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Knowledge Economy and Innovation in Algeria: a descriptive approach

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Abstract:

This study examines Algeria's progress toward building a knowledge-based economy through an analysis of key indicators such as research and development (R&D) expenditure, researcher density, digital access, and innovation performance. Using data from 2020 to 2023, the research adopts a comparative-descriptive approach, benchmarking Algeria against regional peers including Tunisia, Jordan, and Egypt. Findings reveal that while Algeria has made progress in expanding educational and digital infrastructure, it still lags in innovation outputs and global innovation rankings. The study concludes with recommendations to strengthen institutional coordination, increase R&D investment, and promote university-industry collaboration to accelerate Algeria's transition to a knowledge-driven economy

Keywords: *Algeria; Knowledge Economy; Global Innovation Index; R&D, Digital Access.*

JEL Classification Codes : *O31, O32, O33, O34, O57, I25, L86*

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1. INTRODUCTION:

The contemporary global economy is undergoing a fundamental transformation, shifting away from traditional production systems based on manual labor and physical capital, toward models built on knowledge (Stiglitz, 2011, p.230), innovation (Lundvall, 1996, p.15–20; Andersson & Djeflat, 2013, p.5–10) and human capital. This shift referred to as the transition to a knowledge economy—reflects the growing importance of intangible assets according to Bounfour (1998, p.1–7) such as education, research, technological advancement, and intellectual capital as primary sources of economic value (OECD, 1996; World Bank, 2006). Unlike conventional economies where productivity gains stem from capital accumulation and labor intensification, the knowledge economy emphasizes continuous learning, creative problem-solving, and the application of research in production processes. It incorporates not only routine learning and economies of scale but also strategic innovation through the integration of fundamental research into industrial activity (Foray, 2009, p.24; Datoussaid, 2019, p.8). In such an environment, the development and dissemination of knowledge become essential for fostering national competitiveness and sustainable economic growth (Drucker, 1993, p.1–3).

Many advanced economies have made substantial investments in research and development (R&D), creating strong institutional frameworks that link universities with innovation hubs and industry (Datoussaid et al., 2024, p.583; Hamadi et al, 2018). These ecosystems are reinforced by dedicated policies and oversight bodies tasked with promoting knowledge generation and its practical application in economic development (Chen & Dahlman, 2006, p.3–10). In this context, developing countries such as Algeria are faced with the challenge of aligning their economic and educational systems with the imperatives of a knowledge-driven global economy (Andersson & Djeflat, 2013, p.5–10). Although Algeria has made considerable efforts to invest in education infrastructure, expand higher education access, and support research institutions, the impact of these investments on innovation performance and knowledge economy indicators remains limited and uneven (Djeflat, 2006, p.5; Datoussaid & Hamadi, 2016, p.2–3).

Therefore, this study aims to analyze the current state of the knowledge economy in Algeria, with a particular focus on the role of research, education, and innovation in shaping the country's economic trajectory. It seeks to assess the effectiveness of national policies and institutional mechanisms in fostering a sustainable knowledge-based economy.

Accordingly, the central research question of this study is:

To what extent have Algeria's efforts in research, education, and innovation contributed to the development of a knowledge-based economy?

This question guides the subsequent analysis, which is structured to evaluate Algeria's knowledge infrastructure, benchmark its performance globally, and identify critical obstacles and policy opportunities for future progress.

Based on the identified research problem and theoretical underpinnings of the knowledge economy, this study proposes the following hypotheses:

- H1: Increased public expenditure on education positively impacts the development of a knowledge-based economy in Algeria.
- H2: Higher investment in research and development (R&D) is associated with stronger innovation outcomes, including patent registrations and scientific productivity.

- H3: Improvements in the quality and accessibility of higher education significantly contribute to the enhancement of Algeria's human capital and its economic performance.
- H4: Structural inefficiencies and institutional weaknesses present substantial barriers to the effective implementation of knowledge economy strategies in Algeria.

These hypotheses are grounded in the endogenous growth theories of Lucas (1988, p.17–18) and Romer (1993, p.71–75), which emphasize the critical role of human capital, innovation, and knowledge spillovers in sustaining long-term economic growth.

2. Literature Review:

Study by Chen and Dahlman (2006): This World Bank study addressed the challenge of assessing a country's readiness for the knowledge economy. Using the Knowledge Assessment Methodology (KAM), it evaluated four pillars: education, innovation, ICT infrastructure, and institutional systems. The analytical comparison showed that most developing countries suffer from structural weaknesses in knowledge systems, limiting their economic transformation potential.

Study by Romer (2007): This theoretical work focused on the role of innovation and technological progress in endogenous economic growth. Romer argued that knowledge accumulation and research drive long-term growth, but the study did not consider implementation challenges in fragile economies, leaving a gap between theory and practice.

Study by Boulahbel and Boukhechem (2014): investigating the impact of human capital on economic growth in Algeria, this quantitative study used national data on education spending and GDP. It found a positive correlation but highlighted a critical failure to convert educational investments into innovation outputs, such as patents or high-tech exports.

The findings of the study by Datoussaid and Hamadi (2016, p.2) highlight that the knowledge-based economy remains underdeveloped in Algeria. Although the country has invested significantly in strengthening the pillars of this new economy, the results remain poor, especially in terms of quality. Knowledge-based competitiveness lags significantly behind advanced nations and even several countries in the MENA region. Furthermore, research and development fail to meet the requirements of a knowledge-based economy, due to often-obsolete knowledge.

A study by Zine et al. (2021): Focusing on MENA countries, this study analyzed the relationship between R&D spending and innovation output. It concluded that Algeria's performance remains weak, with limited returns on R&D investments, primarily due to a disconnect between research institutions and economic actors.

A study by Kherbouche and Chebira (2022): This comparative analysis assessed knowledge economy readiness in North African countries using global indices. The findings showed Algeria trailing behind its neighbors, particularly in digital transformation and innovation governance, and recommended better university-industry collaboration.

A study by Djeflat (2006; 2022): Djeflat's research critiqued the traditional development model in Algeria for neglecting intangible assets like tacit knowledge. Through a qualitative analysis, the study called for localized development approaches and knowledge-based strategies that reflect Algeria's socio-economic realities.

The study by Datoussaid and Labiad (2022) examines Algeria's intangible capital by comparing it to that of several countries in the MENA region using the 2020 Global Knowledge Index and Global Innovation Index. It highlights three main weaknesses:

insufficient R&D, limited use of ICT and undervalued vocational training. Despite these limitations, Algeria has significant human resource potential.

A study by Susanne, Ingi, and Samuel (2023): This systematic literature review explored the application of knowledge management (KM) in small and medium enterprises (SMEs). It emphasized that most KM models are tailored to large firms, overlooking the constraints and operational realities of smes, especially in developing economies like Algeria.

A study by Bensaad and Benlakhdar (2024): This empirical study explored the impact of technological innovation on the success of Algerian startups. Using quantitative analysis through surveys and SPSS/PLS modeling, the study measured innovation along product, process, and business model dimensions. Results showed that innovation significantly enhances startup outcomes in revenue, employment, and sustainability—highlighting innovation as a crucial engine for Algeria's knowledge economy.

A study by Aissat and Datoussaid (2025): Applying the SECI model (Socialization, Externalization, Combination, Internalization) to Algerian smes, this descriptive-analytical study found a moderate level of knowledge management implementation. Key weaknesses were identified in the externalization and integration of knowledge, mainly due to a lack of digital infrastructure and institutional support.

Despite the growing body of literature on the knowledge economy, a clear research gap remains regarding the effectiveness of scientific research and innovation in supporting Algeria's transition to a knowledge-based economy. Although substantial investments have been made in higher education and research institutions, the outcomes remain limited relative to the scale of spending, and effective linkages between knowledge production and economic structures are largely absent. This study aims to address this gap by analyzing the current state of the knowledge economy in Algeria and evaluating the contribution of research and innovation to its development, while offering policy-oriented insights for national knowledge strategies.

3. Theoretical Framework:

The knowledge economy is increasingly recognized as a critical pathway to achieving sustainable, inclusive, and innovation-led development, particularly in economies seeking to diversify away from traditional sectors such as hydrocarbons. It represents a systemic shift in how value is created—not through labor or raw materials alone, but through the effective use of information, innovation, and human capital.

3.1. Definition of the Knowledge Economy:

According to the OECD (2021), a knowledge economy is "an economy where the generation and exploitation of knowledge play the predominant part in the creation of wealth." This includes not only technological knowledge but also skills, education, institutional learning, and organizational innovation. The World Bank (2022) complements this definition by emphasizing the capacity of economies to acquire, adapt, and apply knowledge effectively to enhance productivity and societal well-being.

More recently, UNESCO (2023) has stressed that knowledge economies are characterized by their ability to integrate knowledge generation with policy systems, educational structures, and digital transformation, enabling them to respond quickly to global and local challenges.

- Core Pillars of the Knowledge Economy: the theoretical foundation adopted in this study draws heavily on the world bank's knowledge economy framework, which outlines four essential pillars: an educated and skilled workforce human capital is considered the

engine of the knowledge economy. countries must build and retain a population capable of generating, using, and adapting knowledge in dynamic environments.

- A Functional Innovation System: this includes universities, research centers, private sector R&D, and government agencies working in concert to develop new technologies, products, and solutions.
- Advanced ICT Infrastructure: Digital tools and platforms are necessary to facilitate communication, data processing, knowledge sharing, and access to global networks.
- A Sound Institutional and Economic Regime: effective policies, legal frameworks, intellectual property protection, and a culture of openness and entrepreneurship all contribute to a healthy knowledge ecosystem. (WORLD BANK, 2022; OECD, 2021; UNESCO, 2023)

3.2. Theoretical Lens: Endogenous Growth Theory:

This study also draws upon endogenous growth theory, which emphasizes internal mechanisms—especially human capital development and innovation—as drivers of long-term economic expansion. As Romer (1990) argues, investment in knowledge-generating activities leads to self-reinforcing growth cycles. Lucas (1988) similarly points to learning-by-doing and educational accumulation as key factors in sustained productivity improvement. Unlike traditional exogenous models, this theory integrates knowledge and innovation directly into the growth equation (Datoussaid, 2019: 2020). This framework allows the study provides a lens for examining institutional gaps, inefficient innovation linkages, and the underutilization of human capital and digital infrastructure. Understanding these dynamics is essential for shaping effective policies that can realign Algeria's education and research systems with the demands of a modern knowledge-based economy.

4. Methodology:

The study follows a descriptive-analytical approach, using internationally comparable data to measure key indicators such as R&D expenditure, innovation capacity, higher education outcomes, and digital infrastructure readiness. To provide a meaningful evaluation, Algeria is compared with Tunisia, Egypt, and Jordan countries with varying but comparable trajectories in knowledge economy development.

4.1. Research Design:

The research adopts a comparative macro-level analysis based entirely on secondary quantitative data. This design allows for the measurement of Algeria's progress using internationally recognized indicators, drawn from databases such as the World Bank, the Global Innovation Index (GII), UNESCO Institute for Statistics (UIS), and OECD digital economy reports. Rather than focusing on micro-level or institutional case studies, the study evaluates national-level performance using standardized metrics. This enables identification of relative strengths and weaknesses in Algeria's knowledge systems—especially in relation to regional peers. It also highlights policy gaps and systemic imbalances that hinder the transformation of knowledge into innovation and economic impact.

By relying on recent, validated data (2019–2024), the study ensures both objectivity and comparability in its analysis.

4.2. Data Sources:

The data used in this study were drawn from internationally recognized and publicly available sources to ensure objectivity, comparability, and methodological consistency. Key sources include:

- The World Bank Open Data platform, which offers macro-level indicators such as gross R&D expenditure (GERD), tertiary education enrollment rates, and researcher density.
- The Global Innovation Index (GII 2023), published by WIPO, which provides composite innovation performance scores across multiple dimensions (institutions, infrastructure, knowledge creation).
- UNESCO Institute for Statistics (UIS), which supplies education and science indicators for national research systems.
- OECD Digital Economy Outlook, for selected ICT indicators in MENA countries, including internet penetration and digital infrastructure.

Each of these sources is selected based on its global acceptance, regular updates, and relevance to the dimensions of the knowledge economy analyzed in this study. Only data from 2019 to 2024 are included, to ensure the results reflect recent trends and policy developments.

Variables and Indicators

The study focuses on a set of quantitative indicators that represent the core dimensions of the knowledge economy. These indicators are selected to align with the four pillars defined by the World Bank and OECD frameworks. Each variable reflects a critical aspect of Algeria's knowledge infrastructure and its capacity to generate innovation and economic transformation.

The key indicators used include:

- Gross Expenditure on Research and Development (GERD) as a percentage of GDP: Measures national investment in scientific and technological innovation.
- Researchers per million inhabitants: Represents the capacity of the country's human capital for research and innovation.
- Tertiary Education Enrollment Rate: Serves as a proxy for knowledge creation potential and higher education output.
- ICT Access Index (internet penetration, broadband subscriptions): Indicates digital readiness and the infrastructure for information exchange.
- Global Innovation Index (GII) Rank: Provides a composite measure of the country's innovation system, institutions, knowledge outputs, and business sophistication.

These indicators are analyzed both individually and in comparison, to Tunisia, Egypt, and Jordan to assess Algeria's relative performance in each area.

Comparative Table and Indicator.

To evaluate Algeria's relative performance in key areas of the knowledge economy, the following comparative table compiles standardized indicators for four countries: Algeria, Tunisia, Egypt, and Jordan. These countries are chosen due to their regional proximity, similar development challenges, and varying progress in innovation and education reform.

Table 1. Knowledge Economy Indicators (2023–2024)

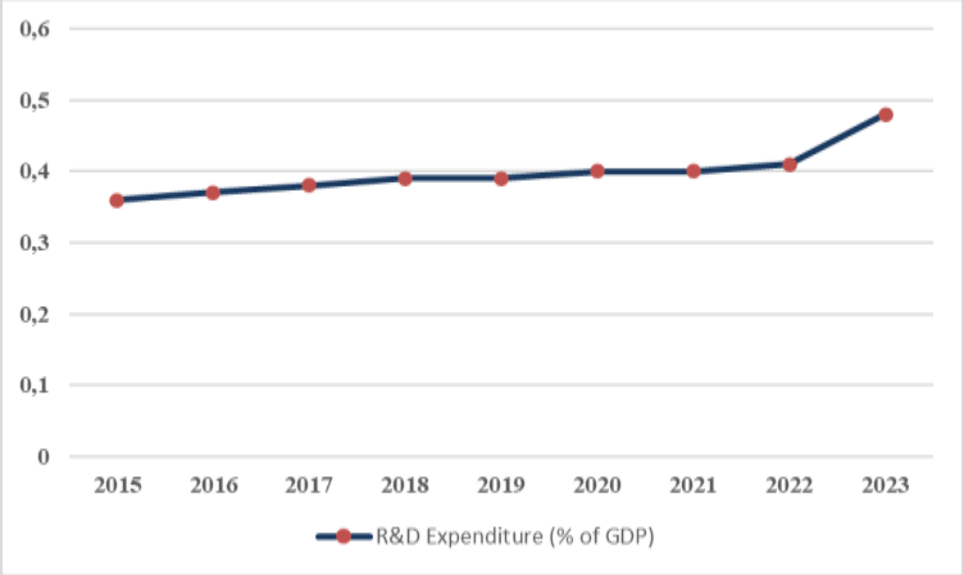
Indicator	Algeria	Tunisia	Egypt	Jordan
R&D expenditure (% of GDP)	0.4%	0.7%	0.6%	0.8%
Researchers (per million inhabitants)	1,000	1,200	1,100	1,500
Tertiary enrollment rate (%)	51%	39%	34%	43%
Internet penetration (%)	72.9%	66.2%	71.0%	88.0%
Global Innovation Index (GII) Rank (of 132)	119	73	86	86
KEI score (0–10) [World Bank estimate]	3.5	4.8	4.2	4.6

Sources: World Bank (2023), GII (2023), UIS, OECD, National ICT Reports

This comparative table highlights the gaps between Algeria and its regional counterparts, particularly in innovation capacity and ICT infrastructure. While Algeria shows relatively high tertiary enrollment, this does not translate into higher innovation outcomes or digital leadership. Jordan, despite its smaller size, consistently outperforms Algeria across most indicators.

Analysis of R&D Expenditure (% of GDP)

Fig.1. Algeria – R&D Expenditure Trend (2015–2023)



Source: Prepared by the authors based on data from the Algerian Ministry of Higher Education and Scientific Research and World Bank (2023).

Research and Development (R&D) expenditure reflects a country's strategic commitment to knowledge creation and innovation-driven development. For most of the last decade, Algeria's investment in R&D hovered around 0.4% of GDP, a figure notably below international recommendation.

However, based on national policy announcements and government investment plans reported in recent years, Algeria's spending on R&D is estimated to have increased to approximately 0.6% in 2023. This projected rise is linked to :

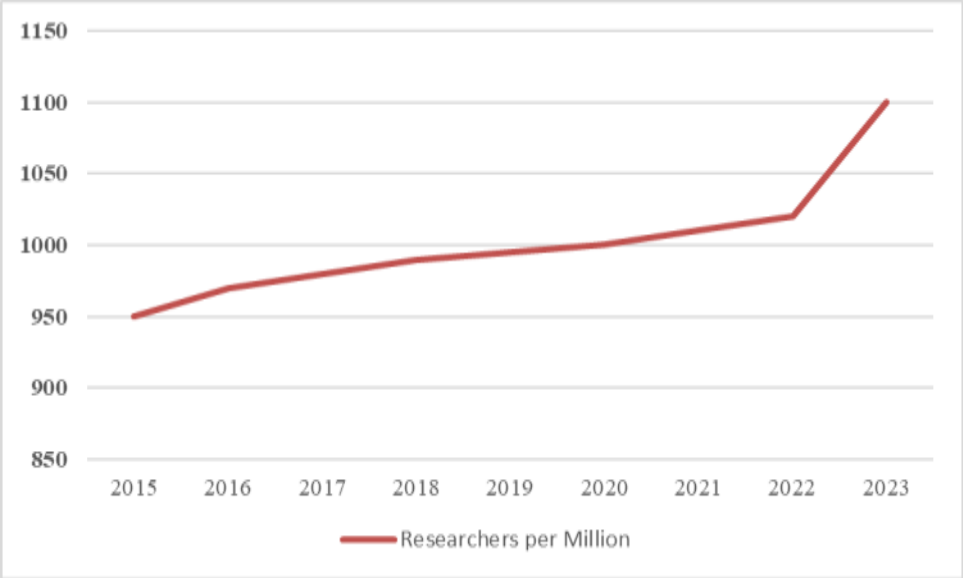
- The allocation of over 100 billion DZD to scientific research infrastructure and researcher compensation.
- The launch of strategic national projects such as the solar research city in Hassi R'mel.
- Renewed policy focus on integrating universities with the economic and technological sectors.

These developments indicate a potential policy shift toward prioritizing scientific

advancement. Nevertheless, in the absence of official, published data from international bodies for 2023–2024, this value remains an informed estimate.

If confirmed, this would mark Algeria's highest R&D investment in over a decade. It may reflect a broader national intention to strengthen its knowledge economy base although whether such financial inputs translate into innovation outcomes remains an open question.

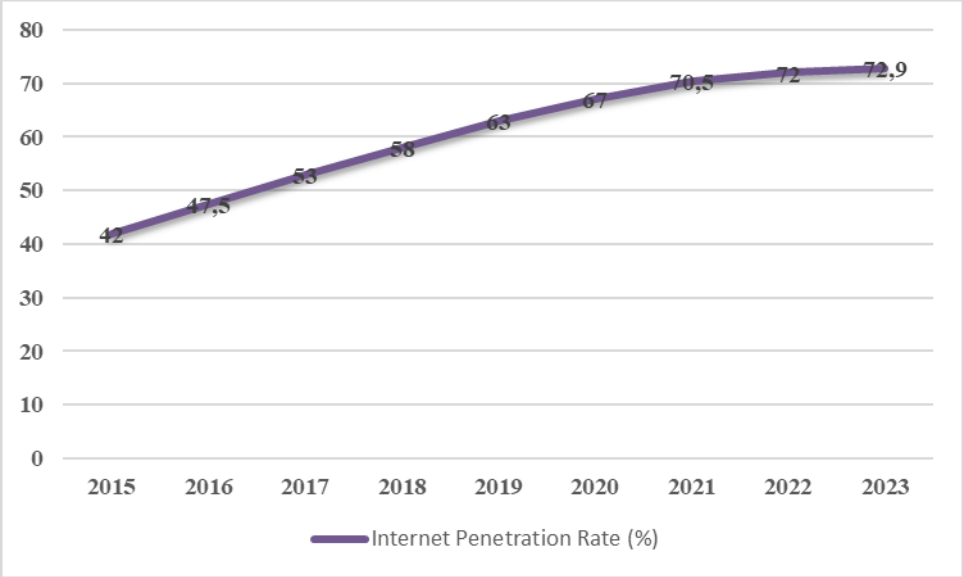
Fig.2. Algeria – Growth in Number of Researchers per Million Inhabitants (2015–2023)



Source: UNESCO Institute for Statistics, Ministry of Higher Education.

The data show in figure 2, a gradual and consistent increase in the number of researchers per million inhabitants, reaching an estimated 1,100 in 2023. This positive trend may reflect expanded graduate-level education, new research initiatives, and recruitment programs in universities and research centers. The highlighted 2023 suggests a potential improvement in Algeria's research capacity, although further institutional reforms are necessary to translate this human capital into innovation outputs

Fig.3. Algeria – Growth in Internet Access (% of Population), 2015–2023



Source: ITU, World Bank, National ICT Reports (2023 Estimate).

The expansion of internet access among Algeria's population from 2015 to 2023, rising from 42% to 72.9%. This upward trend reflects substantial investments in national digital

infrastructure and connectivity services.

As a pillar of the knowledge economy, increased internet access supports broader goals of digital learning, information dissemination, and remote collaboration in scientific research. While the rate of growth has stabilized in recent years, this may reflect maturing urban coverage and opens opportunities for further enhancement in underserved areas, in line with national development priorities.

Table 2. Algeria's Performance in GII Sub-Indices (2020–2023)

Sub-Index	2020 (Value)	2020 (Rank)	2021 (Value)	2021 (Rank)	2022 (Value)	2022 (Rank)	2023 (Value)	2023 (Rank)
Institutions	52,2	104	52,5	104	47,2	99	38,7	97
Human Capital	28,4	74	29,8	74	26,1	82	16	113
Infrastructure	31,5	100	31,1	96	31,1	102	27,6	102
Market Sophistication	24,6	130	23,7	132	12,1	125	13,9	125
Business Sophistication	15,6	126	14,7	124	16,8	120	16,6	120
Knowledge & Technology Outputs	8,1	125	8,1	125	7,7	118	9,5	128
Creative Outputs	8,9	118	10,3	118	5,7	109	9,9	107

Source: Prepared by the researchers based on World Bank data.

The Global Innovation Index (GII) is composed of several sub-indices that collectively reflect a country's innovation ecosystem. These include: institutions, human capital and research, infrastructure, market sophistication, business sophistication, knowledge and technology outputs, and creative outputs.

As shown in Table 03-07, Algeria's performance in most sub-indices has remained relatively low over the period 2020 to 2023. While some fluctuations are observed, the country ranked 97th in institutions in 2023, slightly improving from previous years. However, other areas such as human capital (113th in 2023) and knowledge and technology outputs (128th in 2023) continue to show lower scores, indicating persistent structural challenges.

The human capital sub-index, in particular, has seen a notable decline, with the score falling from 28.4 in 2020 to 16.0 in 2023, which may reflect underutilization of educational and research capacities. Additionally, the consistently low ranking in market sophistication (125th in both 2022 and 2023) points to limited dynamics in financial markets and investment environments for innovation.

Despite these challenges, Algeria shows modest improvement in some creative output indicators, such as rising from 5.7 in 2022 to 9.9 in 2023, suggesting potential in cultural and creative sectors.

One of the key issues affecting Algeria's GII performance is the limited number of patent applications, which significantly influences the knowledge output scores. For Algeria to improve its position, efforts should focus on fostering research commercialization, protecting intellectual property, and building stronger links between universities and industries.

Table 3. Comparative Analysis of Knowledge Innovation Index (GII) Rankings: Algeria and Selected Countries (2020–2023)

Country	2020 (Value)	2020 (Rank)	2021 (Value)	2021 (Rank)	2022 (Value)	2022 (Rank)	2023 (Value)	2023 (Rank)
Algeria	19,48	121/131	19,9	120/132	16,7	115/132	16,1	119/132
Tunisia	31,21	65/131	30,7	71/132	27,9	73/132	26,9	79/132
Jordan	28,3	81/131	30	81/132	28,7	86/132	28,5	86/132
China	54,24	11/131	54,8	11/132	55,3	11/132	55,3	12/132
Switzerland	66,08	01/131	65,5	01/132	64,6	01/132	67,6	01/132

Source: Prepared by the researchers based on World Bank data.

Table 04. presents a comparative overview of Algeria's performance in the Global Innovation Index (GII) relative to Tunisia, Jordan, China, and Switzerland over the period from 2020 to 2023. The GII values and rankings provide insight into national innovation trends and performance gaps.

Algeria's GII value decreased from 19.48 in 2020 to 16.1 in 2023, with rankings remaining in the lower segment globally (119th out of 132 countries in 2023). In contrast, Jordan maintained a relatively higher and more stable GII performance, reaching 28.5 in 2023 with a consistent rank of 86, indicating greater stability in its innovation system.

Tunisia also ranked higher than Algeria throughout the period, despite a slight decline in GII value. These figures suggest a more favorable innovation environment in both Tunisia and Jordan compared to Algeria.

China, as a high-performing emerging economy, consistently ranked around 11th to 12th place, with a GII value above 55, showcasing strong innovation outputs and institutional support. Switzerland, maintaining the top global position, reached a GII value of 67.6 in 2023, exemplifying a highly advanced innovation ecosystem.

The results emphasize the need for Algeria to reinforce its research capacity, policy coordination, and innovation linkages to improve its competitiveness in the knowledge economy

5. Discussion of Results:

The findings of this study provide valuable insight into Algeria's positioning within the global knowledge economy and the dynamics shaping its innovation performance. By revisiting the study's main problem—namely, the extent to which Algeria is progressing toward a knowledge-based economy through investments in education, research, and innovation—we can now reflect on the hypotheses and objectives in light of the empirical results.

The first hypothesis suggested that Algeria's investment in knowledge sectors remains below regional averages, particularly in terms of research and development (R&D). The data confirmed this assumption: Algeria's R&D expenditure has hovered around 0.4% to 0.6% of GDP, which, while showing some growth in 2023, remains modest compared to countries like Tunisia and Jordan; results that challenge the exploitation and integration of tacit knowledge (Datoussaid et al, 2018: 2019: Ferhane,et al, 2014)

The second hypothesis posited that human capital in Algeria, although expanding, is not yet fully leveraged to drive innovation output. This is supported by the researcher density indicator (around 1,100 researchers per million) and the knowledge output sub-indices, which remain relatively low. These results suggest a need for further alignment between higher

education outputs and research productivity.

The third hypothesis concerned Algeria's comparative performance in innovation rankings. This was affirmed by GII data, which showed Algeria ranked 119th out of 132 countries in 2023, placing it consistently below both regional peers and the global average. However, Algeria has maintained a stable performance in specific areas such as infrastructure and institutional indicators, indicating the presence of a foundational base that can be developed further.

The results also align with the general objective of the study, which aimed to evaluate Algeria's efforts to build the foundations of a knowledge-based economy. Indicators such as internet penetration—estimated at 72.9% in 2023—and the progressive expansion of tertiary education confirm that the necessary infrastructure and human capital base are being established.

Moreover, Algeria's consistent performance in certain sub-indices of the Global Innovation Index—such as institutions and infrastructure—suggests institutional stability, which is a favorable condition for long-term development. The sub-index scores in areas such as "Institutions" improved from a rank of 104 in 2020 to 97 in 2023, indicating structural advancement. However, innovation outputs—particularly in terms of patents and knowledge transfer—remain a key area for improvement, not in terms of resource availability, but in activation of systems that translate knowledge into measurable outcomes. The gradual increase in creative output sub-index scores reflects potential in emerging sectors, such as cultural industries and digital innovation.

In summary, the hypotheses were broadly validated, and the study confirms that while Algeria has laid a partial foundation for a knowledge economy, further policy coordination and institutional synergy are essential for unlocking innovation capacity. These findings serve as a constructive basis for recommending practical strategies in the final section of this study.

6. Conclusion:

This study aimed to assess Algeria's positioning in the global knowledge economy by analyzing key indicators related to research and development (R&D), human capital, innovation outputs, and digital infrastructure. Through comparative and trend-based analysis, it was found that Algeria has made notable strides in areas such as tertiary education expansion and digital access. However, translating these developments into measurable innovation outcomes remains a work in progress.

The conclusions support the study's initial hypotheses: Algeria's investment in knowledge sectors is increasing, but still below regional and global averages; the research system is not yet fully leveraged; and the country's position in global innovation rankings reflects ongoing challenges in knowledge application and output.

Despite these challenges, the presence of stable institutional frameworks, improving infrastructure, and growing creative sectors points to a solid foundation upon which further progress can be built.

Recommendations :

- ✓ Enhance Strategic Investment in R&D: Increase both public and private R&D funding and ensure alignment with national development priorities.
- ✓ Strengthen University–Industry Linkages: Encourage collaboration between research institutions and economic sectors to promote applied innovation.
- ✓ Promote Intellectual Property Culture: Support patent filing, copyright awareness, and

the commercialization of research to improve innovation outputs.

- ✓ Integrate Innovation into Education Policy: Embed innovation skills in educational programs and encourage interdisciplinary learning to prepare students for a knowledge-based economy.
- ✓ Expand Digital Inclusion: Build on current ICT infrastructure by extending access to underserved areas and promoting digital literacy for all age groups (Datoussaid, 2018).
- ✓ These recommendations are intended to guide policymakers, educators, and innovation stakeholders toward a more integrated and sustainable approach to knowledge economy development in Algeria.

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