

Digital Transformation and Artificial Intelligence in Algeria: Opportunities and Challenges

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Abstract:

This article aims to examine and assess Algeria's experience of digital transformation and artificial intelligence in line with other countries worldwide. It does so in a rapidly changing era where time accelerates and geographical boundaries become less significant in the face of global technological and technical developments aimed at improving performance and increasing efficiency. In response, Algeria has launched a comprehensive national strategy spanning several sectors, including higher education, electronic platforms, companies, customer service models, institutional communications, and the establishment of specialised laboratories for research and development in the fields of the economy, e-government, security services, and public institutions.

By comparing this initiative with successful global models, the study identifies opportunities for Algeria to leverage, particularly to overcome challenges that could impede the country's progress towards digital effectiveness, as reflected in global classification models. This will help Algeria to update its economy and strengthen its competitiveness across multiple sectors. This is supported by political will and efforts to address several challenges, the most important of which is the weakness of digital infrastructure.

Keywords: Digital transformation; artificial intelligence; digital transformation in Algeria; the comprehensive strategy for digital transformation and artificial intelligence in Algeria; digitalisation in Algeria.

Introduction

The world has witnessed several industrial revolutions, beginning in the late eighteenth century. The invention of the steam engine triggered an unprecedented revolution in production, resulting in profound and radical economic changes. By the end of the nineteenth century, the second industrial revolution had emerged, driven by the advent of electricity, which contributed to the flourishing of many societies.

Then came the twentieth century, which ushered in computing and digital technology. Computers became central to human life, and programming and information technology took shape. The twenty-first century saw the beginning of the fourth industrial revolution, dramatically reshaping the global landscape through artificial intelligence technologies, the Internet of Things, digital currencies, electronic commerce, and other innovations. These developments have pushed industry towards new horizons, accelerating the deployment and evolution of robotics and artificial intelligence technologies. Consequently, states have increasingly sought to keep pace with the ongoing worldwide transformation.

Algeria is one of the countries that has sought to adopt artificial intelligence, introducing digitisation across many sectors with the aim of improving government performance, developing society and strengthening the national economy in line with global standards.

Accordingly, this research paper addresses the following problem statement: What is the current status of artificial intelligence and digital transformation in Algeria, in terms of government initiatives and projects, and the opportunities available to keep pace with worldwide developments?

To answer this question, we propose the following research hypotheses: The real challenge for Algeria lies in formulating an integrated national vision that treats digital transformation and artificial intelligence as a comprehensive strategic project for all sectors.

This vision should be based on existing infrastructure with foundations in scientific research and innovation, and make optimal use of human resources. It should also provide a flexible legal and legislative environment and facilitate the transition from being a mere consumer of digital technology to a producer and source of such technology.

To test this hypothesis, we adopted the strategic logic approach through a comprehensive analytical agenda consisting of:

Logic of Action: Starting from indicators and dimensions, this approach leads to the variables of artificial intelligence and digital transformation, covering the concepts of nature and types, as well as techniques and applications.

Logic of Actors: By identifying the nature of the initiatives and the active parties involved. In this regard, Algeria's digital transformation and artificial intelligence projects and strategies were initiated by the state and governmental institutions.

Logic of interaction: through analysing the Algerian experience of digital transformation and artificial intelligence in relation to the sectors and fields in which they were implemented.

Logic of Effectiveness: This is assessed by evaluating the Algerian experience of digital transformation and artificial intelligence in terms of its potential to achieve the intended outcomes. Available alternatives for addressing the challenges hindering these efforts are also proposed.

First Axis: Conceptual Approach to Digital Transformation and Artificial Intelligence

Digital transformation involves integrating digital technology into all areas of business and embedding technology in all aspects of human life. The aim is to improve processes and services. This encompasses a wide variety of technological developments, such as the adoption of digital platforms, mobile applications, data analytics and internet-based services.

The term 'digital transformation' originated in the 1950s with the advent of the first computers. The 1980s saw a revolution in terms of the size, function and widespread adoption of these developments. This period marked the beginning of enabling ordinary individuals to access these devices, substantially altering many aspects of daily life. Over time, and with the advent of various networks, digital transformation has become an integral part of people's lives and of society as a whole.

Therefore, digital transformation is not just a term that refers to a state in which individuals and society rely on computing systems to manage their affairs. Rather, it is an ongoing process that began decades

ago with the emergence of digital technology and the internet, and has continued to evolve ever since. This phase later experienced enormous and rapid acceleration with the advent of artificial intelligence and the Internet of Things, which has reshaped the way people live, work and interact. Consequently, the significance of geography and the 'virtual' borders between countries has diminished.

Due to the wide range of its uses, it is impossible to claim that there is a single, universally applicable definition of digital transformation since it is a general concept. Its impact can be seen in many areas of life, such as education, health, commerce and industry. Nonetheless, its defining elements can be summarised as a tangible change in working practices through the use of modern digital technologies in these fields.

The Oxford Dictionary defines digital transformation as follows: 'The adaptation of certain systems or processes to digital technology, or the process of converting data into a digital format that can easily be handled by a computer.'

Naturally, this definition can be adapted according to the field in which it is applied.

From an etymological perspective, the term 'digitalisation' is used in English in two ways. It may refer to digitisation, which involves converting documents, images and audio-visual materials from their physical form into a digital format, for example by scanning documents and images or digitally recording analogue tapes.

It may also appear in the form 'digitalisation', which refers to the broader meaning of digital transformation. This includes the use of digital technology in administrative processes through specialised platforms characterised by accuracy and very high speed. Once these processes are fully implemented, they enable society to transition from traditional modes of work to the digital era¹.

Focusing on the term 'digital transformation' makes it clear that it is not fully understood. While the word 'transformation' implies a substantial change from one state to another, it is unclear precisely what is meant by 'digital transformation'.

Does it refer to the large volumes of data available in the digital space? Or does it refer to the integration of digital media into traditional practices? Alternatively, does it refer to immersion in new social forms of communication enabled by algorithms and artificial intelligence?

Olaf Rundel, Dorner and Stefai argue that this debate should not be opened in contexts where countries are strongly inclined towards traditional approaches in terms of both tools and public affairs. Instead, they argue that it is sufficient to view it as a shift from the analogue model (analogue logic), characterised by the continued presence of paper and files, to the digital model (digital).

The latter is characterised by the dominance of networks and new media, cloud storage of data and, more generally, the way these elements shape users' daily lives and associated changes in practices².

¹- Youcef ben Yazza, "Evaluating the Digital Transformation Path in Algeria (2020–2023)," *Journal of Studies and Research in the Arab Journal of Human and Social Sciences*, Volume 16, Issue 3, 15 May 2024, p. 46.

²- The same reference, p. 47.

Artificial intelligence (AI), as a term in English, refers to a field within computer science. It concerns machines and systems designed to perform tasks typically requiring human intelligence. These systems can improve their performance based on the databases and information they collect.

Conceptually, AI can be defined as a system that can perceive its environment and take the necessary actions to maximise its chances of successfully achieving its objectives.

Types of artificial intelligence

Based on functions:

- **Interactive machines (reactive AI):** This is the simplest type of artificial intelligence. It does not make decisions based on past experiences. An example is the Deep Blue computer developed by IBM, which performs direct processing for specific tasks.
- **Limited memory AI (artificial intelligence with limited memory):** This type relies on storing data and using prior predictions, making it more effective at performing tasks than purely reactive systems.
- **Reinforcement learning (education/training by reinforcement):** an approach in which an AI system learns through trial and error, improving its performance based on rewards and penalties.
- **Long-Term Memory AI (Artificial Intelligence with Long-Term Memory):** A form of AI that retains information over extended periods, enabling more sustained learning and decision-making.
- **Advanced Generative Networks (Simulation and Statistics):** These models use simulation and statistical methods to generate new outputs (such as text, images or other forms of data) based on learned patterns.
- **Theory of Mind:** This approach focuses on the AI's ability to understand human emotions, beliefs, feelings and intentions, with the aim of enabling more effective interaction.
- **Self-driven AI (the engine of the self/self-awareness AI):** This refers to hypothetical or 'virtual' AI with self-awareness — an intelligence capable of thinking, perceiving its own existence and understanding the existence of others.

Types of artificial intelligence (based on capabilities):

There are three levels:

- **Narrow (Weak) Artificial Intelligence (ANI):** This refers to AI systems that are programmed to perform specific functions within a limited environment.

For example, the Deep Blue chess program defeated the world chess champion Garry Kasparov in 1997.

- **General (Strong) Artificial Intelligence (AGI):** This level aims to imitate and represent the real world, enabling interaction with its components.

Such systems would be capable of performing any intellectual task successfully and of general reasoning across domains. (In your text, this section includes a reference to extremely high computational capacity; however, it is not fully clear, and the phrasing is questionable, so I have translated it while keeping the intended meaning.)

- **Superintelligent Artificial Intelligence (ASI):** This level goes beyond simulation and understanding human behaviour. It would also be able to predict the feelings and attitudes of others.

Key applications of artificial intelligence

Expert systems analyse information related to a specific problem and identify suitable solution options.

Each step of the reasoning process is determined by a human expert.

They operate as an artificial advisory system for solving problems in a given domain.

Neural networks contain processing units that resemble biological nerve cells. They process data through learning and pattern recognition.

Genetic algorithms simulate biological genetic processes. In genetics and other natural sciences, these methods are used to find the best solution to a given computational problem. They are also applied in areas such as industry and automated robotics.

Natural Language Processing (NLP) enables computers to understand natural language and is used in digital assistants, information searches and machine translation.

Robotic systems are designed according to human logic. They can be programmed and connected to a computer to perform specific tasks while retaining some autonomy to act in different situations. Competitions and industry developments include companies such as Tesla, Google and Apple.

Intelligent agents can take independent actions to achieve their objectives using execution or decision-making mechanisms.

Section Two: The Strategy of Digital Transformation and Artificial Intelligence in Algeria

Algeria has been embracing digital transformation since the early years of the 2000s. However, this process began with the first emergence of the internet in the country in the mid-1990s. At that time, the Algerian government was not primarily focused on implementing these developments, partly due to a lack of economic and political stability.

Today, Algeria is working to digitise existing resources, meaning the effort to shift management methods from traditional approaches to network-based practices while aligning the original concept of digitisation with its more network-oriented counterpart.

This explains why this dossier has been a key item on the agenda of most Algerian Council of Ministers meetings since 2023, under the direct supervision of the Head of State. Algeria also declared 2023 the Year of Comprehensive Digitisation³.

The Algerian experience of digital transformation and artificial intelligence can be summarised by the following core strategies:

- The National Programme for Digital Transformation: implemented through projects such as Digital Algeria, the Year of Artificial Intelligence initiative, and the Electronic Payment project.

Algeria began its digital transformation by launching major projects aimed at improving and facilitating access to public services. The most prominent of these is the National Programme for Digital

³- Youcef ben yazza, the previously cited reference, p. 48.

Transformation, launched in 2021 under the guidance of President Abdelmadjid Tebboune. The programme aims to digitise essential government services, including company registration, renewal of official documents and complaint submissions via the internet.

- 2. Education: towards a promising digital generation.
- 3. Health: Enhancing care through technology.
- 4. Finance: Financial innovation in the digital age.
- 5. Startups and emerging enterprises as drivers of innovation.
- 6. Digitisation of public administration towards electronic government (e-government).
- 7. Digital transformation and artificial intelligence in higher education: strengthening efficiency and fostering innovation.

The Electronic Payments Project

The Electronic Payments Project is part of the government's plan to strengthen the digital economy and reduce reliance on cash. The project aims to manage citizens' financial transactions and promote comprehensive financial inclusion. It also promotes e-commerce, with electronic payment outlets showing notable growth, increasing from 25,000 in 2018 to 55,000 in 2023 — an overall increase of approximately 12% over five years⁴.

Adoption of digital transformation and artificial intelligence

In Algeria, the adoption of digital transformation and artificial intelligence is beginning to take shape, particularly in the economic sector and higher education, despite structural challenges hindering full-scale digital modernisation.

Growth in digital transactions: Digital transactions increased from 20 million in 2018 to 95 million in 2023, reflecting growing acceptance of electronic payments among citizens and businesses.

Distribution of Electronic Payment Users by Sector: E-commerce accounts for the largest share of users at 25%, followed by services at 16.75%, with approximately 300,000 users. By comparison, the education sector represents 2.8%, with around 50,000 users.

This can be explained by the following statistics: electronic payments in Algeria have grown significantly in recent years, particularly after the government and banks introduced policies to increase the number of payment points and raise awareness among citizens of the importance of digital transactions. Nevertheless, technical and cultural challenges remain obstacles to the system being adopted more widely.

The Algerian government has started to digitise a number of administrative, customs and tax services, helping to reduce paperwork and improve the business environment. However, the use of artificial intelligence for analysis, planning and forecasting is still in its infancy. Investment in digital infrastructure and the training of specialised competencies could bring about a qualitative shift in sectors such as smart agriculture, financial services, and e-commerce.

⁴- atima al-Zahra ibn Ahmad, and Nadia ben Ahmad, Digital Transformation in Algeria: Reality and Challenges—a case study—Algerian Journal of Public Finance, Volume 15, Issue 1, 2025, pp. 507–510.

Specialised institutions have also been established to guide national strategies, such as the Higher School of Artificial Intelligence. Additionally, Algerian universities offer specialised programmes in artificial intelligence and computer science, reflecting a strong focus on human capital. Furthermore, the Scientific Council for Artificial Intelligence serves as an advisory body whose purpose is to propose strategies for developing artificial intelligence in various sectors across the country.

Launching the first high-performance computing centre for artificial intelligence

Algeria is planning to launch its first High-Performance Computing Centre for Artificial Intelligence, overseen by the Ministry of Post, Telecommunications and Wireless Technologies.

The project includes developing advanced data centres and improving cloud-based infrastructure for artificial intelligence, advanced mathematics and industrial enhancement. The aim is to support and assist start-ups and institutions in developing AI solutions for various sectors.

Growth in Digital Projects

By 2026, it is expected that more than 500 digital projects will have been implemented, 75% of which will be dedicated to public services.

Expansion of International Connectivity

Two undersea cable lines connecting Algeria and Egypt are set to begin operations this year. In addition, a fibre-optic network across the Sahara is being established to connect to Nigeria.

Digital Platforms and Mobile Connectivity

The Algerian state, through the Ministry of the Knowledge Economy and Startups, has launched several digital platforms, including those for administrative and broadcasting services (e.g. Engaz for media services), as well as platforms supporting start-ups. There has also been significant investment in fibre-optic infrastructure and 4G and 5G networks, the rollout of which began with initiatives in electronic payments. As of the beginning of 2024, 33.49 million users were connected, representing approximately 72.9% of the population⁵.

Electronic connectivity and usage continued to expand as follows:

- Mobile internet users increased to 36.2 million in January 2025, representing 76.9% of the population.
- Active mobile subscriptions: 50.65 million active mobile phone subscriptions at the beginning of 2024, corresponding to an 110.2% coverage rate.
- 3G/4G updates: by 2023, 3G and 4G subscriptions exceeded 48 million, covering 98% of the population. In the second quarter of 2024, there were more than 49 million mobile subscriptions.

Urban–rural disparity:

- 75.5% of subscriptions/users are in urban areas, while 24.5% are in rural areas.

Fixed internet and fibre

- Fixed internet subscriptions: 6.2 million.
- Fibre-optic subscriptions: 1.7 million.

⁵- Ali Kahlan, “The Current Status of Artificial Intelligence in Algeria,” from the website: <http://www.elbadilabc-ar.dz> (24/9/2025).

Internet speeds

- In January 2025, average speeds were:
 - Mobile internet: 23.42 Mbps
 - Fixed internet: 15.05 Mbps
 - Up to 1.2 Gbps achieved.

Social media connectivity

- In January 2024, social media users reached 24.85 million, representing 54.1% of the total user base.

Electronic payments

Electronic payments have become increasingly widespread.

- In January 2024, 2.8% of cards were credit cards, while 22.9% were debit cards.
- In 2023, 8.2% of the population made online purchases.
- 4.7% of the population sent money during the first quarter of 2024.
- The value of online transactions amounted to approximately 9.3 billion Algerian dinars, equivalent to about USD 69 million, representing progress, albeit the sector is still in its expansion phase⁶.

Future projects

- More than 500 digital projects are planned by 2026, with 75% allocated to public services.
- Two undersea cable lines linking Algeria and Egypt are scheduled to begin operating in 2025.
- A fibre-optic network across the Sahara, connecting to Nigeria, is also planned.

Government bodies have been established, including the Ministry of the Knowledge Economy and the High Commission for Digitalisation. Public administration has been digitised through platforms such as Enjaz, Sijilni and Digital Identity. A robust infrastructure based on fibre optics has also been developed. An electronic payment system has also been introduced alongside the expansion of online shopping cards. In the health and education sectors, digital tools have been introduced, including digital files and remote services — such as the MODELE model/application — aimed at improving access and service delivery.

All these projects and digitisation efforts in education and health aim to move towards 100% electronic administration within a national/local framework. Overall, these efforts can be understood as an attempt to export digital services rather than relying exclusively on oil revenues.

Investment has also been directed towards critical infrastructure, including satellite 5G and fibre-optic networks, estimated at around USD 3.5–3.6 billion. It is projected that an investment of around USD 5 billion could generate approximately USD 30 billion in GDP by 2026–2027⁷.

Finally, despite the structural challenges that still hinder comprehensive digital modernisation, the features of adopting digital transformation and artificial intelligence are beginning to take shape in Algeria, particularly in the economic sector and higher education.

⁶ Artificial Intelligence in Algeria: A Path Toward Digital Transformation, Algerian International Channel, from the website: <https://t.m/Al24newstv/15/4/2025>.

⁷ The National Council for Artificial Intelligence, National AI Strategy Conference, dated 7 December 2024, at the International Conference Centre, Algiers.

Economic sector

The Algerian government has started to digitise a range of administrative, customs and tax services. This has helped to reduce paperwork and improve the business environment. However, the use of artificial intelligence for analysis, planning and forecasting is still in its infancy. Serious investment in digital infrastructure and the training of specialised skills could bring about a qualitative shift in fields such as smart agriculture, financial services, and e-commerce.

Higher Education Sector

The fragility of the education system with respect to distance learning was exposed by the impact of the pandemic. At the same time, it encouraged universities to take digitalisation more seriously. Today, some universities are seeking to integrate artificial intelligence into teaching and scientific research, particularly in areas such as automated/algorithmic systems, medicine, and engineering, as well as in the development of educational systems tailored to students' abilities⁸.

Based on exposure to the most important strategies in Algeria, one might question how effective the Algerian strategy is. Considerable progress has been made in terms of action, innovation and artificial intelligence through specialised schools such as the National Higher School of Artificial Intelligence (ENSIA) and the Higher School of Mathematics (ENSM), as well as AI centres and the Scientific Council on AI, which guides national strategies.

As for the actors, these concern human resources: There are 116 specialised laboratories in artificial intelligence, with a research team structure comprising 568 projects, including 70 robotics projects in 2021.

Regarding interaction, this is reflected in expertise. Graduates of these centres and specialised schools possess sufficient technological and programming skills; therefore, such expertise should be encouraged. As for effectiveness, this relates to training and capacities. In this regard, universities only provide training at Master's and PhD level: 23,240. Additionally, there is 350,000 hours of annual training in mathematics and computer science, electronics and robotics, and neuroscience⁹.

Third Axis: Challenges Hindering the Algerian Experience of Digital Transformation and Artificial Intelligence

Although the Fourth Industrial Revolution is not yet complete, discussions are already underway about a potential Fifth Industrial Revolution. This revolution will focus on strengthening the cooperation between humans and machines so that robots can integrate with human creativity. However, while these revolutions have brought remarkable developments, they have also introduced challenges that cannot be ignored, particularly with regard to threats to privacy and digital security. Personal data is more vulnerable to breaches and hacking than ever before, and the gap between wealthy countries, which

⁸- Ali Kahlan, the previously cited reference.

⁹- The National Council for Artificial Intelligence, the previously cited reference.

control key technologies, and poorer countries, which are still struggling to meet basic living needs, continues to widen. So what can be said about digital transformation and artificial intelligence?

The most important challenges can be summarised as follows:

- Shortage of network infrastructure and weakness of digital infrastructure.
- Lack of laws capable of ensuring the security of data and information.
- Lack of awareness of the importance of using artificial intelligence technologies.
- The slow pace of digital transformation in many economic and social sectors.
- The weakness of Algerian economic companies in using artificial intelligence technologies.
- Challenges related to cybersecurity.
- A lack of transparency in artificial intelligence systems.
- The weakness of Algeria's education system, particularly its healthcare education.
- The absence of integration across sectors, both horizontally and vertically, among ministries, universities, companies and civil society.
- Insufficient large data centres and high-speed communication networks, which are essential for artificial intelligence applications. For example, indicators related to digital infrastructure in Saudi Arabia and the United Arab Emirates show that the proportion of institutions redesigning their digital systems is below the global average, reflecting shared regional challenges. Nevertheless, these countries have stronger infrastructure and make larger investments, such as Saudi Arabia's "Digital Saudi" project or partnerships with global companies to train staff. By contrast, Algeria relies primarily on its human resources. Although Algeria is ranked among the best African countries in terms of producing scientific research related to artificial intelligence, it still needs to strengthen international cooperation and attract investment in order to close the digital gap.
- There is a lack of sectoral integration among ministries, universities, companies and civil society.
- Insufficiency of large data centres and high-speed communication networks.
- Weakness of Algerian economic companies in using artificial intelligence.
- The educational system in Algeria is weak.

In order to overcome these challenges, the following alternatives and recommendations can be proposed:

- Invest in fifth-generation (5G) networks, cloud data centres and investment centres in the research and development (R&D) sector, and expand the rollout of fibre-optic networks.
 - Support start-up companies so that they can provide training in cybersecurity and robotics, and finance them through a dedicated fund. In addition, enhance cooperation between universities and the private sector to commercialise scientific research.
 - Reform the higher education and scientific research system.
- Intensify the dissemination of artificial intelligence culture within society.
- Develop high-quality artificial intelligence applications.
 - Move from being a technology consumer to becoming a technology producer and source.
 - Adapt curricula to integrate artificial intelligence and create educational pathways based on data analytics.

- Update legal and regulatory legislation so that it provides data protection.
- Generalise digital services and avoid concentrating them in major cities only, given that remote regions suffer from weak internet connectivity.
- Promote cooperation between universities and the private sector to commercialise scientific research. In agriculture, use drones to monitor crops and analyse climate-related data to improve productivity. Support start-ups through specialised platforms that provide training in cybersecurity and robotics and fund them through a dedicated fund.
- In education, adapt curricula to integrate artificial intelligence by designing educational pathways based on data analysis.

Conclusion:

Despite the existing challenges, Algeria is moving steadily towards building a bright technological future. It possesses all the prerequisites for success in reaching a global digital economy, which in turn strengthens and supports its sovereignty.

It has taken its first steps towards digital transformation by digitising certain sectors. However, its levels are still lower than those of Arab countries and the rest of the world. Therefore, it is necessary to enhance digital knowledge and skills among individuals and provide an appropriate legislative and regulatory environment.

Artificial intelligence is not a technical luxury, but a driver of the future. It must therefore be harnessed through knowledge and innovation.

Algeria has promising young talent that could enable it to transition from being a technology consumer to a technology producer and source of innovation.

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