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The Reality of Innovation in Algeria in light of the Global Innovation Index: An Analysis of the Problem of Transforming Knowledge into Economic Value

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Abstract:

This study aims to analyze the current state of innovation in Algeria in light of the Global Innovation Index (GII) for the period 2020–2025. From a business management perspective, the research focuses on the gap between innovation inputs and outputs. The study builds upon several theoretical frameworks, including the Dynamic Capabilities Theory, the Resource-Based View (RBV), and the National Innovation System (NIS) concept, to understand the structural nature of the existing imbalance.

The findings reveal a structural dysfunction in the mechanisms of transforming innovation inputs into economic outputs. This is evident in the stagnation of Algeria's ranking at lower levels despite relative improvements in certain sub-indicators. Furthermore, the results demonstrate that investments in education and human capital have not translated into effective technological or marketing performance due to a weak institutional and market environment, as well as a lack of organizational dynamic capabilities necessary for resource redeployment. Consequently, the study concludes that the subpar innovation performance is more closely linked to the limitations of strategic transformation mechanisms than to the scarcity of resources.

Keywords: Innovation Management, Dynamic Capabilities, Knowledge Transfer, National Competitiveness, Global Innovation Index (GII), National Innovation System (NIS).

Jel Classification Codes : O31, O32, O38, M10, M21

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1. INTRODUCTION

The contemporary world is undergoing rapid transformations driven by knowledge and technology, positioning innovation as a primary determinant of both corporate and national competitiveness. Economic growth is no longer solely dependent on resource abundance; rather, it hinges on the capacity of institutions to transform knowledge into sustainable economic value. In this context, Innovation Management has emerged as a pivotal research field that bridges the gap between strategic theory and organizational performance within complex competitive environments.

Modern literature emphasizes that innovation cannot be reduced to mere invention or scientific research; it is manifested through the capacity for effective commercial and organizational application. Furthermore, the Dynamic Capabilities Theory highlights the significance of reconfiguring resources and sensing opportunities to achieve a sustainable competitive advantage. On a macro level, the Global Innovation Index (GII) reflects the readiness of nations to translate innovation inputs into tangible outputs.

Despite significant investments in education and human capital formation in Algeria, its ranking in the Global Innovation Index has remained stagnant in lower tiers in recent years. Algeria's performance has consistently fallen below expectations relative to its income level, ranking 115. While there are notable strengths in education expenditure and capital formation, these are offset by a profound weakness in high-tech exports and e-participation. This disparity indicates a low efficiency in converting inputs into outputs (Mekaoui et al., 2024, p. 179).

This contradiction raises fundamental questions regarding the nature of the existing imbalance: Is the problem a scarcity of resources, or does it lie in the weakness of conversion mechanisms and the strategic management of innovation? Accordingly, this study seeks to analyze the reality of innovation in Algeria from a business administration perspective, treating it as a structural conversion dilemma rather than a mere lack of potential.

1.1 The Research problem

The core problem of this research is defined by the following question:

To what extent does Algeria's lagging performance in the Global Innovation Index reflect a structural defect in the mechanisms of converting knowledge into economic value from a business administration perspective?

1.2 Research sub-questions

• Is there a structural gap between innovation inputs and outputs in Algeria?

• Does investment in human capital and infrastructure enhance competitiveness within an unstimulating market environment?

• Is the weakness in innovative performance attributed to resource scarcity or to the deficiency in organizational dynamic capabilities?

1.3 Research hypotheses

• H1: There is a structural defect in the mechanisms of converting innovation inputs into economic outputs in Algeria.

• H2: Investment in human capital and infrastructure does not necessarily lead to enhanced national competitiveness in the absence of a stimulating institutional and market environment.

• H3: The weakness of innovation performance in Algeria is more closely linked to the deficiency in organizational dynamic capabilities than to the scarcity of resources.

1.4 Significance of the Research

The significance of this study lies in its contribution to shifting the analysis of the Global Innovation Index (GII) from a descriptive dimension to an administrative-explanatory one. It links macro-level performance with innovation management at the firm level. Furthermore, it provides a structural reading that explains the paradox of resource availability versus output deficiency, thereby enriching business administration literature within the context of developing economies.

1.5 Research Methodology

This study adopts a descriptive-analytical approach, relying on data from the Global Innovation Index for the period 2020–2025. It includes an analytical study of the index's seven pillars. Additionally, a theoretical framework based on the Dynamic Capabilities Theory and the National Innovation System (NIS) approach was employed to interpret the findings from a business administration perspective.

1.6 Literature Review

1.6.1 Chao et al. (2014): An intelligent system for assessing national innovation competitiveness based on the Global Innovation Index.

This study provided a systematic review of the literature concerning the construction and enhancement of composite innovation indices. The results indicated that the process of building these indicators still faces significant challenges in three main areas: the selection of primary indicators, addressing uncertainty and data reliability, and determining appropriate weights. The study concluded that future research should shift toward more dynamic and intelligent models using Artificial Intelligence (AI) to improve assessment accuracy.

1.6.2 Li et al. (2023): National innovation systems and the achievement of sustainable development goals: Effect of knowledge-based dynamic capability.

This paper examined the impact of knowledge-based dynamic capabilities within national innovation systems (NIS) on achieving Sustainable Development Goals (SDGs). Utilizing data from 130 countries and applying PLS-SEM modeling, the results demonstrated that knowledge creation and knowledge impact capabilities have a direct positive effect on SDG attainment. In contrast, the effects of knowledge absorption and diffusion were indirect. Furthermore, the findings revealed that a country's level of economic development significantly moderates the strength of these capabilities' impact.

1.6.3 Mekaoui et al. (2024): An analytical study of Algeria's position in innovation according to the main criteria for inputs and outputs of the Global Innovation Index.

This research analyzed Algeria's standing in the 2022 Global Innovation Index by examining innovation inputs and outputs. The results showed that Algeria's performance was lower than expected relative to its income level, ranking 115. Despite this, the study identified notable strengths in education expenditure and capital formation. However, these were undermined by significant weaknesses in regulatory quality, e-participation, and high-tech exports, signaling low efficiency in converting inputs into outputs.

1.6.4 Qazi (2025): Innovation forecasting: mapping pathways with global indicators. Applying Bayesian networks to analyze the determinants of innovation performance, this study utilized 2023 GII data for 132 countries. It focused on mapping the dependencies between five innovation inputs and two outputs. The findings emphasized that Business Sophistication is the most influential factor directly affecting Knowledge and Technology outputs and Creative outputs, followed by Market Sophistication, Human Capital, and Research. Interestingly, the influence of Institutions was found to be the weakest predictor of innovative performance.

1.7 The Research Gap

While previous studies have underscored the significance of the business environment, market sophistication, and national innovation systems in explaining innovative performance, most have approached these relationships either through broad international comparisons or within a general context.

There remains a lack of in-depth focus on specific national cases from a structural analytical perspective that explicitly links GII inputs to the dilemma of transforming knowledge into economic value. Consequently, this study focuses on Algeria as a case study. It constructs a structural analysis that correlates defects in conversion mechanisms with the weakness of institutional dynamic capabilities. By providing a reading from a business administration perspective—rather than a purely macroeconomic one—this research enhances the strategic and managerial dimension in explaining the failure to convert inputs into market-valued outputs.

2. Theoretical Frameword

2.1 Innovation in Business Admistration Literature

2.1.1 Innovation in Contemporary Economic and Managerial Thought

Innovation stands as one of the most widely debated concepts in modern economic and managerial literature. However, this prevalence has not led to a unified definition but rather to a multiplicity of approaches reflecting diverse theoretical and methodological perspectives. While classical economic thought focused on innovation as a growth engine, contemporary managerial studies have placed increasing emphasis on its role in enhancing institutional competitiveness and achieving sustainability.

The theoretical foundation of the innovation concept is largely attributed to the works of Joseph Schumpeter, who regarded innovation as the core of the developmental process in the capitalist system, linking it to what he termed "Creative Destruction." In this process, obsolete models are replaced by new, more efficient ones. This proposition represented a paradigm shift; economic growth was no longer explained solely by capital or labor accumulation, but by the ability to introduce "new combinations" in production, organization, and markets.

Conversely, modern managerial literature has expanded this concept, viewing innovation as an organizational and strategic process that transcends technological boundaries to include business models, management methods, and organizational culture. Innovation is perceived here as a dynamic capability that enables the firm to adapt to complex and rapidly changing competitive environments.

2.1.2 Innovation Patterns and their Managerial Implications

The literature indicates that innovation is a multidimensional phenomenon that cannot be reduced to technological innovation alone. The Oslo Manual classifies innovation into four primary types: Product Innovation, Process Innovation, Organizational Innovation, and Marketing Innovation (OECD, 2005).

Product innovation represents one of the most visible forms, contributing to the firm's external competitiveness by offering new or significantly improved goods/services. Process innovation, however, focuses on enhancing internal efficiency and cost reduction, directly impacting

financial performance. Meanwhile, organizational innovation is a critical element in building a culture that supports creativity through the redesign of organizational structures, leadership styles, and incentive systems. The most successful organizations are those that adopt a holistic approach to innovation, integrating these patterns rather than focusing on a single dimension (Günday et al., 2011, p. 663).

2.1.3 Innovation Management as a Strategic Process

Innovation is no longer viewed as a mere byproduct of R&D (Research and Development) activities, but as an integrated managerial process requiring planning, organizing, leading, and controlling. Innovation Management is defined as the set of practices and mechanisms that enable an organization to generate, evaluate, and implement new ideas in alignment with its strategic objectives.

Innovation is considered a central strategy in modern business administration because it directly influences institutional competitiveness and the capacity to respond to external shifts. Firms that manage innovation effectively demonstrate superior market performance and maintain long-term sustainability (Naeini et al., 2022). This suggests that innovation is not successful when treated as a purely technical procedure; rather, it must be an intrinsic part of the comprehensive organizational strategy, linked to long-term goals and stemming from the strategic vision.

Studies have shown that each type of innovation plays a distinct role in improving institutional performance, and that combining these patterns provides a comprehensive complementary benefit within the firm's overall strategy (Naeini et al., 2022).

2.2 Explanatory Frameworks for Innovation: Form Resources to Competitive Advantage

2.2.1 Innovation and Institutional Competitiveness

Empirical literature consistently indicates a strong positive correlation between innovation and institutional competitiveness. Organizations that invest in innovation achieve higher growth rates, possess a superior ability to penetrate markets, and maintain their market share. Furthermore,

innovation enhances organizational resilience and the capacity to navigate crises.

On a macro level, the innovative performance of firms reflects the competitiveness of the national economy, which explains the reliance on composite indicators—such as the Global Innovation Index (GII)—to measure national innovation readiness. In academic literature, innovation is viewed as a multidimensional process involving the generation and application of new ideas in real economic contexts to create value for both the organization and society. Innovation transcends mere invention; it encompasses the practical application that bolsters organizational performance and provides a competitive edge. Traditional management of innovation is no longer sufficient; instead, innovation must be managed as an integrated system encompassing knowledge, corporate culture, organizational structures, and market strategies. Thus, Innovation Management is the set of procedures that organize the innovation process and facilitate the structuring of new ideas, methods, and products within the firm, serving as the foundation for achieving competitive advantage (Naeini et al., 2022).

A key research trend in innovation management is the transition from general theories to applicable managerial models. Studies have revealed a deficiency in practical models that explain how organizations can systematically implement innovation management (Zartha et al., 2020, pp. 178–179). Consequently, innovation is no longer seen as an isolated phenomenon within the firm, but as an integrated system interacting with the external environment (markets, governance, resources, and knowledge). This perspective aligns with the National Innovation System (NIS) framework, which focuses on the interaction between actors—government, firms, universities, and markets—to produce and apply innovative knowledge.

Innovation is a fundamental determinant of competitiveness at the firm, sectoral, and national levels. Contemporary competitiveness is no longer built solely on low costs or economies of scale; it increasingly depends on the capacity for continuous innovation. True competitive advantage does not stem from natural resources or traditional factors of production, but

from the ability of firms to innovate and constantly improve their productive and organizational methods. This shifts the focus from price competition to value-based competition (Porter, 1990, p. 45).

2.2.2 Resource-Based View (RBV) and Sustainable Competitive Advantage

Sustainable competitive advantage links innovation to the long-term performance of organizations, as innovation allows firms to provide value that is difficult for competitors to imitate or substitute. Within the Resource-Based View (RBV), innovation becomes a source of competitive advantage when it results from resources that are Valuable, Rare, Inimitable, and Non-substitutable (VRIN) (Barney, 1991, pp. 105–106).

From this perspective, it is insufficient for a firm to innovate once; it must transform innovation into an accumulated organizational capability. This explains why some institutions or nations fail to achieve lasting competitive gains despite adopting intermittent innovative initiatives. In this context, the Dynamic Capabilities Theory emerges, suggesting that a firm's advantage lies not just in its resources, but in its ability to reconfigure these resources in response to environmental changes (Teece, Pisano, & Shuen, 1997, pp. 515–518).

2.2.3 Dynamic Capabilities Theory

The **Dynamic Capabilities** framework is one of the most widely used theoretical lenses for explaining innovation in unstable environments. Developed by Teece, Pisano, and Shuen, it is defined as the organization's ability to **sense** opportunities and threats, seize opportunities, and reconfigure its resources to align with environmental shifts (Teece et al., 1997, p. 516).

This theory emphasizes that innovation is not merely the result of resource abundance, but of managerial efficiency in redeploying available resources. This framework is crucial when analyzing innovation in developing economies, where resources may be limited, but failure often stems from weak organizational and institutional capabilities. From a business administration perspective, innovation is a practical expression of the dynamic capabilities that enable a firm to reshape its resources. Knowledge

creation and knowledge impact capabilities positively and directly influence innovative performance, while knowledge absorption and diffusion have an indirect effect; moreover, the level of economic development moderates the strength of these capabilities (Li et al., 2023, p. 7).

2.2.4 Innovation and Organizational Performance

Numerous empirical studies published in prestigious journals have confirmed the positive relationship between innovation and organizational performance. A study in *Technological Forecasting and Social Change* concluded that highly innovation-oriented organizations achieve higher levels of financial and operational performance compared to others (Rosenbusch et al., 2011, p. 444). These results support the argument that innovation should be integrated into the Performance Management System (PMS) of organizations, rather than being viewed as a separate or experimental activity.

2.3 From the Micro to the Macro Level: National Systems and Innovation Measurement Indicators

2.3.1 From Institutional to National Competitiveness

National competitiveness is essentially a cumulative reflection of the performance of firms within an economy. From this perspective, weakness in innovation at the institutional level directly impacts a country's ranking in international indices, most notably the Global Innovation Index (GII). Within the framework of the National Innovation Systems (NIS) theory, a nation's innovative performance depends on the quality of interaction between institutions, universities, and the state, rather than isolated individual efforts (Lundvall, 1992, p. 12).

2.3.2 National Innovation System (NIS) Theory

The National Innovation System approach is one of the most significant theoretical frameworks for explaining disparities in innovative performance across countries. Lundvall defined the NIS as a network of public and private institutions whose interactions initiate, import, modify, and diffuse new technologies and knowledge for economic exploitation. (Lundvall ,1992, p. 2)

This framework facilitates the transition from the firm level to the state level, allowing innovation to be understood as a result of institutional

interaction rather than merely individual initiatives. From a business administration perspective, corporate performance cannot be understood in isolation from the institutional environment in which it operates (laws, universities, financial markets, and digital infrastructure). Furthermore, Business Sophistication is identified as the most influential factor directly affecting innovation outputs, followed by Market Sophistication, Human Capital, and Research, while the "Institutions" pillar was found to be the weakest predictor of innovative performance (Qazi, 2025, p. 39). Nelson added that differences in national innovation systems largely explain the variance in competitiveness between countries, even when they possess similar natural resources or market sizes. (Nelson ,1993, p. 5)

2.3.3 Theoretical Foundations for Measuring Innovation

Despite the theoretical importance of the NIS concept, researchers have faced methodological challenges in measuring innovation at the national level. This led to the development of composite indicators that integrate institutional, human, technological, and market dimensions. In this context, Edquist pointed out that measuring innovation cannot rely on a single indicator (such as the number of patents); instead, it must be based on a system of indicators reflecting both innovation inputs and outputs. This proposition clarifies the logic behind the construction of the Global Innovation Index (GII) as a composite index that encompasses not only outputs (patents, high-tech exports) but also inputs (education, institutions, infrastructure, and business environment). (Edquist, 2005, p. 183)

2.3.4 Characteristics of Innovation in Developing Economies

Literature confirms that innovation in developing economies possesses structural specificities, including weak university-industry linkages, fragile innovation financing, and slow technology transfer. Developing economies often suffer from an "Innovation Paradox"—a gap between innovation inputs and their economic outputs (Cirera & Maloney, 2017, p. 4). This framework is instrumental in explaining the Algerian case within the broader context of rentier or transition economies, where innovation manifests asymmetrically between infrastructure availability and actual

economic results.

3. Empirical Framework

3.1 General Overview of the Global Innovation Index (GII)

The Global Innovation Index (GII) is one of the most prominent international composite indicators used to measure national innovation performance. It is published annually by the World Intellectual Property Organization (WIPO) in partnership with INSEAD and Cornell University. The index is built upon a theoretical framework that distinguishes between two core pillars:

- Innovation Inputs
- Innovation Outputs (Dutta et al., 2023, p. 23).

The GII comprises seven primary pillars:

1. Institutions
2. Human Capital & Research
3. Infrastructure
4. Market Sophistication
5. Business Sophistication
6. Knowledge & Technology Outputs
7. Creative Outputs (Dutta et al., 2023, pp. 28–31).

The GII relies on a methodological approach that separates innovation inputs from outputs, aligning with the theoretical conceptualization of innovation as a knowledge production system. The construction of these indicators faces significant challenges across three main axes: the selection of primary indicators, addressing uncertainty and data reliability, and determining appropriate weights (Chao et al., 2014, p. 1). This underscores the importance of relying on a structural analysis of the seven pillars rather than merely observing the overall ranking—an approach adopted by this study to diagnose defects within the Algerian innovation system.

This framework demonstrates that the GII is not merely a numerical ranking but a direct reflection of a theoretical perspective that views innovation as the outcome of interactions between human capital, the regulatory environment, markets, and technology. Consequently, a country's low ranking indicates a structural imbalance in its innovation system.

From a Business Administration perspective, GII results carry particular

significance as they indirectly influence:

- Investment decisions.
- Market attractiveness.
- Innovation costs within firms.
- Collaboration opportunities between companies and universities.

Thus, national performance is intrinsically linked to the ability of domestic firms to manage innovation and exploit knowledge (Pepe et al., 2024, p. 7). This connection explains why Algeria's GII ranking does not only reflect the level of scientific research but also the capacity of economic institutions to transform knowledge into economic value, which is the core concern of business management.

3.2 Analyzing the Temporal Path and Performance Efficiency

Table (01): Algeria GII Ranking (2025–2020)

Year	GII Position	Innovation Inputs	Innovation Outputs	Efficiency Gap
2020	121st	111st	126th	-15
2021	120th	109th	128th	-19
2022	115th	110th	118th	-8
2023	119th	118th	116th	2
2024	115th	113rd	115th	-2
2025	115th	112nd	111st	1

Source: World Intellectual Property Organization (WIPO). (2025). *Global Innovation Index 2025: Algeria's Ranking and Innovation Performance*. WIPO.

An analysis of the historical evolution of Algeria's ranking in the Global Innovation Index (GII) during the period (2020–2025) indicates a state of "Negative Stagnation." This trend reveals a deeply rooted structural crisis within the national innovation system. While the world is witnessing an unprecedented acceleration in the pace of innovation and technological change, Algeria remains confined to the lower ranks (115 out of 139 countries), reflecting an institutional failure to keep pace with global transformations.

What is particularly striking in this dynamics is the persistent fluctuation in the gap between innovation inputs and outputs, which ranges from -19 to

+2 points. This fluctuation is not merely a statistical variance; rather, it is an indicator of the instability of knowledge and technology conversion mechanisms. For instance, in 2021, the gap reached -19 points, implying that innovation investments were almost entirely wasted. Conversely, in 2023, the gap turned positive (+2), representing a fragile and unsustainable improvement.

From a Business Administration perspective, this pattern indicates the absence of a systematic conversion strategy, where results depend on individual or situational initiatives rather than an integrated system. The stagnation of the overall ranking around the 115 position for six consecutive years—despite a slight improvement in the output ranking from 126 to 111 reveals the limited cumulative impact of innovation investments. This necessitates a radical reconsideration of governance models and monitoring and evaluation (M&E) mechanisms.

3.3 Analysis of Seven Pillars and the Enabling Gap

Table (02): Science and Innovation Investment Tracker (Algeria - 2025)

	Rank 2025	**Strategic Status**
Human capital and research	82nd	Strategic Asset
Institutions	89th	Supportive
Infrastructure	97th	Developing
Creative outputs	107th	Emerging
Knowledge and technology outputs	112nd	Underperforming
Business sophistication	119th	Critical Gap
Market sophistication	138th	Structural Failure

Source:World Intellectual Property Organization (WIPO). (2025). *Global Innovation Index 2025: Algeria's Ranking and Innovation Performance*. WIPO.

The analysis of the seven pillars of the Global Innovation Index reveals a performance gradient that begins with relatively supportive pillars and ends with those suffering from structural failure, indicating a severe systemic imbalance.

- **Relatively Supportive Pillars (Ranks 82-97):**

These include Human Capital and Research 82, Institutions 89, and Infrastructure 97. While these pillars provide the minimum essential requirements for innovation, they remain below aspirations. The absence of

globally ranked universities (e.g., QS World University Rankings) despite substantial investment in education creates a "Quality Paradox," where quantity is available without the requisite excellence in quality.

- **Lagging Performance Pillars (Ranks 107-112):**

Represented by Creative Outputs 107 and Knowledge and Technology Outputs 112, these pillars manifest the conversion crisis in its clearest form. Inputs fail to translate into superior outputs. For instance, the 11.64% growth in mobile application downloads (reaching 9.88 million) originates from a low baseline and does not represent a true digital transformation.

- **Structural Failure Pillars (Ranks 119-138):**

These embody deep systemic gaps. A ranking of 138 in Market Sophistication (out of 139 countries) is not merely a low rank; it is conclusive evidence of a business environment that stifles creativity and innovation. This failure is rooted in several factors:

- A financial system incapable of financing innovative risks (Venture Capital).
- Regulatory barriers hindering market entry and exit (Ease of doing business).
- A corporate culture that prioritizes compliance over innovation.
- Isolation from international trade and financial networks.

3.4 Dynamics of Innovative Growth: Between Quantity and Quality

Table (03): Science and Innovation Investment Tracker (Trends)

Indicator	Short term (23-24)	Long term (14-24)
Scientific publications	▲ 13.2%	▲ 9.3%
International patent filings	▲ 15.4%	▲ 7.9%
Venture capital deal numbers	▼ -66.7%	▲ 18.9%

Source: World Intellectual Property Organization (WIPO). (2025). *Global Innovation Index 2025: Algeria's Ranking and Innovation Performance*. WIPO.

The analysis of short-term growth indicators presents a paradoxical image; quantitative growth in specific sectors coexists with a sharp decline in others, revealing a misalignment in innovation policy priorities. The growth

in scientific publications (13.2%) and international patent filings (15,4%) demonstrates a research momentum that cannot be ignored. However, this growth remains fragile and untranslated into a tangible economic impact. The H-index، standing at only 10.5, indicates a weak scientific impact of these publications on a global scale.

Furthermore, the total number of patents (1.4 thousand) remains modest relative to the size of the economy and population. More critically, only a negligible percentage of these patents are successfully converted into commercial products, highlighting a profound gap in the technology transfer process.

3.5 Analysis of Strengths and Weaknesses

Table (04): Rankings in the Seven GII Pillars for Algeria (2025)

Top Strengths (Indicator)	Rank	Key Weaknesses (Indicator)	Rank
Gross capital formation, % GDP	10	High-tech exports, % total trade	138
Graduates in science and engineering, %	15	Software spending, % GDP	137
Expenditure on education, % GDP	22	ICT services exports, % total trade	132
State of cluster development	24	FDI net inflows, % GDP	120

Source:World Intellectual Property Organization (WIPO). (2025). *Global Innovation Index 2025: Algeria's Ranking and Innovation Performance*. WIPO.

The analysis of strengths and weaknesses presents a juxtaposition of remarkable potential alongside deep structural gaps. On the side of strengths, Algeria maintains advanced global positions in Gross Capital Formation 10, Education Expenditure 22, and Science and Engineering Graduates 15. These indicators reflect a clear political will to invest in physical and human capital. They also point to the availability of an innovation infrastructure base, particularly as the percentage of science and engineering graduates reaches 31.15% of total graduates—a rate surpassing many developed nations, providing a knowledge-based demographic dividend that can be leveraged.

However, the weaknesses expose a structural conversion and application crisis. The 138 rank in High-tech Exports is not just a low standing; it is a profound indicator of the failure to translate knowledge into exportable products. Similarly, Software Spending 137 reveals an institutional digital

lag that hinders the transition toward a knowledge-based economy.

Most concerning is the 120 rank in FDI Net Inflows and the 132 in Digital Services Exports, signaling a dual isolation of the Algerian economy: isolation from global financial networks and isolation from international digital value chains. This isolation creates a vicious cycle of technological marginalization, where external competitive incentives are absent, and opportunities for cross-border knowledge transfer are weakened.

3.6 Discussion and Hypothesis Testing

Based on the preceding structural and statistical analysis, the study reaches the following conclusions regarding the research hypotheses:

3.6.1 Acceptance of the First Hypothesis (H1)

"There is a structural defect in the mechanisms of converting innovation inputs into economic outputs."

Justification: The persistent gap between inputs and outputs, coupled with a stagnant innovation efficiency ratio, confirms that the core dilemma lies within the conversion mechanisms rather than the scarcity of raw inputs or initial resources. Algeria possesses the foundational elements, yet fails to architect the "bridge" that connects them to the market.

3.6.2 Acceptance of the Second Hypothesis (H2)

"Investment in human capital and infrastructure does not necessarily lead to enhanced national competitiveness in the absence of a stimulating market environment."

Justification: The data reveals a relative improvement in education and research indicators, contrasted by severe weaknesses in market sophistication, financing, and the regulatory environment. This confirms that knowledge investment without parallel institutional reform acts as a "sunk cost" that fails to yield a sustainable competitive advantage.

3.6.3 Acceptance of the Third Hypothesis (H3)

"The weakness of innovation performance is more closely linked to the deficiency in organizational dynamic capabilities than to resource scarcity."

Justification: Through the lens of Dynamic Capabilities Theory, the Algerian innovation ecosystem exhibits systemic failures across three

critical dimensions:

1. **Weak Sensing:** A failure to identify and analyze global technological opportunities and market trends.
2. **Weak Seizing:** An inability to mobilize resources and investments toward high-potential innovative projects.
3. **Weak Reconfiguring:** Rigidity in restructuring organizational and institutional assets to respond to environmental shifts.

4. Conclusion

The reality of innovation in Algeria is not dictated by a deficiency in inputs as much as it is by the absence of an effective Conversion System that bridges the gap between scientific research and the marketplace. The stagnation of Algeria's ranking in lower tiers reflects a structural defect in the market environment and governance mechanisms, which severely limits the capacity of institutions to capitalize on knowledge. Fundamentally, the dilemma is managerial and institutional in nature rather than resource-based. The imbalance lies in the weakness of the strategic transformation system and the lack of dynamic capabilities required to link knowledge to market needs. Consequently, improving Algeria's standing in the Global Innovation Index (GII) necessitates profound reforms in Innovation Management rather than merely increasing expenditure.

4.1 Study Results

- **Persistent Structural Gap:** There is a stable structural gap between innovation inputs and outputs. Relative superiority is observed in specific inputs—particularly Human Capital, Research, and Infrastructure—contrasted with a pronounced weakness in Knowledge and Technology Outputs and Creative Outputs.
- **Fragility of Market Sophistication:** The Market Sophistication pillar stands as one of the weakest links, especially regarding investment financing, Venture Capital (VC), and market openness. This confirms that the current market environment fails to provide sufficient incentives for innovative risk-taking.
- **Weak Inter-Actor Connectivity:** There is a significant lack of synergy between the actors within the innovation ecosystem. This is evidenced by limited University-Industry collaboration and a scarcity of

marketable patents, reflecting a fragmentation in the Innovation Value Chain.

- **Chronic Systemic Imbalance:** The stability of the ranking in lower tiers without qualitative improvement—despite marginal gains—indicates a chronic structural imbalance. This suggests the issue is rooted in the nature of the institutional framework rather than transitory factors.

4.2 Recommendations

- **Enhancing Market Sophistication:** Implementing regulatory and financial reforms designed to incentivize innovation and facilitate access to diverse funding sources.
- **Bridging the Lab-to-Market Gap:** Developing robust mechanisms to transform scientific research into commercial products through high-performance Business Incubators and Technology Transfer Offices (TTOs).
- **Building Dynamic Capabilities:** Encouraging institutions to adopt systematic Innovation Management Strategies to enhance their ability to sense and seize market opportunities.
- **Fostering Triple-Helix Partnerships:** Stimulating strategic partnerships between universities, the private sector, and the government to accelerate technology transfer and industrial application.
- **KPI Integration:** Integrating Knowledge Conversion Indicators into institutional performance evaluation systems to ensure accountability and focus on economic impact.

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