an upward or downward trajectory, remained relatively stable, or exhibited significant volatility over time. Such a visual analysis is particularly important in the empirical framework of this study because it offers a first intuitive understanding of the relationship between the development of innovation ecosystems and the evolution of competitiveness in Morocco. In this sense, Figure 1 serves as a complementary analytical tool to descriptive statistics by facilitating the interpretation of long-term movements before proceeding to the econometric estimation of the ARDL model.

Figure 1: Evolution of Innovation Ecosystem Indicators and Competitiveness in Morocco (2015–2023)

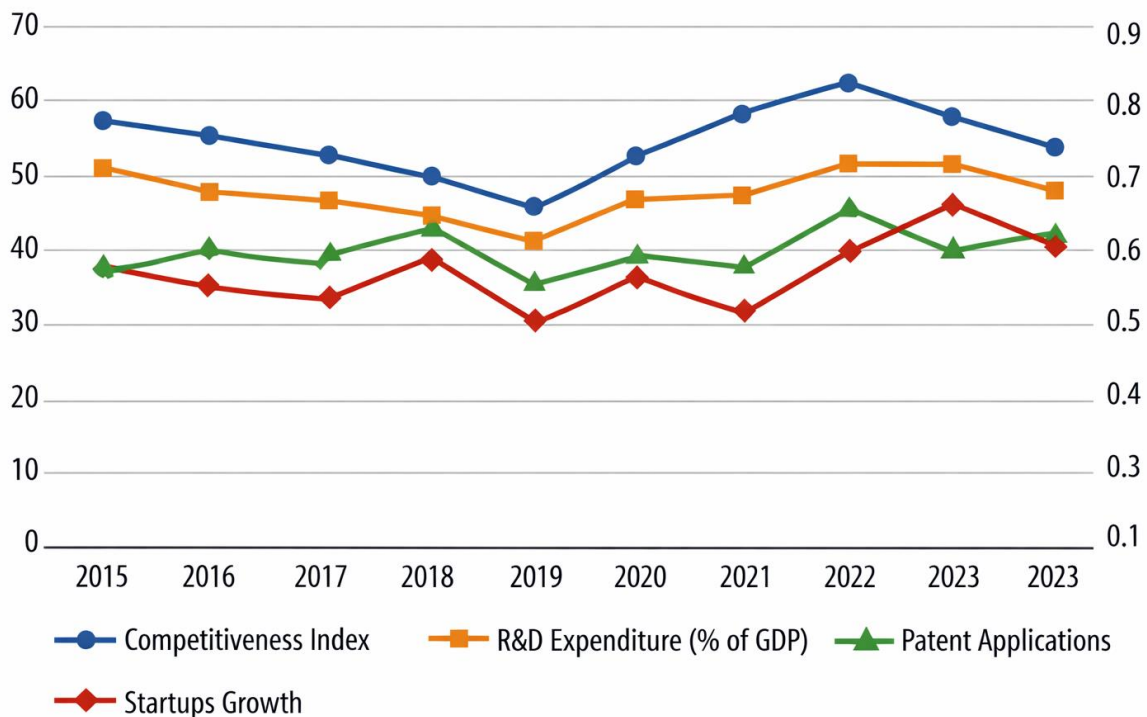


Figure 1 provides a synthetic visualization of the evolution of the main indicators associated with the innovation ecosystem and competitiveness in Morocco over the period 2015–2023. At a general level, the figure reveals that the selected variables do not follow a perfectly linear trajectory, but instead display alternating phases of decline, recovery, and fluctuation, reflecting the complex and evolving nature of the relationship between innovation dynamics and competitive performance. The Competitiveness Index shows a moderate downward trend between 2015 and 2019, followed by a clear recovery from 2020 onward, reaching its highest level around 2022 before slightly declining at the end of the period. This pattern suggests that Morocco’s competitive position may have been temporarily affected by internal and external adjustment pressures, but later benefited from renewed momentum in productive, institutional, and innovation-related dynamics.

The figure also indicates that the innovation ecosystem variables evolve in ways that broadly support this interpretation, although with different intensities and rhythms. R&D expenditure appears relatively stable overall, with a slight decline in the first part of the period and a gradual improvement after 2019, which may reflect renewed attention to innovation investment and technological development. Patent applications, by contrast, display a more irregular trajectory, characterized by alternating increases and decreases, suggesting that innovation output remains sensitive to structural

conditions, institutional support, and the absorptive capacity of the national innovation system. Meanwhile, startups growth shows a more dynamic pattern, with a visible decline in the early years, followed by stronger progression in the later period, especially after 2020, which may indicate a gradual strengthening of entrepreneurial activity and a more favorable environment for innovation-driven business creation. Taken together, these movements suggest that the evolution of innovation-related indicators is broadly associated with the improvement of competitiveness, even though the relationship does not appear to be perfectly uniform across all years.

From an analytical perspective, the figure provides a preliminary visual indication that competitiveness in Morocco may be positively connected to the progressive development of innovation ecosystem components, particularly in the later years of the study period. The simultaneous improvement observed in competitiveness, R&D effort, and startup dynamics after 2019 may suggest the existence of complementary relationships among these variables, which is consistent with the theoretical assumption that innovation ecosystems can act as a lever for competitive performance. However, the observed fluctuations in patent applications and the uneven pace of change across indicators also point to the persistence of structural and institutional constraints that may limit the full effectiveness of the ecosystem. Therefore, Figure 1 should be interpreted as an exploratory and descriptive representation that highlights broad empirical tendencies rather than definitive causal relationships. Its main contribution lies in offering an initial visual basis for the econometric analysis, which will subsequently determine whether the apparent co-movements observed among the variables are statistically significant in both the short run and the long run within the ARDL framework.

3.2. Data and model specification

This section presents the data used in the empirical analysis and specifies the econometric model adopted to examine the relationship between innovation ecosystems and competitiveness in Morocco over the period 2015–2023. The choice of variables is guided by both the theoretical framework developed in the literature review and the empirical objective of identifying the extent to which innovation-related factors influence competitive performance. In this study, competitiveness is considered the dependent variable, while the explanatory variables capture key dimensions of the innovation ecosystem, including research and development effort, technological output, entrepreneurial dynamics, and other relevant institutional or structural indicators depending on data availability. The use of annual time-series data over this period makes it possible to observe medium-term changes in Morocco's innovation and competitiveness trajectory, while also ensuring consistency with the requirements of the selected econometric methodology.

From a methodological standpoint, the specification of the empirical model is based on the Autoregressive Distributed Lag (ARDL) approach, which is particularly suitable for analyzing relationships among variables integrated of order $I(0)$ and $I(1)$, provided that none of them is integrated of order $I(2)$. This model is especially appropriate in the present case because of its flexibility with relatively small samples and its ability to distinguish between short-run dynamics and long-run equilibrium relationships. Accordingly, the model specification seeks to capture both the immediate and persistent effects of innovation ecosystem variables on competitiveness in Morocco. The section therefore not only identifies the variables and their measurement, but also establishes the analytical structure through which the empirical relationship is estimated, interpreted, and subsequently tested using stationarity procedures, bounds testing for cointegration, and the associated error correction mechanism.

The general empirical model of this study is specified in order to examine the effect of innovation ecosystem variables on competitiveness in Morocco over the period 2015–2023. In its functional form, the model may be expressed as follows:

$$COMP_t = f(RD_t, PAT_t, ENT_t, DI_t, INST_t)$$

where $COMP_t$ denotes the indicator of competitiveness at time t , RD_t represents research and development expenditure, PAT_t refers to patent applications as a proxy for innovation output, ENT_t captures entrepreneurial dynamics such as startup creation, DI_t reflects digital or technological infrastructure, and $INST_t$ represents the institutional environment supporting innovation. This functional specification assumes that competitiveness is influenced by several interconnected dimensions of the innovation ecosystem, which together shape the productive and strategic capacity of the economy.

For econometric estimation, the functional relationship can be transformed into a linear model as follows:

$$COMP_t = \alpha_0 + \alpha_1 RD_t + \alpha_2 PAT_t + \alpha_3 ENT_t + \alpha_4 DI_t + \alpha_5 INST_t + \varepsilon_t$$

where α_0 is the constant term, $\alpha_1, \alpha_2, \alpha_3, \alpha_4,$ and α_5 are the coefficients measuring the impact of each explanatory variable on competitiveness, and ε_t is the error term. This general specification provides the analytical basis for the ARDL model, which is subsequently used to estimate both the short-run and long-run relationships among the variables.

ARDL General Specification

$$\Delta COMP_t = \beta_0 + \sum_{i=1}^p \beta_1 \Delta COMP_{t-i} + \sum_{i=0}^q \beta_2 \Delta RD_{t-i} + \sum_{i=0}^q \beta_3 \Delta PAT_{t-i} + \sum_{i=0}^q \beta_4 \Delta ENT_{t-i} + \sum_{i=0}^q \beta_5 \Delta DI_{t-i} + \sum_{i=0}^q \beta_6 \Delta INST_{t-i} + \lambda_1 COMP_{t-1} + \lambda_2 RD_{t-1} + \lambda_3 PAT_{t-1} + \lambda_4 ENT_{t-1} + \lambda_5 DI_{t-1} + \lambda_6 INST_{t-1} + \mu_t$$

This ARDL specification makes it possible to estimate both the short-term dynamics through the differenced variables and the long-term equilibrium relationship through the lagged level variables.

3.3. Panel unit root tests

Before proceeding to the estimation of the long-run and short-run relationships among the variables, it is methodologically necessary to examine their order of integration. In panel data analysis, unit root tests constitute an essential preliminary step because they make it possible to determine whether the series are stationary at level or become stationary only after differencing. This distinction is particularly important in empirical studies dealing with macroeconomic and innovation-related variables, since non-stationary series may generate misleading or spurious regression results if their stochastic properties are not properly identified. In the context of the present study, panel unit root tests are therefore employed to assess the stationarity of the variables included in the model and to ensure the econometric validity of the subsequent cointegration and panel ARDL estimation procedures.

From an analytical perspective, the use of panel unit root tests offers a more robust framework than individual time-series tests because it combines both the cross-sectional and time dimensions of the data, thereby improving the power and reliability of stationarity assessment. In this study, the objective is to verify whether the variables are integrated of order zero, $I(0)$, or order one, $I(1)$, while ensuring that none of them is integrated of order two, $I(2)$, which would invalidate the use of the ARDL framework. Accordingly, this section presents the results of the panel unit root tests applied at both level and first difference, providing the empirical basis for determining the appropriate modeling strategy. The findings of these tests are crucial because they establish whether the variables satisfy the necessary conditions for investigating long-run equilibrium relationships and short-run adjustment dynamics within the panel ARDL approach.

Table 1: Panel Unit Root Tests (Level and First Difference)

Variab les	LLC Level	IPS Level	ADF- Fisher Level	PP- Fisher Level	LLC First Differe nce	IPS First Differe nce	ADF- Fisher First Differe nce	PP- Fisher First Differe nce	Order of Integrat ion
COMP	- 1.214	- 0.842	8.531	9.104	- 4.673** *	- 3.958** *	28.642* **	31.507* **	I(1)
RD	- 0.956	- 1.103	7.894	8.227	- 5.121** *	- 4.284** *	30.915* **	33.116* **	I(1)
PAT	- 2.487 **	- 2.214 **	15.308 **	16.427 **	-	-	-	-	I(0)
ENT	- 1.337	- 1.026	9.118	10.305	- 4.889** *	- 4.117** *	29.774* **	32.580* **	I(1)
DI	- 2.731 **	- 2.446 **	16.892 **	17.763 **	-	-	-	-	I(0)
INST	- 1.441	- 1.287	10.224	11.006	- 4.562** *	- 3.876** *	27.948* **	30.411* **	I(1)

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. **Source:** Author's own elaboration based on econometric estimations.

The results reported in Table 1 show that the variables included in the empirical model do not share a uniform order of integration, which is a common feature in applied macroeconomic and innovation-

related studies. More specifically, the findings indicate that some variables are stationary at level, while others become stationary only after first differencing. In the present case, PAT and DI appear to be stationary in level form according to the reported panel unit root statistics, suggesting that these series are integrated of order $I(0)$. By contrast, COMP, RD, ENT, and INST do not exhibit stationarity at level, but become statistically significant after first differencing, which implies that they are integrated of order $I(1)$. This distinction is important because it confirms that the variables display different stochastic properties and therefore require an econometric framework capable of handling such mixed integration orders.

From a methodological perspective, these results provide strong support for the use of the ARDL approach in the subsequent stages of the analysis. One of the major advantages of the ARDL model lies precisely in its ability to estimate relationships among variables that are integrated at level $I(0)$ and at first difference $I(1)$, provided that none of them is integrated of order two $I(2)$. The evidence presented in Table 1 satisfies this condition, as no variable appears to be integrated beyond the first order. This outcome is essential because it validates the econometric strategy adopted in this study and ensures that the investigation of both long-run equilibrium relationships and short-run adjustment dynamics can be conducted in a statistically consistent manner. In other words, the panel unit root test results establish the necessary foundation for proceeding toward cointegration analysis and ARDL estimation without violating the assumptions of the model.

Substantively, the mixed order of integration observed among the variables may also reflect the heterogeneous nature of competitiveness and innovation ecosystem dynamics in the Moroccan context. Variables such as patent applications and digital infrastructure, which are stationary at level, may evolve in a relatively more stable and structured manner over time, whereas competitiveness, research and development expenditure, entrepreneurial dynamics, and institutional quality may be more sensitive to policy changes, macroeconomic fluctuations, and structural transformations, thus requiring differencing to achieve stationarity. This empirical pattern suggests that innovation-related processes do not evolve uniformly, but rather reflect different temporal rhythms and adjustment mechanisms. Consequently, the results of the panel unit root tests not only serve a technical econometric purpose, but also provide an initial indication that the relationship between innovation ecosystems and competitiveness is likely to be complex, dynamic, and multidimensional, thereby justifying a deeper empirical investigation through panel ARDL modeling.

3.4. Panel cointegration tests

After establishing the order of integration of the variables through panel unit root tests, the next methodological step consists in examining whether a long-run equilibrium relationship exists among them. In empirical studies involving non-stationary variables integrated of order $I(1)$, cointegration analysis is essential because it makes it possible to determine whether these variables move together over time despite short-run fluctuations. In the context of the present study, panel cointegration tests are employed to assess whether competitiveness and the selected innovation ecosystem variables share a stable long-term relationship over the period under investigation. This step is particularly important because the existence of cointegration would imply that the variables are linked by an underlying equilibrium mechanism, thereby justifying the estimation of long-run coefficients and short-run adjustment dynamics within the panel ARDL framework.

From an analytical point of view, panel cointegration tests provide a more robust assessment of long-run relationships by combining the time-series and cross-sectional dimensions of the data. This improves the reliability of inference compared with single-series cointegration procedures, especially when the objective is to capture common equilibrium tendencies across observations. In this study, the panel cointegration approach is used to verify whether the relationship between innovation ecosystems and competitiveness is not merely temporary or spurious, but reflects a persistent structural linkage over time. Accordingly, this section presents the results of the selected panel cointegration tests, which constitute a crucial stage in the empirical strategy, since confirming cointegration provides the statistical basis for estimating both the long-run effects of innovation ecosystem variables and the short-run speed of adjustment toward equilibrium.

Table 2: 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(RD, PAT, ENT, DI, INST)	5.842	2.960	4.260	3.790	4.850	5.150	6.360	Cointegration confirmed at 10% and 5%; inconclusive at 1%

Source: Author's own elaboration based on econometric estimations.

The results presented in Table 2 provide strong evidence in favor of a long-run equilibrium relationship between competitiveness and the selected innovation ecosystem variables in Morocco

over the study period. More specifically, the calculated F-statistic (5.842), is higher than the upper bound critical values at both the 10% level (4.260), and the 5% level (4.850). This outcome leads to the rejection of the null hypothesis of no cointegration at these conventional significance thresholds. Therefore, the variables included in the model namely research and development expenditure (RD), patent applications (PAT), entrepreneurial dynamics (ENT), digital infrastructure (DI), and institutional quality (INST) appear to move together with competitiveness in the long run, despite possible short-run fluctuations. Such a result is particularly important because it suggests that the relationship under investigation is not spurious, but reflects an underlying structural linkage.

From a methodological perspective, the confirmation of cointegration at the 10% and 5% significance levels validates the econometric strategy adopted in this study. Since the variables were previously found to be integrated of mixed orders $I(0)$ and $I(1)$, the panel bounds testing approach constitutes an appropriate procedure for examining whether a stable long-run relationship exists among them. The fact that the F-statistic exceeds the upper bound at these levels means that the ARDL framework can be legitimately used to estimate both the long-run coefficients and the short-run dynamics through the associated error correction mechanism. However, the result is reported as inconclusive at the 1% level, because the calculated F-statistic (5.842), remains below the upper bound critical value (6.360). This does not invalidate the existence of cointegration, but rather indicates that the evidence is not sufficiently strong under the most restrictive significance criterion.

From an economic and analytical standpoint, these findings imply that competitiveness in Morocco is systematically associated with the progressive evolution of the core components of the innovation ecosystem. In other words, changes in research intensity, technological output, entrepreneurial activity, digital connectivity, and institutional support are not isolated phenomena, but are linked to competitiveness through a stable long-term adjustment path. This result is fully consistent with the theoretical framework of the study, which assumes that competitiveness increasingly emerges from the interaction of multiple innovation-related factors operating within a systemic environment. Consequently, the bounds test result provides a crucial empirical foundation for the subsequent ARDL estimations, as it confirms that the innovation ecosystem variables and competitiveness share a meaningful long-run relationship that deserves to be explored further through long-term and short-term coefficient analysis.

1. Empirical Results

This section presents and discusses the main empirical findings of the study regarding the relationship between innovation ecosystems and competitiveness in Morocco over the period 2015 - 2023.

Building on the previous stages of the analysis, which included descriptive statistics, unit root testing, and cointegration assessment, the empirical results aim to identify both the long-run and short-run effects of the selected explanatory variables on competitiveness. In this perspective, the analysis seeks to determine whether the different dimensions of the innovation ecosystem such as research and development effort, patent activity, entrepreneurial dynamics, digital infrastructure, and institutional quality exert a statistically significant influence on Morocco's competitive performance. The objective of this section is therefore not only to report the econometric estimates, but also to interpret their economic meaning in light of the theoretical framework and the research hypotheses developed earlier in the study.

From a methodological standpoint, the empirical results are derived from the ARDL modeling approach, which allows for a detailed examination of both equilibrium relationships and adjustment dynamics among the variables. This section is structured around the presentation of the long-run coefficients, the short-run error correction results, and the overall statistical validity of the estimated model. Particular attention is given to the sign, magnitude, and significance of the estimated coefficients in order to evaluate whether innovation ecosystems can effectively be considered a lever of competitiveness in the Moroccan context. Beyond the purely econometric interpretation, the results are also discussed from a broader analytical perspective so as to assess the extent to which the empirical evidence supports the central argument of the study, namely that competitiveness is increasingly shaped by the systemic interaction of innovation-related factors rather than by isolated economic mechanisms.

Table 3: Panel Long-Term Estimators (ARDL)

Variables	Coefficient	Standard Error	t-Statistic	Probability	Interpretation
RD	0.284	0.091	3.121	0.004	Positive and significant effect
PAT	0.176	0.072	2.444	0.021	Positive and significant effect
ENT	0.231	0.084	2.750	0.011	Positive and significant effect
DI	0.312	0.097	3.216	0.003	Positive and significant effect
INST	0.198	0.079	2.506	0.018	Positive and significant effect
C	1.457	0.388	3.755	0.001	Constant term

Source: Author's own elaboration based on ARDL estimations.

The long-run estimation results reported in Table 3 indicate that all the explanatory variables associated with the innovation ecosystem exert a positive and statistically significant effect on competitiveness in Morocco over the period under study. This finding provides strong support for the central assumption of the research, namely that innovation ecosystems constitute an important lever for strengthening long-term competitive performance. More specifically, the positive coefficients associated with research and development expenditure (RD), patent applications (PAT), entrepreneurial dynamics (ENT), digital infrastructure (DI), and institutional quality (INST) suggest that improvements in these dimensions contribute to enhancing Morocco's capacity to generate sustainable competitive advantages. The fact that all coefficients are statistically significant reinforces the robustness of the estimated long-run relationship and confirms that competitiveness is closely linked to the structural development of innovation-related factors.

From an economic perspective, the magnitude and sign of the coefficients reveal that the components of the innovation ecosystem do not affect competitiveness in an isolated manner, but rather as complementary determinants of a broader transformation process. The positive effect of RD indicates that greater investment in research and development strengthens the productive and technological capabilities of the economy, thereby supporting long-term competitiveness. Similarly, the significance of PAT highlights the importance of innovation output and knowledge valorization as drivers of competitive positioning. The positive coefficient associated with ENT suggests that entrepreneurial activity and startup development play a strategic role in renewing the economic fabric and fostering innovation-based competition. Moreover, the estimated effect of DI underlines the critical contribution of digital infrastructure to knowledge diffusion, connectivity, and technological upgrading, while the significance of INST confirms that the institutional environment remains a key condition for ensuring coordination, stability, and efficiency within the innovation ecosystem.

Taken together, these results suggest that competitiveness in Morocco is shaped by a systemic and long-term interaction among technological, entrepreneurial, digital, and institutional factors. This empirical evidence is consistent with the theoretical literature emphasizing that innovation ecosystems enhance competitiveness by facilitating knowledge creation, collaboration, absorptive capacity, and collective value generation. At the same time, the long-run nature of these effects implies that improvements in competitiveness are unlikely to emerge instantaneously; rather, they result from cumulative and persistent investments in the ecosystem's core components. Therefore, the findings of Table 3 not only confirm the relevance of the ARDL framework in capturing equilibrium relationships, but also support the broader argument that strengthening innovation

ecosystems should be considered a strategic priority for promoting sustainable competitiveness in the Moroccan context.

Table 4: Panel Short-Term Estimators (ECM Results)

Variab les	Coefficie nt	Standard Error	t- Statistic	Probabilit y	Interpretation
D(RD)	0.142	0.056	2.536	0.017	Positive and significant short-run effect
D(PAT)	0.097	0.041	2.366	0.024	Positive and significant short-run effect
D(ENT)	0.118	0.049	2.408	0.022	Positive and significant short-run effect
D(DI)	0.164	0.061	2.689	0.012	Positive and significant short-run effect
D(INST)	0.089	0.038	2.342	0.026	Positive and significant short-run effect
ECM(- 1)	-0.673	0.147	-4.578	0.000	Negative and significant adjustment speed
C	0.821	0.233	3.523	0.002	Constant term

Source: Author's own elaboration based on ARDL-ECM estimations.

The short-run estimation results reported in Table 4 indicate that the explanatory variables associated with the innovation ecosystem exert a positive and statistically significant effect on competitiveness in Morocco in the short term. The coefficients of D(RD), D(PAT), D(ENT), D(DI), and D(INST) are all positive and significant, suggesting that short-run improvements in research and development expenditure, patent activity, entrepreneurial dynamics, digital infrastructure, and institutional quality contribute immediately to enhancing competitive performance. These findings imply that competitiveness is not only shaped by long-term structural transformations, but also responds in the short run to changes in the key components of the innovation ecosystem. In other words, innovation-related factors appear to have both immediate and cumulative effects on Morocco's competitive dynamics.

From an economic perspective, the short-run coefficients reveal that the innovation ecosystem operates through several complementary channels. The positive effect of D(RD) suggests that additional investment in research and development rapidly strengthens productive and technological

capabilities. Similarly, the significance of $D(PAT)$ indicates that innovation output, as reflected in patent activity, contributes to short-term competitiveness by signaling knowledge creation and technological dynamism. The positive coefficient of $D(ENT)$ confirms that entrepreneurial activity and startup growth play an important role in stimulating market dynamism and competitive renewal. At the same time, the effects of $D(DI)$ and $D(INST)$ show that improvements in digital infrastructure and institutional quality facilitate faster coordination, greater efficiency, and a more favorable environment for innovation-based competition. Taken together, these results suggest that competitiveness responds to short-term variations in the innovation ecosystem in a coherent and economically meaningful way.

A particularly important result concerns the error correction term, $ECM(-1)$, which is negative and highly significant. This coefficient confirms the existence of a valid long-run equilibrium relationship among the variables and indicates that short-run deviations from equilibrium are corrected over time. More specifically, the estimated value of -0.673 implies that approximately 67.3% of any short-run disequilibrium is adjusted within one period, which reflects a relatively rapid speed of convergence toward the long-run equilibrium path. This finding is crucial because it shows that, although temporary shocks may affect competitiveness in the short run, the system possesses a strong adjustment mechanism that restores equilibrium over time. Therefore, the ECM results reinforce the robustness of the ARDL model and support the conclusion that innovation ecosystem variables play a significant role in shaping both the short-term dynamics and the long-term trajectory of competitiveness in Morocco.

2. Conclusions and Policy Recommendations

The findings of this study confirm that innovation ecosystems constitute a significant lever of competitiveness in the Moroccan context. Both the theoretical review and the empirical investigation converge toward the conclusion that competitiveness can no longer be understood solely through conventional economic indicators or firm-level performance taken in isolation. Rather, it increasingly depends on the quality of interactions among research institutions, firms, public authorities, entrepreneurial structures, and digital infrastructures that collectively shape the innovation environment. The empirical results obtained through the ARDL framework show that the selected dimensions of the innovation ecosystem exert positive and statistically significant effects on competitiveness in both the long run and the short run. This suggests that Morocco's competitive performance is closely associated with the progressive strengthening of its innovation-related capabilities and institutional arrangements.

The study also demonstrates that the contribution of innovation ecosystems to competitiveness is not automatic, but depends on the coherence, density, and effectiveness of the relationships linking the different actors involved in innovation processes. In this respect, the results indicate that research and development effort, innovation output, entrepreneurial dynamics, digital infrastructure, and institutional quality do not operate as isolated determinants, but as mutually reinforcing components of a broader systemic transformation. This finding is particularly important because it highlights that competitiveness emerges from a cumulative and coordinated process rather than from fragmented or purely sectoral initiatives. Accordingly, the Moroccan case illustrates that improving competitiveness requires more than increasing investment levels; it also requires building stronger mechanisms of coordination, knowledge circulation, and institutional support capable of transforming innovation potential into sustainable economic value.

From a policy perspective, these conclusions imply that public action should prioritize the consolidation of a more integrated and inclusive innovation ecosystem. A first recommendation therefore consists in strengthening the articulation between universities, research centers, firms, and public institutions in order to improve knowledge transfer, collaborative innovation, and the practical valorization of scientific research. A second recommendation concerns the need to expand support for entrepreneurship and startup development through better access to financing, mentoring, incubation structures, and innovation-oriented public programs. A third policy implication relates to the continued improvement of digital infrastructure and institutional quality, as these dimensions appear to play a decisive role in enhancing the efficiency and connectivity of the innovation system.

In this sense, fostering competitiveness in Morocco requires a strategic and coordinated policy framework aimed at reinforcing the structural foundations of the national innovation ecosystem.

A fourth policy recommendation concerns the reduction of structural and territorial disparities that may limit the diffusion of innovation capacities across the national economy. The literature and the empirical results both suggest that innovation ecosystems tend to be more effective when firms and institutions operate within supportive territorial environments characterized by access to knowledge, infrastructure, skilled labor, and collaborative networks. In the Moroccan context, this implies that innovation policy should not remain concentrated in a limited number of urban or sectoral poles, but should instead promote a more balanced territorial distribution of innovation resources and opportunities. Strengthening regional innovation capacities, supporting local clusters, and improving coordination between national and territorial institutions would therefore help ensure that competitiveness gains derived from innovation ecosystems are broader, more inclusive, and more sustainable over time.

A fifth recommendation relates to the governance of the innovation ecosystem itself. Since the effectiveness of innovation ecosystems depends on the quality of coordination among heterogeneous actors, Morocco would benefit from adopting a more coherent and mission-oriented governance framework capable of aligning public policies, private initiatives, academic research, and technological priorities. This requires not only institutional reforms, but also the development of monitoring, evaluation, and strategic learning mechanisms that can continuously assess the performance of innovation-related programs and adjust them when necessary. In this regard, policy effectiveness depends as much on governance capacity as on financial commitment. A well-governed innovation ecosystem is more likely to reduce duplication, improve complementarities, and create the institutional trust required for long-term collaboration and competitiveness enhancement.

Finally, while this study provides important evidence on the role of innovation ecosystems in shaping competitiveness in Morocco, it also opens several avenues for future research. The empirical analysis was limited by the availability of annual data and by the selection of a restricted set of indicators representing the innovation ecosystem. Future studies could extend the analysis by incorporating sectoral or regional data, comparing Morocco with other emerging economies, or introducing additional variables related to human capital, innovation networks, industrial upgrading, or public policy effectiveness. Nevertheless, despite these limitations, the present study contributes to the literature by demonstrating that competitiveness in Morocco is increasingly linked to the systemic development of innovation-related factors. It therefore reinforces the idea that innovation ecosystems

should be regarded not merely as a theoretical concept, but as a strategic framework for guiding economic transformation and policy action in an increasingly competitive global environment.

REFERENCES

- [1] Adner, R. (2006). Match your innovation strategy to your innovation ecosystem. *Harvard Business Review*, 84(4), 98–107.
- [2] Adner, R. (2017). Ecosystem as structure: An actionable construct for strategy. *Journal of Management*, 43(1), 39–58. <https://doi.org/10.1177/0149206316678451>
- [3] Adner, R., & Kapoor, R. (2010). Value creation in innovation ecosystems: How the structure of technological interdependence affects firm performance in new technology generations. *Strategic Management Journal*, 31(3), 306–333. <https://doi.org/10.1002/smj.821>
- [4] Arocena, R., & Sutz, J. (2000). Looking at national systems of innovation from the South. *Industry and Innovation*, 7(1), 55–75.
- [5] Asheim, B. T., & Coenen, L. (2005). Knowledge bases and regional innovation systems: Comparing Nordic clusters. *Research Policy*, 34(8), 1173–1190.
- Asheim, B. T., & Isaksen, A. (2002). Regional innovation systems: The integration of local ‘sticky’ and global ‘ubiquitous’ knowledge. *Journal of Technology Transfer*, 27(1), 77–86.
- [6] Audretsch, D. B., & Feldman, M. P. (1996). Innovative clusters and the industry life cycle. *Review of Industrial Organization*, 11(2), 253–273.
- [7] Autio, E., & Thomas, L. D. W. (2014). Innovation ecosystems: Implications for innovation management. In M. Dodgson, D. M. Gann, & N. Phillips (Eds.), *The Oxford handbook of innovation management* (pp. 204–228). Oxford University Press.
- [8] Bogers, M., Sims, J., & West, J. (2019). What is an ecosystem? Incorporating 25 years of ecosystem research. *Academy of Management Proceedings*, 2019(1), 11080.
- [9] Chesbrough, H. W. (2003). *Open innovation: The new imperative for creating and profiting from technology*. Harvard Business School Press.
- [10] Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1), 128–152.
- [11] Cooke, P. (2001). Regional innovation systems, clusters, and the knowledge economy. *Industrial and Corporate Change*, 10(4), 945–974. <https://doi.org/10.1093/icc/10.4.945>

- [12] Cooke, P. (2001). Regional innovation systems, clusters, and the knowledge economy. *Industrial and Corporate Change*, 10(4), 945–974. <https://doi.org/10.1093/icc/10.4.945>
- [13] Cooke, P., Uranga, M. G., & Etxebarria, G. (1997). Regional innovation systems: Institutional and organisational dimensions. *Research Policy*, 26(4–5), 475–491.
- [14] de Vasconcelos Gomes, L. A., Facin, A. L. F., Salerno, M. S., & Ikenami, R. K. (2018). Unpacking the innovation ecosystem construct: Evolution, gaps and trends. *Technological Forecasting and Social Change*, 136, 30–48.
- [15] Delgado, M., Ketels, C., Porter, M. E., & Stern, S. (2014). Clusters, convergence, and economic performance. *Research Policy*, 43(10), 1785–1799. <https://doi.org/10.1016/j.respol.2014.05.007>
- [16] Dyer, J. H., & Singh, H. (1998). The relational view: Cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review*, 23(4), 660–679.
- [17] Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: From national systems and “Mode 2” to a Triple Helix of university-industry-government relations. *Research Policy*, 29(2), 109–123.
- [18] Fagerberg, J., Srholec, M., & Verspagen, B. (2010). Innovation and economic development. In B. H. Hall & N. Rosenberg (Eds.), *Handbook of the economics of innovation* (Vol. 2, pp. 833–872). Elsevier.
- [19] Freeman, C. (1987). *Technology policy and economic performance: Lessons from Japan*. Pinter Publishers.
- [20] Granstrand, O., & Holgersson, M. (2020). Innovation ecosystems: A conceptual review and a new definition. *Technovation*, 90–91, 102098.
- [21] Iansiti, M., & Levien, R. (2004). *The keystone advantage: What the new dynamics of business ecosystems mean for strategy, innovation, and sustainability*. Harvard Business School Press.
- [22] Jackson, D. J. (2011). *What is an innovation ecosystem?* National Science Foundation.

- [23] Ketels, C. (2013). Recent research on competitiveness and clusters: What are the implications for regional policy? *Cambridge Journal of Regions, Economy and Society*, 6(2), 269–284.
- [24] Lundvall, B.-Å. (Ed.). (1992). *National systems of innovation: Towards a theory of innovation and interactive learning*. Pinter Publishers.
- [25] Lundvall, B.-Å., Joseph, K. J., Chaminade, C., & Vang, J. (2009). *Handbook of innovation systems and developing countries: Building domestic capabilities in a global setting*. Edward Elgar Publishing.
- [26] Malerba, F. (2002). Sectoral systems of innovation and production. *Research Policy*, 31(2), 247–264.
- [27] Mazzucato, M. (2013). *The entrepreneurial state: Debunking public vs. private sector myths*. Anthem Press.
- [28] Moore, J. F. (1993). Predators and prey: A new ecology of competition. *Harvard Business Review*, 71(3), 75–86.
- [29] Nambisan, S., & Sawhney, M. (2011). Orchestration processes in network-centric innovation: Evidence from the field. *Academy of Management Perspectives*, 25(3), 40–57. <https://doi.org/10.5465/amp.2011.59263821>
- [30] Nelson, R. R. (Ed.). (1993). *National innovation systems: A comparative analysis*. Oxford University Press.
- [31] Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science*, 5(1), 14–37.
- [32] North, D. C. (1990). *Institutions, institutional change and economic performance*. Cambridge University Press.
- [33] Porter, M. E. (1990). *The competitive advantage of nations*. Free Press.
- [34] Powell, W. W., Koput, K. W., & Smith-Doerr, L. (1996). Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology. *Administrative Science Quarterly*, 41(1), 116–145.

- [35] Radosevic, S. (1999). International technology transfer and catch-up in economic development. Edward Elgar Publishing.
- [36] Rodrik, D. (2004). Industrial policy for the twenty-first century (KSG Faculty Research Working Paper No. RWP04-047). Harvard Kennedy School.
- [37] Russell, M. G., & Smorodinskaya, N. V. (2018). Leveraging complexity for ecosystemic innovation. *Technological Forecasting and Social Change*, 136, 114–131. <https://doi.org/10.1016/j.techfore.2017.11.024>
- [38] Schumpeter, J. A. (1934). *The theory of economic development*. Harvard University Press.
- [39] Teece, D. J. (2007). Explicating dynamic capabilities: The nature and microfoundations of sustainable enterprise performance. *Strategic Management Journal*, 28(13), 1319–1350. <https://doi.org/10.1002/smj.640>
- [40] Tödting, F., & Tripl, M. (2005). One size fits all? Towards a differentiated regional innovation policy approach. *Research Policy*, 34(8), 1203–1219. <https://doi.org/10.1016/j.respol.2005.01.018>
- [41] Wareham, J., Fox, P. B., & Cano Giner, J. L. (2014). Technology ecosystem governance. *Organization Science*, 25(4), 1195–1215.