

Artificial Intelligence in Algeria: A Diagnostic Assessment

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Abstract:

In the midst of ongoing digital transformations, the world has increasingly become a global village through the rapid expansion of internet networks, information technologies, and artificial intelligence (AI) applications. Algeria is among the countries striving to adapt to these global dynamics by accelerating its efforts in the field of digitalization. For several years, the Algerian state has shown growing interest in digital modernization, with initiatives aimed at improving data systems, promoting technological innovation, and creating the necessary conditions for the development of AI technologies in line with global trends.

Despite these efforts, Algeria's path toward adopting AI has been marked by persistent challenges. The most critical obstacles include a shortage of highly qualified personnel capable of developing and applying advanced AI systems, as well as insufficient infrastructure to support large-scale digital transformation. These constraints limit the country's ability to fully harness AI's potential across vital sectors such as healthcare, education, agriculture, and governance. In addition, the lack of synergy between research institutions, universities, and industry actors continues to slow progress and reduce the effectiveness of state-led initiatives.

Nonetheless, the Algerian state's growing focus on digitalization demonstrates a recognition of the strategic role of AI in driving socio-economic development and strengthening competitiveness in the digital age. With sustained investments in human capital, infrastructure, and institutional capacity, Algeria has the potential to gradually overcome these challenges and move toward more effective integration of AI technologies.

Keywords: *Artificial Intelligence; AI Technologies; Evolution; Challenges; Algeria.*

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Introduction:

In recent years, there have been significant advancements in technology and technical fields that serve various disciplines and sectors, resulting in a world characterized by continuous innovation and scientific progress. This evolution occurs against the backdrop of a global transition through new developmental stages marked by rapid changes affecting financial, economic, political, and social systems. In fact, the world stands on the threshold of a fourth industrial revolution, whose impact extends beyond transforming industries and production methods to fundamentally altering human cognitive perspectives on life's requirements and human needs in general.

Despite the risks associated with the misuse of certain artificial intelligence technologies and systems—as warned by numerous experts and specialists in the field—artificial intelligence nonetheless holds considerable promise, offering many opportunities that can contribute to societal advancement across multiple domains. Algeria possesses significant potential to compete in this arena, benefiting from both financial savings and a pool of creative minds employed by global companies, which can be leveraged extensively.

This study aims to shed light on the current state of artificial intelligence technology adoption in Algeria, the efforts undertaken by the Algerian government in this regard, as well as the main challenges and obstacles facing the integration of AI within the country.

Study Significance:

The importance of this research paper stems from the subject matter itself. The topic of artificial intelligence (AI) in Algeria represents a fertile field for study and investigation. This research aims to explore the current state of AI technology usage in Algeria, the efforts undertaken in this context, as well as the difficulties and challenges associated with the adoption of AI in the country.

Study Methodology:

In order to conduct a rigorous and systematic scientific analysis of the subject—artificial intelligence in Algeria from a diagnostic perspective—the study primarily employs a descriptive-analytical

approach throughout most sections. This methodology is deemed most appropriate for addressing various social and humanistic topics broadly. The study applies this method by describing the theoretical frameworks related to the concept of artificial intelligence and by analyzing and processing diverse data pertinent to the topic.

Study Problem:

The central research question guiding this study is: What are the main opportunities and challenges facing the adoption of artificial intelligence technologies in Algeria?

The paper is organized into three main sections following the introduction, concluding with a summary.

- Section One: The Concept of Artificial Intelligence
- Section Two: Opportunities and the Future of Artificial Intelligence
- Section Three: The Current State of Artificial Intelligence Technology Usage in Algeria

1. The Concept of Artificial Intelligence:

The world today is experiencing a remarkable technological revolution known as the Fourth Industrial Revolution, also referred to as artificial intelligence. This section will explore the most significant definitions of artificial intelligence, as well as its fields and applications.

1.1 Definition of Artificial Intelligence:

Artificial intelligence, referred to in English as Artificial Intelligence (AI) and sometimes called Machine Intelligence, is a branch of computer science.¹ It is the study of intelligent behavior and represents an attempt to develop methods for integrating such behavior into artificial machines.

Artificial intelligence is considered one of the most complex and controversial subjects in human history. At times, research in this field is

1- Artificial Intelligence, Knowledge Site, accessed on 19/12/2024 at: M.Marefa.org.

as challenging as exploring deep space. However, a crucial fact emerges: research in artificial intelligence is significantly more difficult.¹

Artificial intelligence is defined as a branch of computer science and an emerging technological discipline that focuses on studying and developing theories, methodologies, techniques, and applied systems to simulate human intelligence.² It encompasses the cognitive abilities individuals use to confront new situations through structured thinking, facilitating inferential knowledge acquisition, including deduction, induction, distinction, analysis, synthesis, and sequential reasoning.³

In a joint report on artificial intelligence titled *Artificial Intelligence and Robotics 2017*, the Associated Chambers of Commerce and Industry of India (Assocham) and PwC defined artificial intelligence as "the ability of computers and computer-powered robotic systems to process information and generate outcomes in a manner similar to human cognitive processes in learning, decision-making, and problem-solving."⁴

Artificial intelligence is the imitation of human behaviors in an intelligent manner using robots or machines with an integrated system that enables them to think in the same cognitive way as humans, performing tasks such as problem-solving, decision-making, speech recognition, translation, and more.⁵

It is defined as the intelligence demonstrated by machines and software to simulate human cognitive abilities and patterns of functioning, such as the ability to learn, infer, and interact. In this context, the machine imitates the human mind and its operations, such as the capacity for thinking, discovery, and learning from past experiences.

1- Blay Whitby, *Artificial Intelligence*, United Arab Emirates: Dar Al-Farouq for Cultural Investments, 2008, p. 15.

2- Asaad Abir, *Artificial Intelligence and Its Applications in Our Daily Life*, Jordan: Dar Al-Kindi for Publishing and Distribution, 2020, p. 11.

3- Medhat Mohamed Abu Al-Nasr, *Artificial Intelligence in Smart Organizations*, Egypt: Dar Al-Mogamaa Al-Arabiya for Training and Publishing, 2020, p. 133.

4- David Valle Cruz, *Assessing the Public Policy-Cycle Framework in the Age of Artificial Intelligence: From Agenda-Setting to Policy Evaluation*, *Government Information Quarterly*, 37, 2020.

5- Magdy, N., *Using Artificial Intelligence (AI) in Banking Services*, Arab Monetary Fund, 2021, p. 5.

Devices and computer systems that are made to function in a way that may be regarded as intelligent are referred to as artificial intelligence. It consists of technology models that mimic human performance by learning, making certain deductions, comprehending intricate material, conversing with others, and improving human cognitive function.¹

Based on the above, it can be said operationally that artificial intelligence is a newly coined term that emerged in the last decade of the current century. It refers to the ability of machines and equipment to perform functions that were once exclusively carried out by individuals with human cognitive abilities. However, with the growing advancement of science and knowledge, humans have been able to make machines and equipment simulate the human mind and perform the tasks and duties traditionally carried out by humans.

1.2 Fields and Applications of Artificial Intelligence:

Artificial Intelligence (AI) is utilized across various sectors, including military, industrial, economic, technological, medical, educational, and service industries. Some of its most significant applications include:

- Autonomous vehicles and drones.
- The robot is a mechanical machine that has been programmed to function without human supervision. It is intended to carry out activities, use linguistic, and movement abilities that are normally performed by people. It is also used in nuclear reactors, underground cable maintenance, mine detection, wire installation and repair, automobile production, and other specialized sectors.
- Nonlinear control, such as control in railway systems.
- Smart devices capable of performing cognitive tasks, such as examining industrial designs, monitoring processes, and decision-making.

1- Hassan, A., *The Usage of Artificial Intelligence in Arab Financial Institutions, Artificial Intelligence for Sustainable Finance and Sustainable Technology*, 2021, p. 5.

- Computers are used in cognitive simulation to test ideas about the human mind and its processes, including handwriting recognition, picture processing, memory activation, data extraction, and the identification of familiar faces and voices.
- Computer applications for conducting surgery and medical diagnostics in clinics and hospitals.
- Programs that use AI to analyze economic data, such the stock market, and create stock trading systems.
- Google’s search algorithms on computers via the internet.
- Expert systems are capable of carrying out activities similarly to those of experts and helping them make accurate judgments by following a set of logical steps that lead to the right choice. One of the most crucial and vital fields of artificial intelligence research, both now and in the future, is this.
- Televisions, cellphones, smart home services, self-governing weaponry, and hundreds of more applications.¹

2. Opportunities and the Future of Artificial Intelligence:

There is no doubt that AI, as an emerging technology, is still not widely adopted, particularly in developing countries. This section explores the opportunities presented by AI and its future prospects.

2.1 Opportunities of Artificial Intelligence:

AI systems offer numerous solutions and future opportunities that support economic growth and contribute to societal advancement. A study conducted by the European Union, published in June 2020, examined the potential opportunities AI could provide. The study highlighted several key sectors, including the following:

1- Artificial Intelligence, Research and Studies Center, article published in: www.abhacci.org.sa.

2.1.2 Manufacturing:

AI can be employed in enhancing the workforce, maintenance, and process control. For example, AI can be applied to improve workforce planning, maintenance, and process control. It can analyze production data to identify forecasts and trends, helping companies plan labor levels more effectively. AI can also be used to detect and fix issues in equipment before failures occur, reducing downtime. Furthermore, AI can optimize process control, leading to increased productivity and improved product quality.

2.1.3 Transportation:

AI can be employed to drive autonomous vehicles and improve public transportation efficiency by utilizing a variety of sensors to assess the surrounding environment and control the vehicle. This helps reduce road accidents and traffic congestion. Additionally, AI can optimize public transportation efficiency by improving route planning and determining the optimal times for buses and trains to operate.

2.1.4 Financial Services:

AI can be employed assess risks and make decisions related to loans and investments. For example, AI can analyze sales data and transaction records to identify investment opportunities and determine stocks with the highest potential for profit. AI can also be used to provide investment recommendations and manage personal finances. The use of AI in financial services is expected to enhance the efficiency of the financial sector, reduce risks, and improve the customer experience.¹

2.1.5 Environment:

AI can contribute to reducing global greenhouse gas emissions by approximately 1.5% to 4% by 2030.

1- Ben Nasser Saeed, *Artificial Intelligence and the Digital Economy: Opportunities and Challenges*, *Maghreb Journal of Organization Management*, Vol. 08, Issue 01, 2023, p. 36.

2.1.6 Healthcare:

AI can accelerate the process of identifying and developing new drugs, as well as repurposing existing medications for other uses. It can also enhance and improve diagnosis and treatment, improve fetal health, predict and monitor epidemics and chronic diseases, enhance primary healthcare services, and strengthen medical research and drug discovery.

2.1.7 Productivity and Employment:

AI systems are expected to bring significant benefits in terms of productivity. For example, one estimate predicts a labor productivity increase ranging from 11% to 37% by 2035. Additionally, AI is expected to support positive contributions to the United Nations Sustainable Development Goals.¹

2.2 The Future of Artificial Intelligence:

The near future (2020–2025), the medium-term future (2025–2030), and the long-term future (2030–2040) are the three primary phases of artificial intelligence's future. The following explanation applies to these stages:

2.2.1 AI in the Near-Term Future (2020–2025):

Artificial intelligence will soon be used in specialized applications to assist information and logistical tasks that the government has historically handled to provide public services. Here are a few instances of potential near-term applications for artificial intelligence:

- Using AI-powered robots to replace repetitive and costly manual labor.
- Employing artificial intelligence to filter through millions of data points via sensors connected to the Internet of Things (IoT).
- Using AI to assist public service experts in monitoring agricultural and health conditions.

1- Al-Asad, Saleh Al-Asad, *Artificial Intelligence: Opportunities, Risks, and Reality in Arab Countries*, *Economic Additions Journal*, Vol. 07, Issue 01, 2023, pp. 170-171.

- Implementing AI-driven digital assistants to identify and assist in understanding biases.
- Utilizing AI-enabled "digital twins" in real-world dynamics.
- Since many cities already offer phone lines and mobile applications to assist people with non-emergency services and give information about local programs and events, the usage of AI-supported assistance for people seeking government information is growing.

2.2.2 AI in the Medium-Term Future (2025–2030):

The medium-term future of artificial intelligence involves transitioning from specialized applications to integrating AI into all processes to support government operations, interpretation, and decision-related tasks traditionally performed by the government in order to improve public services. Below are some examples of artificial intelligence in the medium-term future:

- Using AI to enable material delivery and provide transportation services.
- Employing AI-powered autonomous vehicles in public services, such as firefighting and emergency response.
- Using AI-driven robots to replace repetitive and labor-intensive manual work.¹

2.2.3 AI in the Long-Term Future (2030–2040):

There are more ambitious plans for the development of artificial intelligence in 2030 and beyond. The speed and capacity of microprocessors and computer memory are predicted to continue improving, allowing for speedier delivery of all help and empowerment tasks for public services, even if it is difficult to anticipate the precise future capabilities of AI. The following are expected:

1- Mufarih Jaber Musfer Al-Talidi, *The Impact of Introducing Artificial Intelligence on the Future of Employment in the Saudi Government Sector: An Applied Study on the Ministry of Justice in the Asir Region*, *Journal of Economic, Administrative, and Legal Sciences*, Vol. 5, Issue 1, 2021, p. 87.

- The use of augmented reality, government computers, and other technology to radically change the function of institutions into a more individualized strategy that enables the government to address each citizen's particular requirements.
- AI's ability to collaborate with humans and assist them in acting better, responding, and providing public services is expected to be quite powerful at this stage.
- We will be able to move objects simply by thinking, with technology allowing us to achieve ideal bodies through nanotechnology.
- The use of smooth, fuel-free self-driving vehicles.
- Harnessing the energy of stars.
- The emergence of cybernetic organisms.¹

3. The Current State of AI Technology Adoption in Algeria:

To fully harness the benefits of AI in Algeria, significant efforts must be made, alongside overcoming various obstacles and challenges.

3.1 Efforts by the Algerian Government in the Field of Artificial Intelligence:

AI is experiencing notable growth in Algeria, with both the government and private sector increasingly investing in this field. Research centers and educational initiatives have been established to enhance AI capabilities. Additionally, Algeria is actively working to integrate AI technologies into key sectors such as healthcare, agriculture, and industry, aiming to drive economic and social development.

This section explores the initiatives undertaken by the Algerian government to leverage AI in advancing the national economy,

1- Malika Mzakkour, *The Future of Humanity in Light of Super Artificial Intelligence Projects*, *Journal of Studies in Humanities and Social Sciences*, Issue 01, 2020, pp. 32-51.

particularly in the context of digital transformation across various sectors.

The Algerian government has long prioritized digitalization and data modernization, recognizing their essential role in the development of AI systems, in alignment with global trends. In 2018, a decision was made to establish the National Artificial Intelligence Strategy (2020–2030), which introduced several key measures, including:

3.1.1 Establishment of the Artificial Intelligence Center (SKAILAB):

Established in February 2020 at the University of August 20, 1955, in Skikda, it is the first national center for artificial intelligence in Algeria. The center provides solutions to economic and industrial partners, as well as training experts in the fields of computer science and artificial intelligence. The center aims to achieve a number of goals, including:

- Establishing partnership communications with operators across various sectors.
- Organizing collaborative work with company managers to collect data and share expertise.
- Collecting, coding, and filtering data.
- Developing artificial intelligence models suitable for the available data.
- Training university researchers and entrepreneurs, which is the ultimate goal of the artificial intelligence center.
- Implementing, testing, and deploying advanced models.
- Assisting users in expressing their needs regarding management models and decision support.¹

1- Ahmed Daqa, Ahmed Hnish, *The Use of Modern Artificial Intelligence Technologies in Arab Countries: A Case Study of Algeria*, *Journal of Economic and Financial Studies*, Vol. 17, Issue: December 2024, pp. 242-243.

3.1.2 The National Higher School of Artificial Intelligence (ENSIA):

The National Higher School of Artificial Intelligence (ENSIA) is a prestigious higher education institution whose mission is to train engineers specializing in the theory and applications of artificial intelligence and data science. The establishment of ENSIA aims to fulfill responsibilities in the field of higher education, as well as in scientific research and technological development within its area of expertise.¹

3.1.3 The National Higher School of Mathematics (ENSM):

The National Higher School of Mathematics (ENSM) is equally important in the effort to develop artificial intelligence tools in Algeria. The school officially commenced its educational activities on October 12, 2021, with the objective of training highly skilled engineers in mathematics, providing support to major companies in Algeria, offering postgraduate training, and leading scientific research in the field.²

The world is currently undergoing a profound transformation with the advent of the digital revolution, also known as the Fourth Industrial Revolution, in which AI serves as the new driving force of the global economy. Studies predict that AI will contribute approximately \$15 trillion to global economic growth over the next ten years. Algeria is no exception to this trend, as it has the potential to boost its economy by nearly \$80 billion, based on population-based economic projections.

More than 150 countries have adopted a national AI strategy, with some even establishing dedicated ministries for the sector. Meanwhile, the number of AI-driven enterprises worldwide has increased by 270% over the past four years. Reports indicate that over 90% of leading companies have invested in AI to enhance productivity, applying its technologies across various sectors, from oil and gas to agriculture, manufacturing, and even tourism.

Algeria has outlined national priorities in healthcare, food security, and energy security, integrating AI to reduce oil exploration costs and foster substantial growth in other strategic areas. Additionally, the

1- National School of Artificial Intelligence, 2023.

2- The National Higher School of Mathematics: <http://nhsm.edu.dz>.

country is striving to invest in data science and AI to improve planning, forecasting, and public services offered to citizens.¹

3.2 Challenges Facing AI Adoption in Algeria:

Despite Algeria's significant efforts to keep pace with digital transformation, the adoption of AI faces numerous challenges. These challenges can be summarized as follows:

3.3 The Level of Development of IT Infrastructure:

This is the primary and leading indicator, as it provides an overview of the availability of the technology and infrastructure necessary to support the application of artificial intelligence, such as internet bandwidth, data analysis centers, and others.

The second indicator is the robustness of the sector, which includes the availability of talent and skills required to develop and implement artificial intelligence applications in practice.

From the first indicator, it can be concluded that Algeria is still far from achieving this in the current period. Artificial intelligence applications are currently individual and collective projects, not "community projects," meaning they do not yet have the capacity for widespread use in various public services.

From the second indicator, based on official and field data, it can be concluded that Algeria possesses a considerable "information infrastructure" base to implement this project. This is complemented by the third indicator, which concerns the availability of talent and skills in Algeria for executing projects in this field. Additionally, government initiatives are laying the foundation for interest in this area, such as the establishment of a graduate school for artificial intelligence in 2021, followed by the integration of artificial intelligence roles in various universities across the country. These initiatives aim to support various projects and innovations, transforming them into startups that will gradually contribute to the national economy. Notably, numerous reports

1- Abdel hakim Haddaka, *The University Follows an Elite School System to Graduate Engineers with High Theoretical Knowledge of the Principles and Techniques of Artificial Intelligence*, article published on 29/10/2021 at 10:00 on: <http://www.aljazerra.net>.

predict that the Middle East and Africa will be the fastest-growing regions in the world in terms of artificial intelligence spending until 2026.¹

3.4 Slow Digital Transformation in Various Economic and Social Sectors:

It is noticeable in Algeria that most sectors, whether economic, industrial, or financial, are still struggling with the slow pace of digital transformation. Despite over five years having passed since the declaration on the need to adopt technology and digitization in economic and social sectors, progress has been slow to this day.

Some sectors, such as higher education and national education, are attempting to keep pace with technological advancements.

The speed at which the country's leadership implements recommendations for complete digital transformation presents an opportunity for Algeria to become a leading force in the field of artificial intelligence, driving economic growth, creating new job opportunities, and improving the quality of public services. However, all of this requires strong commitment from the government, the private sector, the academic community, and society as a whole. Ultimately, artificial intelligence is a tool, and its success depends on how effectively this tool is used.²

3.5 Legal and Regulatory Challenges:

Regarding Algeria, within the framework of the laws enacted to regulate electronic transactions (Law 18/05), the Algerian legislature has not explicitly or implicitly addressed artificial intelligence and its applications. This omission represents a notable shortcoming, especially when contrasted with certain Arab legislations that have indirectly referenced AI, for example, by validating electronic agent transactions or

1- Ahmed Lallawi, Ilham Safra, *Artificial Intelligence and Startups in Algeria: Patterns of Use, Employment, and Expected Impacts*, *Algerian Journal of Human Security*, Vol. 09, Issue 02, 2024, p. 421.

2- Ali Kahlane, *Artificial Intelligence and Machine Learning in Financial Services and E-commerce: Future Perspectives in Algeria*, <http://ae.linkedin.com/posts/alikahlane>.

what some legislations refer to as electronic intermediaries, such as in the United Arab Emirates.¹

Furthermore, Algeria remains lagging in the development of specific regulatory texts governing the governance and ethics of artificial intelligence. This gap is reflected in the country's rankings in cyber security, where Algeria was positioned 105th globally in 2023.²

3.6 Cyber security Challenges:

Digital technologies in government pose new challenges in the field of cyber security and data protection, particularly in storing and exchanging sensitive data over networks. Despite Algeria's relatively recent move toward e-governance, the number of crimes committed suggests the scale of the risks it faces. This places Algeria in front of new challenges and obstacles, primarily achieving cyber security both now and in the future. The technological advancements and the emergence of the internet (Wi-Fi, 3G, 4G, 5G) require security authorities to rise to the challenge and be prepared with the latest technologies to confront and combat these developments.³ Additionally, the country faces transnational cybercrimes and wars, especially considering the external tensions along its borders, such as those with Libya, Mali, Niger, and Morocco.

3.7 Weaknesses in Algeria's Educational System:

Despite Algeria's technological infrastructure, the country faces significant challenges in the education sector, particularly regarding technological infrastructure deficits and the lack of adequate training for teachers. Additionally, there is a generational divide between the older and younger generations, which impacts the adoption of new technologies. Given that the quality of education plays a crucial role in the ability to integrate and utilize technology effectively, artificial

1- Ben Othman Farida, *Artificial Intelligence (A Legal Approach)*, *Journal of Policy and Law Notebooks*, Vol. 12, Issue 02, 2020, p. 160.

2- Dutta, S, bruno, L&Sacha, *Global innovation index, 2023, switzerland: world intellectual property organisation*, 2023.

3- Siham Bouamoucha, *Cyberspace is Characterized by the Openness of the Information Network and the Absence of Geographical Barriers*, *El Shaab Newspaper*, Issue 17345, May 24, 2017, p. 06.

intelligence presents a valuable opportunity for enhancing educational quality and contributing to sustainable development in Algeria.

3.8 Weaknesses in Algeria's Healthcare System:

The use of artificial intelligence technologies in the healthcare sector in Algeria is not comparable to some neighboring countries, with its application being modest in certain university hospitals, such as in the diagnosis and surgery of tumors. The limited use of AI technologies in healthcare is due to the challenges the sector has faced for years, including the lack of accurate data on citizen health, the poor quality of healthcare services provided to citizens, and the absence of digitization in the healthcare sector. These factors have caused Algeria to miss opportunities for the successful implementation of artificial intelligence in the healthcare field.¹

Conclusion:

In conclusion, it can be said that more and more people are relying on artificial intelligence technologies. This is because of the changes and developments that are happening all over the world, especially in technology. There are many new opportunities and growth in artificial intelligence in Algeria. The Algerian government is working hard to use AI to boost the economy as many sectors become more digital. Algeria has worked hard to keep up with digital progress, but this progress has faced many problems and challenges that have made it hard for AI to be widely used in the country.

Study Findings:

Based on the analysis conducted, the study reached the following conclusions:

- Lack of Skilled Workers: Algeria has a big problem finding qualified workers in the field of artificial intelligence. There aren't enough experts and specialists with the right skills to plan and carry out high-quality AI projects. This is mostly because AI is still new in Algeria and people are still being trained at places like the

1- Ahmed Daqa, Ahmed Hnish, *Op. cit.*, p. 246.

Higher School of Artificial Intelligence, which is expected to graduate its first class by the end of 2025.

- **Weak Technological Infrastructure:** AI applications need a strong technological infrastructure that meets the needs of AI technologies. Algeria still needs to improve its telecommunications networks and high-speed, high-precision internet services so that AI applications can work well. Algeria's lack of qualified workers and poor infrastructure are major obstacles to AI development. To overcome these problems, the government, private sector, and civil society must work together. To support AI systems, these efforts should focus on education and training, improving technological infrastructure, encouraging new ideas, and making cyber security better.
- **Lack of Regulatory Framework:** There isn't a set of laws that makes sure AI is used correctly. As the risks of cyber-attacks grow, Algerian laws are still not strong enough, especially when it comes to protecting data. So, the Algerian government needs to make laws and rules that can deal with these new technologies and the new problems that AI brings up, while also protecting people's rights and the interests of society as a whole.
- **Insufficient Investment in Research and Development:** The limited participation of the private sector and heavy reliance on government funding impede the development of high-quality AI applications.

Study Recommendations:

- Invest significantly in AI research and development, allocating adequate financial resources toward technological advancement.
- Establish specialized institutes dedicated to AI training, targeting top students in sciences, mathematics, physics, and related fields.
- Develop the skills of the AI workforce and implement supportive government policies, including plans and programs to prepare human resources and support startups in the AI domain.

- Adapt educational curricula and training approaches to keep pace with the latest developments in AI technologies.
- Align national legislation with the rapid evolution of AI systems and intensify research into the legal issues raised by AI to better prepare for the future.
- Overcome technophobia by embracing new technologies as drivers of progress and development rather than sources of fear and stagnation.