

A Comprehensive Review of the Algerian National Innovation Systems:
Dynamics and Challenges

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Abstract:

This paper examines the factors influencing a nation's innovation capacity, focusing on Algeria within the MENA region. It highlights the importance of a strong innovation ecosystem for economic growth. By analyzing Algeria's performance in the Global Innovation Index, the paper identifies challenges such as insufficient R&D investment, bureaucratic barriers, and weak intellectual property protections. To improve its innovation ranking, Algeria needs to prioritize strategic investments in education, research, and infrastructure, create a supportive business environment, and enhance international collaborations. The paper concludes with recommendations for innovation policy that integrates both top-down and bottom-up initiatives.

Keywords: Innovation; R&D, National Innovation Systems; Algeria; Global Innovation Index.

Jel Classification Codes: O31, O32, O33, O55.

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1. INTRODUCTION

In today's global economy, innovation is widely recognized as a crucial driver of sustainable economic growth and competitiveness. National innovation systems (NIS) - involving the network of institutions, policies, and processes that encourage knowledge creation, technological advancement, and economic application - play a fundamental role in fostering innovation. In advanced economies, NIS have proven essential for economic resilience, supporting high-value industries and facilitating rapid responses to global challenges. In emerging economies, such as those in the Middle East and North Africa (MENA) region, effective NIS can be transformative, helping these countries diversify their economies, reduce dependency on natural resources, and address pressing socio-economic issues such as unemployment and productivity gaps.

However, despite their potential, many MENA countries, including Algeria, face significant obstacles in establishing robust NIS. Issues such as inadequate research and development (R&D) investment, limited collaboration between universities and industry, regulatory constraints, and insufficient innovation policies have hindered progress. As a result, while some MENA nations have made strides in creating supportive environments for innovation, others lag behind, impacting their global competitiveness. By examining the state of NIS across the region, with a focus on Algeria, we can better understand these barriers and identify key areas for improvement.

This paper aims to assess the current state of NIS s in Algeria and other MENA countries, comparing their structures, policies, and outcomes. Through a comparative analysis, the study will highlight Algeria's position relative to its regional peers and uncover best practices that may help enhance its NIS. Furthermore, the paper will offer insights into the challenges that MENA countries face in building effective innovation systems and propose recommendations to strengthen these systems. The ultimate goal is to contribute to a deeper understanding of the region's innovation landscape and to provide actionable strategies that can support sustainable economic growth through improved NIS s.

2. Overview of the National Innovation System (NIS) Approach

Innovation has long been recognized as a vital driver of economic growth, shaping the development of products, services, and managerial practices throughout history. Groundbreaking innovations such as electricity, microprocessors, telephones, the internet, automobiles, and penicillin have fundamentally transformed economies and societies. While the pursuit of new and improved ways of doing things is intrinsic to human nature, the significance of innovation has gained substantial attention only in the past few decades. Early scholars, including Schumpeter (1939) and Freeman (1990), explored the intricate links between innovation, economic growth, and societal change, laying the groundwork for contemporary discussions on innovation systems.

The concept of the NIS emerged in the late 20th century, primarily attributed to the works of Freeman, Lundvall, and Nelson. This framework posits that innovation is a collective process involving multiple actors, including government, universities, research institutions, and private firms. The effectiveness of an NIS hinges on the interactions among these entities and their capacity to foster an environment conducive to innovation. Schumpeter (1942) emphasized that continuous change and the process of "creative destruction" necessitate systematic innovation in products, processes, and management practices.

The idea of the NIS raised in the late 1980s, thanks to scholars like Freeman, Lundvall, and Nelson. This concept was expanded and refined in the early 1990s, becoming a significant framework in the study of innovation. The NIS framework examines the national systems that foster innovation, the institutional influences shaping these systems, and the economic effects that follow. Freeman (1987) defined the NIS as a network of public and private organizations involved in creating, adapting, importing, and disseminating new technologies. Lundvall (1992) expanded on this by highlighting that the NIS comprises all components and interactions involved in creating, disseminating, and applying economically valuable knowledge within a country. Nelson (1993) emphasized that the NIS includes institutions whose interactions influence the innovation

capacity of domestic firms.

The NIS approach emphasizes the crucial role of information and technology exchange among institutions, businesses, and individuals in promoting innovation. Innovation and technological progress emerge from the intricate interactions among NIS participants, including individuals, companies, universities, and research institutions (OECD, 1997). The OECD (1997) states that optimal innovation performance and competitiveness are achievable when these actors employ the most effective tools and clearly understand their essential roles within the system. A thorough grasp of the NIS framework can identify ways to boost economic outcomes. In developed economies, policies are often implemented to foster collaboration between institutions and actors, enhancing the innovative capacities of both firms and individuals. These policies support education, research, and business initiatives, aiming to bolster both national and regional competitiveness.

Differences in economic performance across nations can be linked to the intricate networks and coordination among public and private entities that shape their NIS s. When the goals of public and private sectors, along with other national institutions engaged in industrial and technological policy, are misaligned, national economic performance may suffer. Nelson (1993) asserts that understanding NIS s requires recognizing how technological progress unfolds globally and identifying key institutions and processes. Rosenberg (1993) highlighted that R&D facilities, supervised by scientists and engineers with university education who work within businesses, universities, or government agencies, play a vital role in driving technological advancements across multiple sectors.

The literature has extensively examined and analyzed NISs by focusing on four primary types of knowledge flows: (1) interactions among companies, (2) relationships between companies, universities, and public research institutes, (3) the spread of knowledge and technology to enterprises, and (4) the mobility of technical personnel. Since its introduction, the NIS framework has shaped innovation policies by emphasizing the necessity of collaborative efforts among innovative firms

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and other institutions. This approach is particularly effective when businesses, financial systems, and research institutions operate within a cohesive system. Nelson's research team, which compared the NISs of 15 nations, found that differences among these systems stem from various institutional factors, including university research frameworks, industrial R&D practices, financial structures, managerial expertise, public infrastructure, and fiscal and trade policies.

In recent years, the Arab region has made efforts to enhance its National Innovation Systems (NISs); however, an overwhelming 95% of the world's researchers are located in Asia, Europe, and North America, leaving only 5% in Africa, Latin America, Oceania, and the Caribbean (UIS S&T Statistics, 2005). This significant imbalance highlights the research and development gap between the global north and south, with Algeria's Gross Expenditure on R&D (GERD) as a percentage of GDP at just 0.07% (UIS S&T Database, 2008).

Developing nations, however, face distinct challenges, including lower income levels, limited institutional support for R&D, and a scarcity of accumulated knowledge. In these contexts, foreign direct investment plays a far more critical role compared to wealthy, industrialized countries, but this is less applicable in the least developed nations; therefore, the intricate link between globalization and national or local innovation systems demands further exploration.

Innovation has always been a core element of human progress, reflecting a fundamental drive to enhance methods and outcomes. However, it is only in recent decades that innovation's impact on economic growth, societal evolution, and organizational development has received extensive scholarly and practical attention. Scholars have analyzed multiple dimensions of the innovation process, demonstrating its role as a catalyst for economic expansion, a force for societal transformation, and a critical factor in organizational adaptability and growth.

Joseph Schumpeter (1934) pioneered the study of innovation's economic significance, introducing the concept of "creative destruction,"

which underscores how innovation disrupts established markets and drives economic development. Building on this foundation, Freeman and Soete (1997) explored the broader economic impacts of technological advancements, revealing how innovation transforms industries and fuels growth. Rogers (2003) contributed by examining how innovations diffuse through societies, identifying factors that influence the adoption of new ideas and technologies and, consequently, spark social change.

In terms of organizational impact, researchers have highlighted the role of innovation in developing capabilities that support long-term adaptation and success. Dosi, Nelson, and Winter (2000) analyzed how innovation builds and strengthens organizational capabilities, helping companies respond to dynamic market conditions. Chesbrough (2003) introduced the idea of "open innovation," emphasizing the importance of collaborative efforts in fostering innovation for competitive advantage. Further, Teece (2018) discussed "dynamic capabilities" as essential for organizational resilience and adaptability, highlighting innovation's role in enabling firms to navigate economic and technological shifts.

Additionally, studies have examined how institutional and systemic factors shape innovation's impact. Edquist (1997) discussed how innovation systems-comprising institutions, organizations, and technologies-foster technological advancement and economic growth. Lundvall's (1992) work on national innovation systems further elaborated on how social, economic, and organizational elements collectively drive innovation within a country, reinforcing its role in national and international economic competitiveness. Economists and theorists widely agree on the crucial role that innovation plays in achieving economic success (Hamel & Getz, 2004; Audretsch 2004). Indeed, substantial economic growth often emerges from "disruptive innovations" that challenge and reshape established norms (Christensen et al., 2002). While the relationship between innovation and economic growth has been a central topic since Schumpeter's groundbreaking work in the 1930s, contemporary research increasingly emphasizes external environmental factors alongside internal drivers of innovation. Elements such as privileged access to information, local economic conditions,

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societal influences, and the capacity to align with consumer needs are now seen as vital components of innovation (Porter & Stern, 2001). Schumpeter (1942) also highlighted the concept of systematic innovation, emphasizing the importance of unexpected outcomes and the role of creative destruction in fostering product and management advancements.

While many knowledge-related studies focus on individuals, Nelson and Winter (1982) made significant contributions to understanding "organizational memory" and its practical implications. The NIS (NIS) framework, developed in the late 1980s by scholars such as Freeman, Lundvall, and Nelson, positions innovation as a central objective within a research ecosystem composed of government agencies, universities, research labs, and companies (Godin, 2007). Human resource development, foreign direct investment (FDI), and economic growth in regions like the US, EU, Japan, and China have accelerated advancements in science, technology, and innovation, making these areas key points for economic analysis. The growing importance of NIS in both academic literature and policy discussions underscores its critical role in driving innovation and economic development globally (Feinson, 2002).

Firms operate within complex environments shaped by various factors, especially those related to their industry structure, which significantly influences their innovation capacity. Empirical studies show that firms in innovation-driven industries are more likely to engage in innovative activities, particularly under intense competition. Nevertheless, the innovation process is inherently risky and uncertain. This uncertainty can be mitigated by environments that encourage deep integration both within and between organizations.

Research into the NIS in MENA countries reveals ongoing challenges as well as notable successes that shape innovation dynamics across the region. While innovation's role in economic growth is well-established, recent studies are increasingly focusing on the relationship between a firm's internal capabilities and external environmental influences.

Challenges:

1. Funding and Investment: Many MENA countries continue to

face challenges related to limited funding and investment in research and development (R&D). This scarcity often constrains the capacity of firms and research institutions to engage in meaningful innovation activities.

2. **Collaboration Deficiencies:** Weak collaboration between academia and industry has been identified as a significant barrier to innovation. The lack of strong partnerships reduces the potential for knowledge transfer and collaborative research, thereby stifling innovation efforts in the region.

3. **Regulatory Barriers:** Rigid regulatory frameworks can hinder innovation by creating administrative burdens that discourage entrepreneurship. Policymakers in the region are often challenged to establish flexible regulations that promote rather than impede innovative activities.

Successes:

1. **Emerging Innovation Hubs:** In recent years, several MENA countries have developed innovation hubs and technology parks aimed at fostering entrepreneurship and collaboration among startups, researchers, and investors. These initiatives have demonstrated the potential to stimulate local economies and drive innovation.

2. **Government Initiatives:** Various government programs have been introduced to promote innovation, such as Tunisia's "Startup Act," which aims to enhance the entrepreneurial landscape by providing financial incentives and reducing bureaucratic obstacles.

3. **Growing Awareness and Capacity Building:** Increasing recognition of the significance of innovation has led to initiatives focused on education, training, and entrepreneurship support. These efforts are gradually shifting MENA economies toward more innovation-oriented approaches.

3. The Innovation Gap between North and South: A Focus on MENA Countries

There exists a significant disparity between the North and South in various fields, particularly R&D) and innovation; this gap is evident in developing regions like the Maghreb countries, where the establishment of

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innovation systems occurs under distinct conditions. These include privatization of the public sector, emergence of a growing SMEs sector that generally lacks expertise in R&D and innovation, and an industrial sector suffering from high levels of obsolescence in both human resources and equipment (Djefflat A., 2008).

The research and innovation performance of industries and universities in Northern countries is significantly more advanced and dynamic compared to their Southern counterparts. In response, many Maghreb nations have initiated policies to establish innovation and technology centers (ITCs) focusing on strategic sectors such as textiles, garments, mechanical and electrical industries, and food processing (Djefflat A., 2008). Despite these efforts, Arab countries collectively contribute to less than 0.5% of global scientific publications, and their gross domestic expenditure on R&D (GERD) remains low, often under 1% of GDP. This indicates a limited ability to accumulate knowledge and upgrade their productive systems. For instance, Algeria's GERD, although showing some improvement over the past decade, was only 0.35% of GDP in 2004. Furthermore, nearly 98% of research funding in Algeria comes from public organizations, yet there are few effective mechanisms to convert this investment into practical and impactful outcomes. Major innovation efforts are concentrated in large enterprises (Khalfaoui, 2006).

In Tunisia and Morocco, there have been slight advancements in GERD and efforts to foster R&D and innovation. However, research funding remains largely dependent on the public sector. Additionally, these Maghreb countries have a poor record in securing patents internationally, with few patents in European patent offices and none in the American patent office (OST 2006). Algeria's performance in the Business Competitiveness Index for "Sophistication of Company Operations and Strategy" declined from 87th in 2004 to 120th out of 127 in 2007, despite a relatively strong ranking in the "Availability of Engineers and Scientists" category (GCI), where it was ranked 25th, surpassing developed countries (Jörg Janischewski, Katja Branzk, 2008).

The limited integration of R&D and innovation in the private sector

across the Maghreb countries remains a critical challenge. Local firms typically do not prioritize these activities, mainly due to the low technological intensity of the economy. However, there are minor variations between sectors and countries. In Tunisia, for example, the government has implemented a scientific and technological innovation policy aimed at encouraging firms and industrial support organizations to adopt innovation and technology transfer as part of their strategies.

The Algerian NIS faces several structural challenges that impede companies' ability to innovate effectively. Key characteristics of this system reveal significant obstacles:

Centralized System: The NIS in Algeria is highly centralized, with strategies underway to decentralize operational support for enterprise development. This centralization hampers flexibility and adaptability in responding to local innovation needs.

Emerging Private Equity and Venture Capital: There is growing recognition of the need for private equity investments. However, Algeria's venture capital industry is still in its early stages, and legislative frameworks to support private equity are being developed.

Weak Industry-Academia Links: A significant gap exists between industry and academic institutions. Developing effective collaboration structures remains a critical challenge, with fewer than 10% of Algerian companies having partnerships with universities. This lack of connectivity stifles the potential for collaborative innovation.

Underdeveloped Higher Education and Public Research System: This landscape must be reformed in parallel with industry. The absence of a coherent policy for Research for Technological Development and Innovation and poorly developed intermediary organizations further limit the NIS's effectiveness (European Trend Chart on Innovation, 2005).

In Algeria, both the public and private sectors have made investments in R&D, primarily through centers based at local universities. Despite these efforts, structural challenges persist. Approximately 90% of local researchers are university-affiliated, but the industry-university linkage remains inadequate, highlighting the pressing need for coordinated efforts

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to bridge this gap and foster meaningful collaboration (Ouchalal et al., 2007).

The creation of a robust innovation system in the Maghreb, including Algeria, depends on the integration of human, financial, and institutional resources. Djeflat (2008) emphasizes that strengthening institutional connections between universities and industry is essential to stimulate innovation activities within the Algerian economy. This alignment could significantly boost the country's capacity to leverage existing research and develop new technologies.

Globally, transnational industries have become key drivers of R&D globalization, accounting for nearly half of global R&D expenditures. Over two-thirds of industrial R&D activities in the past decade have been concentrated in emerging economies like China and India. In stark contrast, Arab countries, which represent 3.5% of global GDP and over 4% of the world's population, contribute only 0.4% of global GERD. This low level of investment in technology and innovation underscores the region's lag. In developed economies, more than 50% of R&D spending comes from the private sector, while in the Arab world, 89-97% of R&D expenditure is publicly funded, highlighting a major imbalance and the need to increase private sector involvement in innovation (Alnajjar A., 2002).

Many firms in Arab countries, especially in North Africa, lack dedicated R&D accounts in their financial systems. Even when R&D activities are undertaken, expenditures often remain unrecorded, relying instead on other budgets. Despite significant efforts across the Maghreb region to stimulate innovation, the output remains relatively low (Djeflat A., 2008).

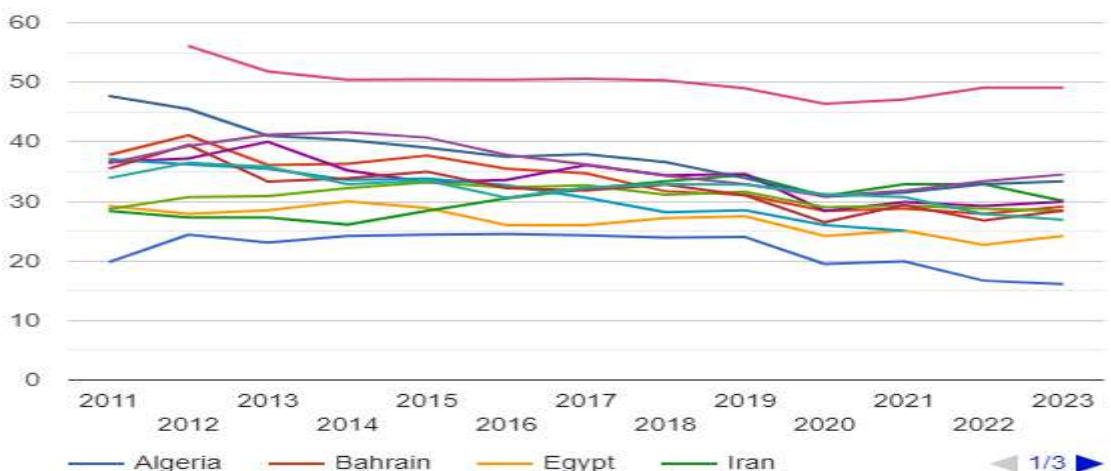
Moreover, the Arab world has increasingly become an attractive destination for firms seeking to invest in R&D across various sectors, not just strategic ones as observed in previous decades. One of the key issues facing Maghreb countries is the high unemployment rates among well-educated and skilled individuals. This gap between graduation and employment limits opportunities to enhance skills acquired at educational institutions and diminishes the knowledge capital of these individuals,

thereby impacting firms' innovative capabilities and their ability to launch products in local and international markets. Consequently, the effectiveness of a firm's R&D activities is intrinsically linked to its core competencies, knowledge base, and efficient innovation processes. Research by Baldwin and Hamel (2003) and Duget (2000) demonstrates that industries with substantial R&D investments are more likely to achieve competitive advantages in radical innovation, along with securing more patent rights. This correlation underlines the strategic importance of R&D as a driver of long-term success and differentiation in global markets.

In the Maghreb region, inadequate institutional frameworks and a lack of incentives significantly limit the absorptive capacity of local industries. Djeflat (2008) argues that these structural deficiencies hinder the ability of firms to assimilate and apply new technologies and innovations effectively. For Algeria, increased integration into the global economy brings both opportunities and challenges. The industrial sector faces mounting pressure to boost its competitiveness and adapt to an environment characterized by intense global competition.

When comparing the MENA region based on selected key indicators of innovation performance, Tunisia significantly outperforms Algeria, which lags considerably behind (lower rankings indicate better performance).

Fig. 1: Innovation Index: 2011-2023



Source: Cornell University, INSEAD, and the WIPO, 2024

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Algeria's innovation performance, as indicated by the Global Innovation Index (GII), reveals a concerning trajectory. Over the past decade, the GII has generally declined, signifying a slowdown in innovation activities within the country. Additionally, Algeria consistently ranks lower than many of its MENA counterparts, highlighting a significant gap in innovation capabilities. Fluctuations in the GII suggest that economic and political factors may be influencing the innovation ecosystem.

Notable differences emerge when comparing Algeria to other MENA countries; The United Arab Emirates (UAE) has established itself as a leader in innovation, consistently ranking higher than Algeria due to its strong commitment to technological advancement. Meanwhile, Saudi Arabia has been heavily investing in innovation and technology development to diversify its economy and enhance its GII standing.

Several challenges contribute to Algeria's low innovation performance. Bureaucratic complexities and regulatory hurdles can stifle innovation, while limited investment in research and development (R&D) restricts the generation of new ideas. Weak intellectual property protection discourages investment, and the brain drain of skilled professionals further undermines innovation capacity. Additionally, economic and political instability creates an uncertain environment that can deter innovation initiatives.

Algeria's performance in the Global Innovation Index (GII) 2024 is indicative of broader challenges faced within its innovation ecosystem. Ranking at 115th, Algeria finds itself significantly lower than many of its MENA counterparts, which positions it as one of the laggards in the region. This is in stark contrast to countries such as the United Arab Emirates (32nd), and Türkiye (37th), which showcase robust innovation capabilities.

While Algeria holds the 115th position, other MENA countries demonstrate much stronger standings. The UAE (32nd) has made significant strides through heavy investment in technology and a supportive regulatory environment. Türkiye (37th) has also improved its ranking, emphasizing innovation and technological development as key components of its economic strategy. Algeria's ranking is a clear indicator of its struggle to foster a competitive innovation landscape, particularly when compared to

these higher-ranking countries.

In terms of innovation indicators, countries like Saudi Arabia (47th) and Qatar (49th) are making notable advancements in the GII, focusing on the diversification of their economies through innovation. Both countries have invested heavily in infrastructure and R&D, which has paid off in their improved rankings. In contrast, Algeria's performance reflects limitations in R&D investment and innovation capacity, highlighting a critical area for development.

The economic and political context of these countries also plays a significant role in their innovation success. The stability experienced by nations such as the UAE contributes to their favorable business environments, proactive government policies, and strong private sector engagement in innovation. Algeria's ongoing economic and political challenges, including bureaucratic inefficiencies and regulatory hurdles, have adversely affected its ability to attract investment and support innovation initiatives. This instability hinders the potential for sustainable innovation growth.

Regional trends further illustrate the diversity of innovation capabilities within the MENA region. Countries like Morocco (66th) and Egypt show mixed performance levels. While Morocco is making progress, it still faces challenges that Algeria shares, such as bureaucratic obstacles and the need for greater investment in human capital. Meanwhile, Oman and Bahrain also present cases of moderate performance, indicating that Algeria's position appears particularly weak in comparison.

Algeria has demonstrated notable strengths in specific areas of the Global Innovation Index (GII) 2024, ranking 10th globally in expenditure on education and 20th in graduates in science and engineering. These rankings reflect the country's commitment to education and the development of a skilled workforce. Additionally, Algeria has made significant progress in intellectual property (IP)-related indicators, climbing to 65th in patents—a rise of 15 positions—largely attributed to a near doubling of resident patent applications in 2022. The country also ranks 87th in trademarks and 46th in industrial designs, indicating an encouraging trend

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toward innovation and protection of intellectual property.

In comparison, Egypt ranks 86th overall, but it has achieved a notable milestone by entering the GII top 100 science and technology clusters ranking for the first time in 2024, showcasing its growing innovation capabilities. This contrasts with Algeria's more established position in educational expenditure and science and engineering graduates, which may suggest different paths to enhancing innovation in the region.

It is important to note that many, though not all, African clusters are primarily driven by scientific publications rather than by international patent activity under the Patent Cooperation Treaty (PCT). As a result, it is more accurate in some cases to refer to these as African top science clusters rather than African science and technology (S&T) clusters. However, it would be misleading to assert that African S&T clusters do not engage in patenting at all.

Clusters in countries such as Egypt, South Africa, Morocco, Tunisia, as well as Algeria and Kenya, demonstrate significant activity in international patent filings. This indicates a level of engagement with the global patenting system that is noteworthy.

Furthermore, it is essential to recognize that the Global Innovation Index (GII) methodology for identifying top S&T clusters focuses solely on patents filed under the PCT system. PCT patents are designed for protection across multiple jurisdictions, which means that they do not account for the larger number of patents that seek protection only in a single jurisdiction, typically the applicant's domestic market (national patents).

While some clusters may exhibit modest PCT filing activity, they often still demonstrate robust domestic patenting efforts. Future editions of the GII will provide a more detailed exploration of such clusters, including those beyond Africa, enhancing our understanding of the dynamics of innovation in various regions.

In Algeria, Indonesia, and Türkiye, over 66 percent of social enterprises reported relying on self-financing as their primary source of funding. This funding typically comes from family, friends, and personal savings, highlighting the challenges these enterprises face in accessing

traditional funding avenues (British Council and Social Enterprise UK, 2022). This reliance on personal networks for financial support underscores the need for improved funding mechanisms and resources to support the growth and sustainability of social enterprises in these countries.

To enhance its innovation standing and catch up with its MENA peers, Algeria should consider several strategies. Increasing public and private sector investment in research and development is crucial, particularly targeting sectors with high growth potential, such as technology and renewable energy. Streamlining bureaucratic processes and simplifying regulations can create a more conducive environment for innovation by reducing red tape and enhancing transparency.

Moreover, fostering collaboration between universities, research institutions, and the private sector can lead to more innovation-driven initiatives. Such partnerships can facilitate knowledge transfer and the commercialization of research outputs. Strengthening intellectual property rights is also essential, as improved protection can incentivize innovation and attract both domestic and foreign investments in new technologies. Lastly, promoting a culture of entrepreneurship by supporting startups can stimulate innovation at all levels of the economy.

The provided data in the following table demonstrate a relatively strong institutional environment, ranking 99th globally in the "Institutional environment" sub-pillar, indicating a solid foundation for operational stability in both business and government effectiveness. However, challenges persist, particularly in the "Regulatory environment," where Algeria ranks lower at 121st, suggesting significant opportunities for improvement in regulatory quality and adherence to the rule of law. The "Business environment" sub-pillar reflects a moderate strength, with Algeria positioned 61st globally, showcasing some policy stability conducive to business operations. Nonetheless, the absence of data regarding entrepreneurship policies and culture highlights a potential gap that could hinder innovation.

Table 1: Institutional and regulatory indicators: Algeria

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Section	Indicator	Value	Rank
Institutions		34.8	95
Institutional environment		38.6	99
	Operational stability for businesses*	46.7	100
	Government effectiveness*	30.6	100
Regulatory environment		16.9	121
	Regulatory quality*	13.9	124
	Rule of law*	20.0	110
Business environment		49.0	61
	Policy stability for doing business*	49.0	66
	Entrepreneurship policies and culture*	n/a	n/a

Source: Global Innovation Index report 2024

Analyzing Algeria's performance within the "Business Sophistication" reveals several critical insights into the country's knowledge assets and innovation capabilities. Algeria scores relatively low in terms of knowledge-intensive employment and GERD performed by businesses, indicating a significant gap in skilled workforce development and business investment in R&D. While the country exhibits strengths in university-industry R&D collaboration and cluster development, it falls short in public research-industry co-publications and international collaborations, highlighting an area for growth. The performance in knowledge absorption presents a mixed picture: although Algeria has a relatively high share of high-tech imports, it lags in intellectual property payments and foreign direct investment (FDI) net inflows. To enhance its business sophistication and innovation capabilities, Algeria could prioritize investments in education and training to cultivate a skilled workforce, provide incentives for private sector R&D investment, and strengthen partnerships between academia and industry to promote knowledge transfer.

Table 2: Business sophistication Indicators: Algeria

Section	Indicator	Value	Rank
Business sophistication		18.0	114
Knowledge workers		15.0	113
	Knowledge-intensive employment, %	17.9	86
	Firms offering formal training, %	n/a	n/a
	GERD performed by business, % GDP	0.0	77
	GERD financed by business, %	6.7	82
	Females employed w/advanced degrees, %	8.1	83
Innovation linkages		23	65
	Public research-industry co-publications, %	0.6	115
	University-industry R&D collaboration	54.7	47
	State of cluster development	55.0	50
	Joint venture/strategic alliance deals/bn PPP\$ GDP	0.0	121
	Patent families/bn PPP\$ GDP	0.0	100
Knowledge absorption		15.8	120
	Intellectual property payments, % total trade	0.4	82
	High-tech imports, % total trade	10.4	35
	ICT services imports, % total trade	0.3	119
	FDI net inflows, % GDP	0.5	107
	Research talent, % in businesses	0.5	83

Source: Global Innovation Index report 2024

Algeria performs relatively well in terms of school life expectancy and PISA scores, indicating a strong foundation in basic education. However, it falls short in areas such as government funding per pupil and pupil-teacher ratios, which are critical for enhancing the quality of education. Although tertiary education enrollment is relatively high, the percentage of graduates in science and engineering remains lower than desired. Furthermore, Algeria's expenditure on research and development (R&D) as a percentage of GDP is low, suggesting limited investment in research initiatives. Despite a relatively high number of researchers per million people, the quality of research may be hampered by insufficient funding, as evidenced by weak performances in global corporate R&D and university rankings. To enhance its human capital and research performance, Algeria could prioritize increased investments in education, particularly in STEM fields, to develop a highly skilled workforce.

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Table 3: Human capital and research indicators: Algeria

Section	Indicator	Value	Rank
Human capital and research		28.1	76
Education		46.0	78
	Expenditure on education, % GDP	6.3	10
	Government funding/pupil, secondary, % GDP/cap	n/a	n/a
	School life expectancy, years	15.5	44
	PISA scales in reading, maths and science	361.7	78
	Pupil-teacher ratio, secondary	n/a	n/a
Tertiary education		33.9	65
	Tertiary enrolment, % gross	53.4	67
	Graduates in science and engineering, %	29.9	20
	Tertiary inbound mobility, %	0.5	99
Research and development (R&D)		4.2	79
	Researchers, FTE/mn pop.	832.4	58
	Gross expenditure on R&D, % GDP	0.5	41
	Global corporate R&D investors, top 3, mn USD\$	0.0	75
	QS university ranking, top 3*	0.0	75

Source: Global Innovation Index report 2024

Algeria's low scores in patent filings and utility model filings indicate a limited capacity for innovation and knowledge creation, despite some strength reflected in scientific and technical publications. The mixed results in knowledge impact show that while Algeria benefits from a relatively high labor productivity growth rate, it lags significantly in key metrics such as unicorn valuation, software spending, and high-tech manufacturing. Furthermore, the country's performance in knowledge diffusion is notably weak, particularly in areas like intellectual property receipts, high-tech exports, and exports of ICT services. To enhance its knowledge and technology outputs, Algeria could adopt several strategic measures. Strengthening intellectual property rights would be crucial to protect innovations and attract investment. Increasing both public and private investment in research and development (R&D) is essential to foster a more robust innovation ecosystem.

Table 4: Knowledge and technology outputs indicators:
Algeria

Section	Indicator	Value	Rank
Knowledge and technology outputs		9.1	125
Knowledge creation		10.2	82
	Patents by origin/bn PPP\$ GDP	0.8	65
	PCT patents by origin/bn PPP\$ GDP	0.0	85
	Utility models by origin/bn PPP\$ GDP	-	-
	Scientific and technical articles/bn PPP\$ GDP	8.1	83
	Citable documents H-index	10.2	74
Knowledge impact		10.9	128
	Labor productivity growth, %	-0.6	111
	Unicorn valuation, % GDP	0.0	49
	Software spending, % GDP	0.0	132
	High-tech manufacturing, %	4.1	101
Knowledge diffusion		6.2	112
	Intellectual property receipts, % total trade	0.0	106
	Production and export complexity	27.3	94
	High-tech exports, % total trade	0.0	131
	ICT services exports, % total trade	0.2	126
	ISO 9001 quality/bn PPP\$ GDP	1.1	112

Source: Global Innovation Index report 2024

Algeria's performance in the "Market Sophistication" highlights several opportunities within its financial and investment landscape. The data indicates that Algeria has a relatively low level of domestic credit to the private sector as a percentage of GDP, which suggests limited access to finance for businesses. Furthermore, the absence of data on finance for startups and scaleups, as well as loans from microfinance institutions, underscores potential gaps in financial support for emerging enterprises.

In terms of investment, Algeria's market capitalization is notably low, reflecting limited depth and liquidity in its financial markets. The country also exhibits a low level of venture capital activity, which further constrains innovation and entrepreneurship. Trade dynamics reveal a relatively high applied tariff rate, which can delay both trade and investment flows, while the domestic industry remains inadequately diversified, raising concerns about economic resilience. Nevertheless, Algeria boasts a large domestic

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market scale, presenting an opportunity to stimulate domestic demand and drive economic growth.

Algeria should consider several strategic actions. First, developing the financial market is essential to facilitate greater access to finance for businesses, particularly small and medium-sized enterprises (SMEs) and startups. Regulatory reforms aimed at simplifying regulations and reducing bureaucratic hurdles would encourage increased investment.

Table 5: Market sophistication indicators: Algeria

Section	Indicator	Value	Rank
Market Sophistication		5.2	132
Credit		5.0	126
	Finance for startups and scaleups	n/a	n/a
	Domestic credit to private sector, % GDP	21.1	115
	Loans from microfinance institutions, % GDP	n/a	n/a
Investment		1.7	108
	Market capitalization, % GDP	0.2	85
	Venture capital (VC) investors, deals/bn PPP\$ GDP	n/a	n/a
	VC recipients, deals/bn PPP\$ GDP	0.0	108
	VC received, value, % GDP	0.0	66
Trade, diversification and market scale		8.8	132
	Applied tariff rate, weighted avg., %	12.7	133
	Domestic industry diversification	14.2	108
	Domestic market scale, bn PPP\$	629.0	41

Source: Global Innovation Index report 2024

The data indicate that while Algeria scores relatively well in trademark registrations, it falls short in global brand value and industrial designs. This suggests a pressing need for the country to focus on building strong, recognizable brands and implementing effective measures to protect intellectual property.

In terms of creative goods and services, Algeria's performance is relatively weak, this highlights the necessity for Algeria to cultivate and promote its creative industries to fully leverage their potential for economic contribution. Conversely, there is some promise in Algeria's online creativity, particularly regarding mobile app creation, indicating an area of growth. However, the country lags in top-level domain registrations and GitHub commits, which are essential for fostering a vibrant digital creative

landscape.

Investing in digital infrastructure is essential to enhance access to the internet and digital technologies, fostering online creativity and expanding opportunities for Algerian creators. Promoting international collaboration with creative industries in other countries can help Algerian creative gain exposure, resources, and new markets. Finally, supporting education and training programs focused on the skills needed for creative industries will be vital in developing a workforce that can thrive in this sector.

Table 6: Creative Outputs:

Creative Outputs	Score	Rank
7.1 Intangible assets	9.2	100
7.1.1 Intangible asset intensity, top 15, %	n/a	n/a
7.1.2 Trademarks by origin/bn PPP\$ GDP	20.0	87
7.1.3 Global brand value, top 5,000, % GDP	0.0	75
7.1.4 Industrial designs by origin/bn PPP\$ GDP	1.5	46
7.2 Creative goods and services	0.6	124
7.2.1 Cultural and creative services exports, % total trade	0.0	105
7.2.2 National feature films/mn pop. 15–69	0.1	84
7.2.3 Entertainment and media market/th pop. 15–69	0.7	93
7.2.4 Creative goods exports, % total trade	0.0	125
7.3 Online creativity	17.7	106
7.3.1 Top-level domains (TLDs)/th pop. 15–69	0.3	117
7.3.2 GitHub commits/mn pop. 15–69	1.4	110
7.3.3 Mobile app creation/bn PPP\$ GDP	51.5	103

Source: Global Innovation Index report 2024

4. CONCLUSION

This study provides a comprehensive analysis of Algeria's performance across various pillars of the Global Innovation Index (GII), highlighting both strengths and weaknesses in its innovation ecosystem. Algeria demonstrates notable achievements in education and knowledge production, particularly in terms of science and engineering graduates and progress in intellectual property indicators. However, challenges persist in the areas of market sophistication, business environment, and the overall innovation output, which impede the country's ability to fully harness its creative and intellectual potential.

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Key findings underscore the necessity for targeted interventions, including increased investment in research and development, enhancement of educational quality, strengthening of intellectual property protections, and the promotion of entrepreneurship. Additionally, fostering university-industry collaboration and improving the regulatory framework are essential steps to cultivate a more robust innovation landscape.

To effectively address these challenges, Algeria must prioritize the development of its NIS including its creative industries, enhance financial market accessibility, and encourage international collaboration. By focusing on these areas as well as publishing the real statistics and data in such rankings, Algeria can not only improve its positions but also stimulate sustainable economic growth, diversify its economy, and position itself as a competitive player in the regional and international innovation landscape. Ultimately, a concerted effort toward innovation and creativity will be crucial for Algeria's long-term development and prosperity.

5. Bibliography List :