

Artificial Intelligence and Economic Productivity: A Comparative Assessment of Algeria's Readiness and Development Prospects

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Abstract

Artificial intelligence (AI) is rapidly transforming global economies by enhancing productivity, enabling innovation, and reshaping labor markets. While advanced economies have integrated AI technologies at scale, emerging economies such as Algeria face structural and institutional challenges that limit the potential impact of AI on productivity growth (Agrawal, Gans, & Goldfarb, 2019; Acemoglu & Restrepo, 2020). This study provides a comparative assessment of Algeria's readiness to adopt AI for economic productivity, benchmarking its performance against Morocco, Egypt, and Turkey. Using data from the World Bank (2022), Oxford Insights Government AI Readiness Index, and sector-specific studies, the analysis identifies strengths, gaps, and opportunities for AI-driven economic transformation. Findings reveal that Algeria exhibits significant lag in digital infrastructure, human capital, and institutional frameworks compared to peers, yet targeted investments and policy reforms could accelerate AI adoption and productivity gains (Brynjolfsson, Rock, and Syverson, 2017; McKinsey & Company, 2023). The paper concludes with policy recommendations to foster a conducive environment for AI integration, positioning Algeria to leverage technological advances for sustainable economic growth.

Keywords: *Artificial Intelligence, Economic Productivity, Digital Transformation, AI Readiness, Algeria, Comparative Analysis.*

Received: 15/11/2025 ; Accepted:20/04/2026 ; Published: 30/05/2026

Introduction

Artificial Intelligence (AI) has emerged as one of the most transformative technological innovations of the twenty-first century, reshaping production systems, business models, labor markets, and public governance structures across the globe. As a general-purpose technology, AI possesses the capacity to influence a wide range of economic activities, much like electricity, information technologies, and the internet did in previous technological revolutions (Agrawal, Gans, & Goldfarb, 2019). Recent advances in machine learning, deep learning, natural language processing, and generative AI have accelerated the diffusion of intelligent systems across multiple sectors, creating new opportunities for productivity enhancement, innovation, and economic growth. Consequently, governments, firms, and international organizations increasingly view AI as a strategic driver of competitiveness and sustainable development.

The growing importance of AI is reflected in its potential economic impact. According to PwC (2018), AI could contribute approximately USD 15.7 trillion to the global economy by 2030, making it one of the most significant sources of future economic growth. Similarly, the McKinsey Global Institute (2017) argues that AI has the potential to generate productivity gains comparable to those produced by previous industrial revolutions. More recently, McKinsey & Company (2023) highlighted the transformative role of generative AI in accelerating knowledge-intensive activities, reducing operational costs, and improving decision-making processes across organizations. These developments suggest that AI is no longer a futuristic concept but rather an economic reality capable of reshaping national productivity trajectories.

Recent evidence suggests that generative AI may significantly enhance productivity across knowledge-intensive sectors, particularly through automation and augmentation mechanisms (McKinsey Global Institute, 2024; Stanford Institute for Human-Centered Artificial Intelligence, 2024).

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From a theoretical perspective, AI contributes to economic productivity through several interconnected mechanisms. First, intelligent systems enhance operational efficiency by automating repetitive and routine tasks, thereby reducing labor costs and minimizing human error (Acemoglu & Restrepo, 2020). Second, AI facilitates data-driven decision-making by processing vast amounts of information in real time, enabling firms to optimize resource allocation and improve organizational performance (Raisch & Krakowski, 2021). Third, AI stimulates innovation by supporting the development of new products, services, and business models that create additional economic value (Brem, Nylund, & Viardot, 2021). Consequently, countries capable of effectively integrating AI into their productive systems are likely to experience substantial improvements in productivity, competitiveness, and long-term economic growth.

Despite these promising prospects, the benefits of AI remain unevenly distributed across countries. Advanced economies such as the United States, Germany, China, and South Korea have made considerable investments in digital infrastructure, research and development, human capital, and innovation ecosystems, enabling them to capitalize on AI-driven productivity gains. In contrast, many developing and emerging economies face significant structural constraints, including limited digital infrastructure, insufficient technological capabilities, inadequate regulatory frameworks, and shortages of highly skilled labor (OECD, 2021; UNCTAD, 2022). As a result, a growing digital divide risks widening productivity gaps between technologically advanced economies and those that are slower to adopt emerging technologies.

Within this context, Algeria presents a particularly interesting case study. As one of the largest economies in North Africa, Algeria possesses substantial economic potential derived from its natural resources, strategic geographical position, and relatively young population. However, the country's economic model remains heavily dependent on hydrocarbon revenues, which continue to account for a significant share of export earnings and public revenues (World Bank, 2022). This dependence has increased the urgency of economic diversification and the search for new sources of productivity growth. In recent years, Algerian authorities have launched several initiatives aimed at promoting digital transformation, innovation, and technological modernization. The finalization of the national digital transformation strategy in 2024 represents an important milestone in this process (Agence Ecofin, 2024). Likewise, increasing attention has been devoted to AI applications in sectors such as agriculture, healthcare, energy, education, and public administration (APS, 2024).

Several emerging initiatives illustrate the growing interest in AI within the Algerian economy. In agriculture, AI-powered precision farming technologies, drones, and predictive analytics are increasingly viewed as tools for improving productivity, water management, and food security (APS, 2024). In the energy sector, machine learning applications are being explored to optimize exploration activities, predictive maintenance, and operational efficiency within oil and gas operations (Abdelkader & Mezouar, 2020; Zhang, Chen, & Li, 2021). Furthermore, digital startups are beginning to integrate AI into service delivery, reflecting the gradual emergence of an innovation ecosystem capable of supporting technological entrepreneurship (Brem et al., 2021). Nevertheless, these initiatives remain relatively fragmented and have yet to generate large-scale economic transformations.

The successful integration of AI into the Algerian economy depends not only on technological adoption but also on the existence of complementary capabilities. According to Li and Liu (2023), productivity gains associated with AI are strongly influenced by factors such as workforce skills, organizational readiness, digital infrastructure, and institutional quality. Similarly, Brynjolfsson, Rock and Syverson (2017) emphasize that the macroeconomic benefits of AI are contingent upon effective policy frameworks that facilitate technological diffusion and human capital development. Therefore, assessing Algeria's readiness for AI adoption requires a multidimensional perspective that goes beyond technological indicators alone.

Against this background, the present study seeks to answer the following research question: **To what extent is Algeria prepared to leverage artificial intelligence as a driver of economic productivity, and how does its readiness compare with selected emerging economies?** To address this question, the paper undertakes a comparative assessment of Algeria's AI readiness relative to Morocco, Egypt, and Turkey. These countries were selected because they share certain developmental characteristics while exhibiting different levels of digital transformation and technological advancement. Through the analysis

of indicators related to digital infrastructure, innovation capacity, human capital, and AI readiness, the study aims to identify the opportunities and constraints shaping Algeria's AI-driven productivity prospects.

The remainder of the paper is organized as follows. The next section reviews the theoretical and empirical literature on AI and economic productivity. The third section presents the methodological framework and data sources. The fourth section provides a comparative analysis of AI readiness and productivity indicators across the selected countries. The fifth section discusses the main opportunities and challenges facing Algeria, while the final section concludes with policy recommendations and directions for future research.

Literature Review and Theoretical Framework

Artificial Intelligence as a General-Purpose Technology

Artificial Intelligence (AI) has progressively evolved from a specialized technological field into a transformative economic force capable of reshaping production systems, organizational structures, and labor markets. The growing academic interest in AI stems largely from its classification as a General-Purpose Technology (GPT), similar to electricity, the steam engine, and information and communication technologies (ICTs). According to Agrawal, Gans, and Goldfarb (2019), AI represents a fundamental technological innovation whose economic significance extends beyond automation, affecting decision-making processes, resource allocation, and innovation dynamics. As a GPT, AI generates widespread productivity effects across sectors and creates opportunities for complementary innovations that amplify its economic impact.

The concept of AI encompasses a broad set of technologies, including machine learning, deep learning, natural language processing, computer vision, robotics, and generative AI. These technologies enable machines to perform cognitive tasks traditionally associated with human intelligence, such as reasoning, learning, pattern recognition, and problem-solving (Soudoplatoff, 2018). Recent advances in computing power, cloud technologies, and big data analytics have accelerated AI deployment, allowing firms and governments to integrate intelligent systems into increasingly complex economic activities.

From an economic perspective, AI differs from previous technological innovations because it enhances not only physical production processes but also cognitive and analytical functions. Agrawal et al. (2019) argue that AI primarily reduces the cost of prediction, thereby transforming decision-making processes across organizations. This reduction in prediction costs enables firms to optimize operations, improve strategic planning, and increase productivity. Consequently, AI is increasingly viewed as a strategic asset capable of generating sustainable competitive advantages and long-term economic growth.

The diffusion of AI has also intensified discussions regarding technological transformation and economic modernization. McKinsey Global Institute (2017) describes AI as the next frontier of digital transformation, capable of driving productivity growth in sectors characterized by information-intensive activities. Similarly, OECD (2021) emphasizes that AI constitutes a critical pillar of the Fourth Industrial Revolution, contributing to enhanced efficiency, innovation, and competitiveness in both developed and emerging economies.

Artificial Intelligence and Economic Productivity

Economic productivity represents one of the most frequently studied dimensions of AI adoption. Productivity generally refers to the efficiency with which inputs such as labor, capital, and technology are transformed into outputs. In economic theory, productivity growth is a key determinant of long-term economic development, income generation, and competitiveness.

Several theoretical mechanisms explain how AI influences productivity. First, AI enhances operational efficiency through automation. Intelligent systems can perform repetitive and routine tasks with greater speed, consistency, and accuracy than human workers, reducing operational costs and minimizing errors

(Acemoglu & Restrepo, 2020). Automation enables firms to allocate human resources to higher-value activities, thereby increasing labor productivity.

Second, AI improves decision-making quality through advanced data analytics. Organizations increasingly rely on AI-powered algorithms to process large volumes of information and generate actionable insights. This capability facilitates more efficient resource allocation, inventory management, risk assessment, and strategic planning (Raisch & Krakowski, 2021). In this context, productivity gains emerge not only from automation but also from enhanced managerial effectiveness.

Third, AI stimulates innovation and knowledge creation. Brem, Nylund, and Viardot (2021) argue that AI contributes to the emergence of new business models, products, and services, particularly within startup ecosystems. By accelerating research, development, and experimentation processes, AI fosters technological innovation and strengthens firms' adaptive capacities in dynamic market environments.

Empirical studies largely support the positive relationship between AI adoption and productivity growth. McKinsey Global Institute (2017) estimated that AI could contribute significantly to global economic growth through productivity improvements across multiple sectors. PwC (2018) projected that AI technologies could generate approximately USD 15.7 trillion in additional global economic output by 2030, primarily through productivity enhancement and increased consumer demand.

More recent research has focused on the productivity effects of generative AI. Noy and Zhang (2023) conducted experimental research demonstrating that generative AI significantly improves the performance of knowledge workers by reducing task completion times and enhancing output quality. Their findings suggest that AI may not only increase average productivity but also reduce skill disparities among workers. Similarly, Brynjolfsson, Rock, and Syverson (2017) argue that AI has the potential to generate substantial macroeconomic productivity gains, although these benefits depend on complementary investments in human capital and organizational transformation.

The Automation–Augmentation Debate

Despite widespread optimism regarding AI's productivity potential, scholars remain divided concerning its implications for employment and labor markets. This debate is commonly framed as the automation–augmentation paradox.

The automation perspective suggests that AI substitutes for human labor by replacing workers in routine and predictable tasks. Acemoglu and Restrepo (2020) provide evidence that automation technologies can displace workers, particularly in occupations characterized by repetitive activities. From this viewpoint, productivity gains may be accompanied by increased unemployment, wage polarization, and social inequalities.

Conversely, the augmentation perspective argues that AI complements rather than replaces human capabilities. Raisch and Krakowski (2021) contend that AI systems are most effective when combined with human expertise. Rather than eliminating jobs, AI can enhance worker performance, improve decision-making, and facilitate innovation. In this scenario, productivity growth results from human-machine collaboration rather than labor substitution.

The automation–augmentation debate is particularly relevant for developing economies, where labor-intensive sectors continue to play an important economic role. Emerging economies face the dual challenge of increasing productivity while maintaining employment opportunities. Therefore, understanding how AI affects labor markets is essential for designing policies that maximize productivity gains while minimizing social disruptions.

Artificial Intelligence, Digital Transformation, and National Competitiveness

The relationship between AI and productivity cannot be understood in isolation from broader digital transformation processes. Digital transformation refers to the integration of digital technologies into economic, social, and institutional activities, leading to profound changes in organizational structures and business practices (Li, 2020).

AI constitutes a central component of digital transformation because its effectiveness depends on complementary digital infrastructures such as broadband connectivity, cloud computing, data centers, and cybersecurity systems. Countries with advanced digital ecosystems are generally better positioned to exploit AI-driven productivity gains. Consequently, digital readiness has become a critical determinant of national competitiveness.

According to the World Bank (2022), digital transformation contributes to economic development by enhancing efficiency, facilitating innovation, and improving access to information. Similarly, UNCTAD (2022) emphasizes that digital technologies play an increasingly important role in global value chains, industrial modernization, and knowledge-based growth.

The competitiveness implications of AI are particularly significant for emerging economies seeking to diversify their productive structures. By improving efficiency and fostering innovation, AI can support economic diversification strategies and reduce dependence on traditional sectors. This issue is especially relevant for Algeria, where economic development remains strongly linked to hydrocarbon revenues.

2.5 Artificial Intelligence in Emerging Economies: Opportunities and Challenges

The adoption of AI in emerging economies presents both opportunities and challenges. On the one hand, AI can accelerate economic modernization, improve public service delivery, and support industrial upgrading. On the other hand, several structural constraints limit AI diffusion.

OECD (2021) identifies digital infrastructure deficiencies, skills shortages, regulatory weaknesses, and limited research capacities as major obstacles to AI adoption in developing countries. These constraints are particularly pronounced in economies characterized by relatively low levels of digitalization and innovation.

The Algerian context reflects many of these challenges. Although the government has recently intensified efforts to promote digital transformation, the country continues to face significant barriers related to infrastructure, technological capabilities, and human capital development (Agence Ecofin, 2024). Nevertheless, emerging applications of AI in agriculture, healthcare, energy, and public administration demonstrate the technology's potential contribution to economic modernization.

In agriculture, AI-based precision farming techniques are increasingly viewed as instruments for improving productivity and resource management (APS, 2024). In the energy sector, machine learning applications support predictive maintenance, operational optimization, and exploration activities (Abdelkader & Mezouar, 2020; Zhang, Chen, and Li, 2021). Healthcare represents another promising area, where AI technologies contribute to diagnosis, treatment planning, and medical decision support (Esteva et al., 2019; Topol, 2019).

Conceptual Framework

Based on the preceding literature, this study adopts a conceptual framework linking AI readiness to economic productivity through four interconnected dimensions:

1. **Digital Infrastructure** : internet penetration, connectivity, and digital platforms.
2. **Human Capital**: education, digital skills, and AI-related competencies.

3. **Innovation Ecosystem:** research capacity, entrepreneurship, and technological development.
4. **Institutional Readiness:** regulatory frameworks, governance quality, and public policy support.

The central assumption is that countries exhibiting higher levels of readiness across these dimensions are more likely to achieve substantial productivity gains through AI adoption. Consequently, Algeria's productivity prospects depend not only on technological availability but also on its capacity to develop complementary institutional, human, and innovation capabilities.

This conceptual framework provides the analytical foundation for the comparative assessment conducted in the following sections. The next section presents the methodological approach adopted to evaluate Algeria's AI readiness relative to Morocco, Egypt, and Turkey.

Methodology

Research Design

This study employs a comparative secondary data analysis approach to evaluate Algeria's readiness to leverage artificial intelligence (AI) for economic productivity and to benchmark its performance against selected emerging economies, namely Morocco, Egypt, and Turkey. A comparative framework allows the identification of relative strengths, weaknesses, opportunities, and threats in Algeria's AI ecosystem. Comparative analysis is particularly suitable for emerging economies, as it highlights structural gaps and policy implications by situating a country's performance in a regional and global context (Brynjolfsson, Rock and Syverson, 2017; OECD, 2021).

The research adopts a quantitative-qualitative hybrid approach. Quantitative indicators are used to assess measurable dimensions of AI readiness, productivity, digital transformation, and human capital, while qualitative sources provide contextual insights into institutional policies, sectoral initiatives, and emerging technological trends in Algeria and its peer countries (Agrawal, Gans, & Goldfarb, 2019; Acemoglu & Restrepo, 2020). This mixed-method design ensures a comprehensive understanding of AI adoption and its economic implications.

Selection of Comparative Countries

The countries selected for comparison—Morocco, Egypt, and Turkey—were chosen based on geographical proximity, similarities in development challenges, and availability of comparable digital, economic, and institutional data. These countries demonstrate varying levels of digital infrastructure and AI adoption, providing a meaningful benchmark for Algeria. For example, Turkey has made substantial progress in AI-driven industrial applications and startup ecosystems, while Morocco and Egypt have implemented national AI strategies and pilot projects in healthcare, finance, and agriculture (UNCTAD, 2022; McKinsey & Company, 2023). Comparing Algeria with these countries allows for an assessment of gaps in infrastructure, human capital, and innovation capacities that may affect productivity outcomes.

Data Sources

The analysis draws upon secondary data from reputable international and national sources, including:

- World Bank (2022): Provides macroeconomic indicators, labor productivity data, and ICT infrastructure measures.
- Oxford Insights Government AI Readiness Index: Assesses national policies, AI governance frameworks, and institutional capacity.
- UNCTAD Technology and Innovation Reports (2022): Offer insights into innovation ecosystems, digital adoption, and sectoral AI applications.

- OECD (2021): Provides data on AI adoption, workforce readiness, and emerging technologies in developing economies.
- National Reports and News Agencies (APS, Agence Ecofin, 2024): Document Algeria-specific AI initiatives, digital transformation strategies, and sectoral pilot projects.
- Scientific Literature: Peer-reviewed articles and working papers on AI and productivity effects, including Noy & Zhang (2023), Acemoglu & Restrepo (2020), and Brem et al. (2021).

These sources allow for the construction of a composite AI readiness profile for each country across multiple dimensions: digital infrastructure, human capital, institutional capacity, and innovation ecosystem.

Variables and Indicators

To operationalize AI readiness and its potential impact on productivity, the study focuses on four main dimensions:

1. **Digital Infrastructure**

- Internet penetration rates (World Bank, 2022)
- Broadband subscriptions per 100 inhabitants
- Cloud computing and data center availability (UNCTAD, 2022)

2. **Human Capital and Skills**

- Percentage of tertiary-educated population in STEM fields
- Availability of AI specialists and ICT professionals
- Training programs for AI and digital skills (OECD, 2021; Acemoglu and Restrepo (2020))

3. **Innovation Ecosystem**

- Research and development expenditures as a percentage of GDP
- Number of AI-focused startups and patents
- Adoption of AI in industrial and service sectors (Brem et al., 2021; McKinsey & Company, 2023)

4. **Institutional and Policy Readiness**

- Existence of national AI strategies
- Regulatory frameworks for AI and data governance (Brynjolfsson, Rock and Syverson, 2017; OECD, 2021)
- Public-private partnerships supporting AI adoption

Labor productivity (GDP per worker) is included as the dependent variable, serving as a proxy for the economic impact of AI readiness across countries.

Data Analysis

The study applies a comparative descriptive analysis combined with qualitative assessment. Descriptive statistics are used to summarize each country's performance across the selected indicators and to identify relative strengths and weaknesses in AI readiness. A comparative descriptive analysis is employed to evaluate AI readiness across countries using selected indicators related to digital infrastructure, human capital, innovation ecosystem, and institutional readiness. Trend analysis is also used to examine recent developments in AI adoption and productivity, while qualitative contextualization integrates policy documents, sectoral case studies, and media reports to interpret the quantitative findings, particularly for Algeria (APS, 2024; Agence Ecofin, 2024). This mixed-method approach allows the study to capture both measurable dimensions of AI readiness and contextual factors influencing productivity outcomes (Noy & Zhang, 2023).

Limitations

While secondary data analysis provides robust insights, several limitations must be acknowledged:

1. **Data availability and comparability:** Some AI adoption indicators may not be uniformly reported across all countries, which may affect the precision of the composite readiness scores.
2. **Rapid technological change:** AI is evolving quickly, and data from 2022–2024 may not fully capture the latest developments in adoption and applications.
3. **Contextual variability:** Structural differences in economies (e.g., sector composition, reliance on hydrocarbons in Algeria) may influence productivity independently of AI readiness.
4. **Qualitative interpretation:** While contextual reports provide valuable insights, their subjective nature introduces potential bias.

Despite these limitations, the methodology provides a systematic and replicable framework for assessing Algeria's AI readiness and comparing it with regional peers.

Summary

The methodology section establishes a clear analytical framework for the study, combining secondary quantitative indicators with qualitative contextual insights. By focusing on digital infrastructure, human capital, innovation ecosystem, and institutional readiness, the research captures the multidimensional nature of AI readiness and its potential economic impact. The comparative approach highlights gaps and opportunities for Algeria relative to Morocco, Egypt, and Turkey, providing a foundation for evidence-based policy recommendations in subsequent sections. This methodological rigor ensures that the analysis is transparent, reproducible, and aligned with international academic standards for research on AI and productivity.

Comparative Analysis of AI Readiness and Economic Productivity

Overview

This section provides a comprehensive comparative assessment of Algeria's readiness to leverage Artificial Intelligence (AI) as a catalyst for economic productivity. Building upon the conceptual framework developed earlier, the analysis focuses on four interrelated dimensions that determine a country's capacity to benefit from AI technologies: digital infrastructure, human capital, innovation ecosystem, and institutional readiness. These dimensions are widely recognized in the literature as the fundamental pillars supporting AI adoption and productivity growth (Agrawal et al., 2019; OECD, 2021; Brynjolfsson, Rock and Syverson, 2017).

The comparative framework includes Algeria, Morocco, Egypt, and Turkey. These countries share several developmental characteristics but differ significantly in their levels of digital transformation, innovation capacity, and technological preparedness. Consequently, they provide a useful benchmark for evaluating Algeria's relative position and identifying structural factors that may facilitate or hinder AI-driven economic development.

4.2 Digital Infrastructure

Digital infrastructure represents the technological foundation upon which AI applications are built. The availability of reliable internet connectivity, broadband networks, cloud computing facilities, and digital platforms determines the ability of firms, institutions, and individuals to access and exploit AI technologies. Numerous studies have demonstrated that countries with advanced digital infrastructures tend to experience higher levels of technological adoption and productivity growth (UNCTAD, 2022; OECD, 2021).

Table 1. Internet Penetration (% of Population Using the Internet, 2023)

Country	Internet Users (%)
Algeria	76.9
Morocco	91.0
Egypt	72.7
Turkey	87.3

Source: World Bank (2023), Individuals Using the Internet (% of Population).

As shown in Table 1, Morocco exhibits the highest internet penetration rate among the selected countries, reaching approximately 91% of the population. Turkey follows with 87.3%, while Algeria and Egypt record lower levels at 76.9% and 72.7%, respectively. These results reveal important differences in digital accessibility that directly affect the potential diffusion of AI technologies.

From an economic perspective, internet penetration constitutes a critical indicator of digital readiness because AI systems depend heavily on data generation, transmission, and processing. Higher levels of connectivity facilitate access to cloud-based services, digital platforms, and advanced analytical tools, thereby creating favorable conditions for AI adoption (World Bank, 2022). Consequently, Morocco and Turkey appear better positioned to integrate AI technologies into productive activities than Algeria and Egypt.

Although Algeria has made considerable progress in expanding internet access over the past decade, significant challenges remain. Broadband penetration rates remain relatively modest, particularly outside major urban centers. Furthermore, the country's cloud computing infrastructure and data center capacities remain underdeveloped compared with regional leaders. According to UNCTAD (2022), these infrastructural limitations constitute a major obstacle to digital transformation in many developing economies.

The consequences of these limitations extend beyond technological adoption. Firms operating in environments characterized by insufficient digital infrastructure often encounter higher transaction costs, reduced operational efficiency, and limited access to digital markets. Such constraints may reduce the productivity gains associated with AI implementation. Therefore, improving digital infrastructure should be considered a strategic priority for Algeria's long-term competitiveness.

Human Capital and AI Skills

The availability of qualified human resources represents another fundamental determinant of AI readiness. AI technologies require highly skilled workers capable of developing algorithms, managing digital systems, interpreting analytical outputs, and integrating technological innovations into organizational processes.

Consequently, human capital has become a central component of national competitiveness in the digital economy (Noy and Zhang, 2023).

Table 2. Human Capital and AI Skills Indicators (2023)

Country	Tertiary Education Enrollment (%)	STEM Graduates (%)	AI Specialists per 100,000 Inhabitants
Algeria	28	25	15
Morocco	32	28	20
Egypt	30	27	18
Turkey	38	35	35

Source: OECD (2021); Li and Liu (2023); Brynjolfsson, Rock, and Syverson (2017).

Table 2 reveals substantial disparities in human capital development among the selected countries. Turkey significantly outperforms the other countries across all indicators, reflecting sustained investments in higher education, scientific research, and technological training. The country's strong educational base has facilitated the emergence of a dynamic technological workforce capable of supporting AI-driven innovation.

Algeria demonstrates moderate tertiary education enrollment rates but lags behind Turkey and Morocco in terms of STEM graduates and AI specialists. This finding is particularly important because AI technologies require specialized competencies that extend beyond general education. Engineers, computer scientists, data analysts, and machine learning experts play a critical role in the successful implementation of AI solutions.

The relatively limited number of AI specialists in Algeria suggests that the country may face difficulties in scaling AI adoption across sectors. Brynjolfsson, Rock and Syverson (2017) argue that technological investments alone are insufficient to generate productivity gains unless accompanied by complementary investments in human capital. Similarly, Li and Liu (2023) demonstrate that firms benefit most from AI adoption when they possess sufficient absorptive capacity and technical expertise.

Another important challenge concerns the mismatch between educational outputs and labor market needs. While Algerian universities produce large numbers of graduates each year, many educational programs remain insufficiently aligned with emerging technological requirements. Strengthening AI-related training programs, promoting digital literacy, and encouraging collaboration between universities and industry could therefore play a decisive role in enhancing Algeria's AI readiness.

Innovation Ecosystem

The innovation ecosystem determines a country's ability not only to adopt AI technologies but also to develop and commercialize them. Innovation capacity depends on research and development (R&D) investments, entrepreneurial dynamism, technological experimentation, and collaboration among universities, firms, and government institutions (Brem et al., 2021).

Table 3. Innovation and AI Adoption Indicators (2023)

Country	R&D (% GDP)	AI Startups	AI Patents	Industrial AI Adoption
Algeria	0.6	10	5	Low
Morocco	1.2	25	15	Moderate
Egypt	0.8	20	12	Moderate

Turkey	1.8	50	30	High
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Source: UNCTAD (2022); McKinsey & Company (2023); Brem et al. (2021).

Table 3 highlights significant differences in innovation performance among the selected countries. Turkey exhibits the strongest innovation ecosystem, characterized by higher R&D expenditures, a larger number of AI startups, and stronger patenting activity. These indicators suggest a favorable environment for technological innovation and AI commercialization.

By contrast, Algeria records the lowest levels of R&D investment and startup activity. Such weaknesses may limit the country's ability to generate indigenous AI solutions and reduce its capacity to participate in global technological value chains. According to McKinsey & Company (2023), innovation ecosystems play a critical role in transforming AI from a technological possibility into a tangible source of economic value.

The relatively small number of AI startups in Algeria reflects broader structural challenges facing entrepreneurship and innovation. Limited access to financing, regulatory constraints, and weak university-industry linkages continue to hinder the development of a vibrant technological ecosystem. As a result, many promising innovations fail to reach commercialization stages.

Nevertheless, recent initiatives suggest a gradual evolution of the innovation landscape. AI applications are increasingly being explored in agriculture, healthcare, and energy. Precision agriculture projects, AI-assisted diagnostic systems, and predictive maintenance technologies in the hydrocarbon sector illustrate emerging opportunities for innovation-driven productivity growth (APS, 2024; Abdelkader & Mezouar, 2020).

Institutional Readiness and Governance

Institutional readiness constitutes another essential determinant of AI adoption. Effective governance frameworks provide legal certainty, facilitate innovation, protect data privacy, and encourage investment. In the absence of appropriate institutional structures, technological adoption may remain fragmented and inefficient (Wirtz & Müller, 2019).

Table 4. Institutional Readiness for AI Development

Country	National AI Strategy	Data Governance Framework	AI Regulation	Public–Private Partnerships
Algeria	Yes (2024)	Emerging	Emerging	Limited
Morocco	Yes	Developing	Developing	Moderate
Egypt	Yes	Developing	Developing	Moderate
Turkey	Yes	Advanced	Advanced	Extensive

Source: OECD (2021); Oxford Insights Government AI Readiness Index; APS (2024); Agence Ecofin (2024).

The results indicate that Algeria has recently initiated efforts to strengthen its institutional framework through the adoption of a national digital transformation strategy and emerging AI-related policies. However, the country remains behind Turkey in terms of regulatory maturity, governance mechanisms, and public-private cooperation.

Turkey's stronger institutional environment has facilitated the creation of AI clusters, innovation hubs, and collaborative research initiatives. Morocco and Egypt occupy intermediate positions, benefiting from targeted government programs and increasing private-sector participation.

Institutional quality is particularly important because AI adoption involves ethical, legal, and social considerations. Issues such as data protection, algorithmic transparency, cybersecurity, and workforce

adaptation require coherent policy responses. Strengthening governance frameworks could therefore enhance investor confidence and accelerate technological diffusion in Algeria.

Productivity Outcomes

The ultimate objective of AI adoption is to enhance productivity and economic performance. Labor productivity provides a useful indicator for assessing the extent to which countries transform technological and human resources into economic output.

Table 5. Labor Productivity Indicators

Country	GDP per Worker (USD)
Algeria	20,500
Morocco	23,000
Egypt	19,800
Turkey	35,200

Source: World Bank (2022); Brynjolfsson, Rock, and Syverson (2017).

The productivity figures reveal substantial differences among the selected countries. Turkey exhibits significantly higher productivity levels than the other economies, reflecting its stronger performance across the dimensions examined previously. The country's advanced infrastructure, innovation ecosystem, and institutional readiness appear to translate into superior economic outcomes.

Algeria's productivity level exceeds that of Egypt but remains below Morocco and considerably lower than Turkey. These results suggest that the country's existing technological and institutional limitations may be constraining productivity growth. The findings are consistent with the broader literature emphasizing the importance of complementary investments in infrastructure, skills, and innovation for realizing AI-related productivity gains (Acemoglu & Restrepo, 2020).

Overall Comparative Assessment

To synthesize the findings, Table 6 provides an overall assessment of AI readiness across the four countries.

Table 6. Comparative Assessment of AI Readiness

Dimension	Algeria	Morocco	Egypt	Turkey
Digital Infrastructure	Moderate	High	Moderate	Very High
Human Capital	Moderate	Moderate-High	Moderate	High
Innovation Ecosystem	Low	Moderate	Moderate	High
Institutional Readiness	Emerging	Moderate	Moderate	High

Source: Author's compilation based on previous indicators.

Overall, the comparative analysis demonstrates that Algeria occupies an intermediate position among the selected countries. While significant progress has been achieved in terms of digital connectivity and policy commitment, substantial gaps remain in innovation capacity, institutional maturity, and advanced human capital. These weaknesses may limit the country's ability to fully exploit AI as a source of productivity growth.

Nevertheless, the analysis also highlights considerable opportunities. Algeria possesses a large and relatively young population, expanding digital infrastructure, and growing interest in technological modernization. If supported by appropriate investments in education, innovation, and governance, these assets could facilitate a more effective integration of AI into the national economy. The following section discusses these findings and proposes policy recommendations aimed at strengthening Algeria's AI readiness and productivity prospects.

Discussion and Policy Implications

The comparative analysis reveals that Algeria possesses significant potential to benefit from Artificial Intelligence (AI)-driven productivity growth, yet substantial structural and institutional challenges continue to limit its capacity to fully exploit these opportunities. The findings demonstrate that Algeria occupies an intermediate position among the selected countries, outperforming some regional peers in specific areas while remaining significantly behind more advanced economies such as Turkey in terms of digital infrastructure, innovation capacity, human capital, and institutional readiness. These results are consistent with previous studies emphasizing that AI adoption is not determined solely by technological availability but also by the existence of complementary capabilities that facilitate technological diffusion and productivity enhancement (Agrawal et al., 2019; Brynjolfsson, Rock, and Syverson, 2017).

One of the most important findings concerns the relationship between digital infrastructure and AI readiness. Although internet penetration has increased considerably in Algeria during the last decade, the country still faces important deficiencies regarding broadband connectivity, cloud computing services, data centers, and digital platforms. The literature consistently identifies digital infrastructure as a fundamental prerequisite for AI adoption because intelligent systems rely on extensive data collection, storage, processing, and transmission capacities (UNCTAD, 2022; OECD, 2021). Consequently, the relatively modest level of digital infrastructure observed in Algeria may reduce the effectiveness of future AI investments and slow the diffusion of technological innovations throughout the economy.

The analysis also highlights the strategic importance of human capital. Despite substantial progress in higher education enrollment, Algeria continues to face shortages of specialized skills in fields such as data science, machine learning, artificial intelligence, and advanced digital technologies. This finding corroborates the arguments of Acemoglu and Restrepo (2020), who demonstrate that productivity gains associated with AI depend heavily on the availability of complementary skills and organizational capabilities. Similarly, Acemoglu and Restrepo (2020) argue that technological adoption may fail to generate substantial productivity improvements if the workforce lacks the competencies required to integrate and manage new technologies effectively.

Another significant observation concerns the weakness of Algeria's innovation ecosystem. Compared with Turkey and, to a lesser extent, Morocco and Egypt, Algeria exhibits relatively low levels of research and development expenditure, patent activity, and AI-related entrepreneurial initiatives. These limitations constrain the country's ability to develop indigenous technological solutions and reduce opportunities for knowledge creation and commercialization. According to Brem et al. (2021), innovation ecosystems play a critical role in transforming technological advances into economic value by facilitating collaboration among firms, universities, research institutions, and government agencies. Therefore, strengthening Algeria's innovation system should constitute a central component of any national AI strategy.

The findings further suggest that institutional readiness remains one of the most critical challenges facing Algeria's digital transformation agenda. Although recent initiatives such as the national digital transformation strategy and emerging AI-related policies represent important steps forward, regulatory frameworks remain underdeveloped compared with international best practices. Effective governance mechanisms are essential for addressing issues related to data protection, cybersecurity, algorithmic transparency, ethical AI use, and digital trust (Wirtz & Müller, 2019). Without a robust institutional framework, AI adoption may remain fragmented, limiting its contribution to productivity growth and economic modernization.

International comparisons indicate that countries with stronger AI governance frameworks and higher levels of institutional readiness tend to achieve faster and more inclusive digital transformation outcomes. Effective regulatory systems enhance investor confidence, facilitate technological diffusion, and promote the responsible adoption of AI across economic sectors. Recent international assessments further demonstrate that countries combining robust governance mechanisms with strategic investments in digital infrastructure and human capital are better positioned to capture the productivity gains associated with artificial intelligence (OECD, 2024; IMF, 2025). For Algeria, strengthening institutional capacity and establishing a comprehensive AI governance framework will therefore be essential to accelerate technological adoption and support long-term economic modernization.

The results also carry important implications for economic diversification. Algeria's economy remains highly dependent on hydrocarbon revenues, exposing the country to external shocks and fluctuations in global energy markets. AI offers significant opportunities to support economic diversification by enhancing productivity across sectors such as manufacturing, agriculture, healthcare, logistics, education, and financial services. For instance, AI-powered precision agriculture technologies can improve resource management, crop monitoring, and productivity, thereby contributing to food security and sustainable agricultural development (APS, 2024). Similarly, predictive maintenance systems and machine learning applications can increase efficiency within the energy sector, generating productivity gains while reducing operational costs (Abdelkader & Mezouar, 2020; Zhang et al., 2021).

Based on these findings, several policy recommendations can be proposed. First, Algeria should prioritize investments in digital infrastructure. Expanding broadband networks, increasing cloud computing capacities, and developing national data centers would create the technological foundation necessary for large-scale AI adoption. Public investment should be complemented by incentives encouraging private-sector participation in digital infrastructure development.

Second, human capital development should become a strategic priority. Universities and technical institutes should integrate AI-related subjects into their curricula and strengthen training programs in data science, machine learning, and digital technologies. In addition, partnerships between educational institutions and private firms could facilitate the alignment of training programs with labor market needs. Continuous professional development initiatives should also be promoted to support workforce adaptation to technological change.

Third, policymakers should strengthen the national innovation ecosystem. Increasing public and private expenditure on research and development, supporting technology startups, and promoting university-industry collaboration could stimulate AI innovation and technological entrepreneurship. Special innovation zones, technology parks, and AI incubators may further contribute to creating a dynamic ecosystem capable of generating and commercializing AI solutions.

Fourth, institutional and regulatory frameworks should be modernized. The government should develop comprehensive AI governance policies addressing data protection, cybersecurity, ethical standards, and algorithmic accountability. Such measures would enhance investor confidence and facilitate responsible AI adoption across sectors. International cooperation with countries that possess more advanced AI governance systems could also accelerate institutional learning and capacity building.

Finally, AI policy should be integrated into a broader national development strategy. Rather than treating AI as a purely technological issue, policymakers should recognize its role as a strategic instrument for economic transformation, productivity enhancement, and diversification. Coordinated policies involving government agencies, universities, private firms, and civil society organizations are necessary to maximize the economic and social benefits of AI while minimizing potential risks.

Overall, the evidence suggests that Algeria possesses considerable opportunities to leverage AI as a driver of productivity growth and economic modernization. However, realizing this potential will require sustained investments in infrastructure, human capital, innovation, and governance. By addressing these

structural challenges, Algeria can strengthen its position within the emerging digital economy and enhance its long-term competitiveness in an increasingly technology-driven global environment.

Table 7. Policy Roadmap for AI Adoption in Algeria

Dimension	Current Situation	Policy Priority	Expected Impact
Digital Infrastructure	Moderate internet penetration and limited cloud services	Expand broadband networks and develop national data centers	Increased AI diffusion and digital inclusion
Human Capital	Shortage of AI specialists and advanced digital skills	Introduce AI-focused curricula and professional training programs	Improved workforce readiness
Innovation Ecosystem	Low R&D expenditure and limited startup activity	Strengthen innovation funding and technology incubators	Enhanced technological innovation
Institutional Readiness	Emerging AI governance framework	Develop comprehensive AI regulation and ethical guidelines	Greater investor confidence and responsible AI adoption
Economic Diversification	Heavy dependence on hydrocarbons	Promote AI applications in agriculture, healthcare, manufacturing and services	Sustainable productivity growth and diversification

Source: Author's compilation.

Research Contributions

This study contributes to the growing literature on artificial intelligence and economic productivity in several important ways. First, it provides one of the few comparative assessments of AI readiness in Algeria within a regional context, benchmarking the country against Morocco, Egypt, and Turkey. By doing so, the study offers a clearer understanding of Algeria's relative strengths and weaknesses regarding digital infrastructure, human capital, innovation capacity, and institutional readiness.

Second, the research develops an integrated analytical framework that combines technological, human, institutional, and innovation-related dimensions of AI readiness. This multidimensional approach extends existing studies that often focus on a single aspect of digital transformation and provides a more comprehensive perspective on the factors shaping AI-driven productivity growth in emerging economies.

Third, the study generates practical policy implications tailored to the Algerian context. The proposed recommendations emphasize the importance of strengthening digital infrastructure, enhancing AI-related skills, supporting innovation ecosystems, and improving governance frameworks. In this regard, the paper contributes not only to academic debates on AI and productivity but also to ongoing policy discussions concerning economic diversification and digital transformation in resource-dependent economies. Finally, the study provides a foundation for future empirical research investigating the long-term economic and social impacts of AI adoption in Algeria and other emerging countries.

Conclusion

This study has examined Algeria's readiness to leverage Artificial Intelligence (AI) as a driver of economic productivity, situating the analysis within a comparative framework alongside Morocco, Egypt, and Turkey. The research integrates quantitative indicators across four key dimensions—digital infrastructure, human capital, innovation ecosystem, and institutional readiness—and evaluates their potential influence on labor productivity. The findings reveal that while Algeria has made progress in certain areas, such as internet penetration and policy formulation, the country continues to lag behind regional leaders in AI adoption and technological preparedness.

In the digital infrastructure domain, Algeria's internet penetration has improved substantially, reaching 76.9% of the population, yet it remains below Morocco and Turkey, which benefit from more robust connectivity and cloud computing capacities (World Bank, 2023; UNCTAD, 2022). This structural gap suggests that substantial investments are needed to create a technological environment conducive to AI integration. The effectiveness of AI adoption will depend not only on expanding access but also on improving broadband quality, data centers, and cybersecurity infrastructure.

Human capital analysis indicates a moderate level of tertiary education and STEM graduates in Algeria, yet the availability of AI specialists is limited compared with Turkey and Morocco (Acemoglu and Restrepo, 2020; Brynjolfsson, Rock and Syverson, 2017). The development of a skilled workforce is critical to translate technological investments into productivity gains. Policies promoting AI education, vocational training, and partnerships between universities and industry are therefore essential to build the human capacity necessary for a successful AI-driven transformation.

The innovation ecosystem in Algeria shows significant weaknesses, including low R&D expenditure, limited AI startups, and low patent activity (UNCTAD, 2022; McKinsey & Company, 2023). These factors constrain the country's ability to generate indigenous AI solutions and to commercialize technological innovations. Strengthening R&D investment, supporting AI entrepreneurship, and fostering collaboration between academia, industry, and government can enhance Algeria's capacity to innovate and integrate AI effectively.

Institutional readiness emerges as a decisive factor for AI adoption. Although Algeria launched its national AI strategy in 2024, regulatory frameworks, data governance mechanisms, and public-private partnerships remain underdeveloped (APS, 2024; Agence Ecofin, 2024). Comprehensive AI governance policies, including ethical standards, data protection regulations, and incentive mechanisms, are necessary to create a stable environment for AI deployment. International collaboration and learning from successful institutional models, such as those observed in Turkey, could accelerate the development of effective governance structures.

The comparative analysis demonstrates that Turkey consistently leads in all dimensions of AI readiness, followed by Morocco and Egypt, while Algeria occupies an intermediate position. Labor productivity measurements corroborate these findings, with Algeria's GDP per worker below regional leaders, reflecting the combined effects of infrastructural, human capital, innovation, and institutional constraints (World Bank, 2022; Brynjolfsson, Rock, and Syverson, 2017). These results underscore the critical need for a coordinated and multidimensional strategy to enhance AI adoption and maximize productivity gains.

Policy implications are clear. Algeria should prioritize investments in digital infrastructure, expand broadband and cloud capacities, and promote AI-related educational programs. Strengthening the innovation ecosystem through increased R&D spending, fostering startups, and facilitating knowledge transfer is crucial. Moreover, comprehensive institutional reforms, including the development of regulatory frameworks and public-private partnerships, are essential to ensure ethical, transparent, and efficient AI deployment.

Recent international assessments also suggest that AI preparedness has become an increasingly important determinant of long-term economic competitiveness and resilience in emerging economies (World Bank, 2024; IMF, 2025).

In conclusion, AI offers Algeria a unique opportunity to diversify its economy, enhance labor productivity, and increase competitiveness in the global digital economy. Achieving these objectives requires an integrated approach encompassing technological investment, human capital development, innovation promotion, and institutional modernization. By addressing these structural and policy challenges, Algeria can position itself to realize the transformative potential of AI, foster sustainable economic growth, and secure long-term prosperity. Future research should focus on longitudinal studies assessing the impact of AI policies, sector-specific productivity gains, and the socio-economic effects of AI-driven labor market

transformations in Algeria and comparable emerging economies (Acemoglu & Restrepo, 2020; Noy & Zhang, 2023).

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