Government Policies for Digital Transformation as a Catalyst for Artificial Intelligence Adoption and Their Impact on the Digital Skills Gap, Innovation, and Startups: An Analytical Study of the Objectives of Algeria's National Digital Transformation Strategy 2025-2030

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Received : 26/11/2025 Acceptation: 19/12/2025 Édition: 27/12/2025

Abstract: The study aims to evaluate Algeria's national digital transformation strategy (2025-2030) by examining its impact on the adoption of artificial intelligence, digital skills, innovation, and the growth of start-ups, with a focus on shortcomings and challenges. The study confirmed that the strategy relies on updating curricula and training programmes to enhance digital skills, but it may overlook extensive retraining programmes for the current workforce. It also contributes to stimulating innovation by providing infrastructure and digitising administration, but its actual contribution is limited due to its neglect of fundamental aspects of the innovation environment, such as the regulatory framework and financing. In conclusion, the study found that the strategy lacks realism and specific implementation plans, requiring the development of realistic plans, the strengthening of partnerships, the setting of priorities, and the preparation of policies for digital inclusion to ensure that its objectives are achieved.

Keywords (5 words) : Digital Transformation; Artificial Intelligence; Innovation; National Strategies; Startups.
JEL Classification Codes : O33 ; O31 ; H11 ; M13; J24

Introduction:

Global digital transformations have radically shifted the development landscape, rendering government digital transformation policies a strategic necessity. These policies are no longer merely tools for sustainable economic and social development; they have become fundamental pillars for adopting artificial intelligence, stimulating innovation, and supporting start-ups. However, nations face a significant challenge: a widening gap between the supply and demand for advanced digital skills, particularly those required for artificial intelligence technologies. Failure to address this gap threatens a country's ability to integrate fully and effectively into the global digital economy. In this context, Algeria responds to these challenges through its National Digital Transformation Strategy 2025-2030. This strategy aims to address the digital skills shortage via measures designed to create an innovation-conducive environment. Furthermore, it seeks to strengthen the competencies required for comprehensive digital transformation.

The Main Issue:

Based on the foregoing, the primary research problem is encapsulated in the following question: What is the role of Algeria's National Digital Transformation Strategy (2025-2030) in promoting the adoption of artificial intelligence? Furthermore, how does achieving its objectives contribute to bridging the digital skills gap, fostering innovation, and supporting start-ups?

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Sub-questions:

1. What role does Algeria's National Digital Transformation Strategy (2025-2030) play in supporting the adoption of artificial intelligence?
2. What are the main mechanisms and programs included in the strategy to enhance individuals' digital skills?
3. How do these objectives, if realized, contribute to stimulating an innovation ecosystem and supporting start-up growth in Algeria?
4. What are the shortcomings of Algeria's national digital transformation strategy?

Hypotheses:

First Hypothesis: Algeria's national digital transformation strategy (2025-2030) acts as a key driver and powerful catalyst for the integration and deployment of artificial intelligence technologies. Through its five interrelated pillars—infrastructure, human resources, governance, economy, and society—the strategy aims to lay the necessary foundations of data and expertise. Additionally, it seeks to provide essential legal frameworks and funding. This thematic integration ensures an ideal environment for the expansion and sustainable development of AI solutions.

Second Hypothesis: Algeria's national digital transformation strategy relies primarily on updating educational curricula and vocational training programs as the main mechanism for enhancing digital skills. However, it may overlook large-scale retraining programs for the current workforce in traditional sectors.

Third Hypothesis: Algeria's national digital transformation strategy contributes to stimulating innovation and supporting start-ups by developing digital human capital. However, its actual contribution may be significantly limited by a failure to address broader aspects of the innovation ecosystem, particularly regulatory frameworks, financing, and market access.

Fourth Hypothesis: The national digital transformation strategy in Algeria exhibits shortcomings at several levels. These include a lack of realism in the set objectives, the absence of specific implementation plans, poor prioritization, and the neglect of supporting policies for effective digital inclusion. Collectively, these factors suggest that despite its stated ambition, the strategy lacks the fundamental elements required to ensure its translation into real achievements.

Significance of the Study:

This study derives its importance from the Algerian economy's growing need for advanced digital skills to maintain regional and international competitiveness. It provides practical insights for decision-makers by identifying the strategy's strengths and weaknesses. Furthermore, it offers actionable recommendations to enhance cross-sector coordination and support the entrepreneurial ecosystem.

Study Objectives:

This study provides a comprehensive critical analysis of Algeria's National Digital Transformation Strategy (2025-2030). It assesses how the strategy’s objectives contribute to bridging the digital skills gap, promoting innovation, and supporting start-up growth. Specifically, the research analyzes the strategy's mechanisms and programs to evaluate their effectiveness in stimulating an innovation-friendly environment.

1. Research methodology

The scope of this study is restricted to analyzing and evaluating the objectives of the 2025-2030 strategy, with a specific focus on the digital skills gap, innovation, and start-up growth. It does not address purely technical aspects of digital transformation or government efforts prior to this period.

2. Algeria's National Digital Transformation Strategy 2025-2030 as a Catalyst for the Adoption of Artificial Intelligence

2.1 Introduction to Algeria's National Digital Transformation Strategy 2025-2030

The Algerian National Digital Transformation Strategy represents a comprehensive and clearly defined roadmap. Through this framework, Algeria seeks to guide and coordinate digitization efforts across various sectors, aiming to achieve a holistic and sustainable digital transformation by 2030. The strategy is founded on several pivotal objectives, including modernizing digital infrastructure, developing human capital, improving digital governance, advancing the digital economy, and promoting digital inclusion within society. These objectives align with a national vision consistent with the state's core values and fundamental principles of social justice and sustainable development.

The strategy focuses on five primary pillars: Information and Communication Technology (ICT) infrastructure, human capital and training, digital governance, the digital economy, and the digital society. Its implementation relies on robust legal and regulatory frameworks, placing particular emphasis on digital security and data protection. Ultimately, these measures aim to cultivate an environment conducive to innovation, thereby contributing to the desired economic and social development.

The ultimate goal of this strategy is to position Algeria as a continental leader in the field of digital transformation. This initiative seeks to provide high-quality connectivity for all, deliver fully digital public services, and build a national digital economy capable of generating wealth, while simultaneously preserving the social dimension. Achieving these milestones ensures that the benefits of digital technology are widely shared, fostering inclusive and equitable economic and social development.

2.2 The Role of Strategy as a Catalyst for the Adoption of Artificial Intelligence

The analysis of methodological frameworks enabling government digital transformation strategies to catalyze AI adoption relies on three integrative models. The first is the "Social-Technical Systems Theory." This model emphasizes the need for mutual adaptation between technical components—such as cloud computing—and organizational structures to ensure system readiness and sustainability (Bharadwaj et al., 2013, p. 475). The second is the "Institutional Theory," which highlights the role of digital policies in promoting legitimacy and setting regulatory standards for data protection and cybersecurity. Consequently, this contributes to risk reduction and increased investor confidence (Kitchin, 2014, p. 83; Yeung, 2017, p. 120). Finally, the "Technology-Organization-Environment (TOE) Framework" explains technology adoption by assessing technological, organizational, and environmental factors (Tornatzky & Fleischer, 1990, p. 22). Collectively, this methodological framework outlines the path of government interventions: starting from policy formulation, through infrastructure and skills development, to establishing public-private-academic partnerships. The ultimate aim is to build an integrated ecosystem that achieves efficiency and innovation in AI applications.

The objectives of the strategy's first pillar serve as a key driver for AI adoption, as achieving each represents a milestone in building a supportive digital environment. Ensuring "100% quality connectivity for all" provides vast amounts of data, which serves as the fuel for training AI models and improving their accuracy in prediction and decision-making (Zwitter & Gstrein, 2020, p. 249). Furthermore, achieving "100% connectivity for public bodies and institutions" facilitates digital integration and knowledge exchange between ministries, accelerating the deployment of integrated AI solutions (Janssen, Charalabidis, & Zuiderwijk, 2012, p. 262). Additionally, "increasing returns on internet investments" generates financial resources that can be reinvested in AI and digital

innovation projects, thereby enhancing the capacity to develop advanced smart services (Bughin et al., 2017, p. 48).

Moreover, establishing "more than five national data centers complying with international standards" ensures a secure, reliable environment for internal big data processing. This infrastructure is a prerequisite for hosting AI platforms and maintaining data sovereignty (Cloud Security Alliance, 2017, p. 36). Simultaneously, providing competitive service offerings for "exporting cloud computing services" enables scalable environments responsive to AI requirements. This opens new markets and encourages local companies to innovate (Sultan, 2014, p. 182). Finally, the "generalization of the national domain (.dz)" promotes digital identity standardization. It supports the traceability and credibility of data sources within AI models, increasing confidence in Algerian data for research and development (World Bank, 2020, p. 45).

The second axis, focused on human competencies, plays a pivotal role in promoting the development and adoption of artificial intelligence. The availability of 500,000 active specialists in information and communication technologies ensures a critical mass of expertise in areas such as data science and machine learning. Such expertise is essential for the sustainability of AI model development and maintenance, as a skilled workforce is a prerequisite for innovating smart solutions and adapting them to local needs (Zwitter & Gstrein, 2020, p. 249). Furthermore, the target of reducing the brain drain by 40% contributes to retaining specialised human capital and enhancing knowledge transfer within the country. This ensures the continuity of AI research and application projects and reduces skill gaps that may hinder the growth of this sector (OECD, 2025, p. 4; OECD, 2021, p. 14).

The third pillar, "digital governance," presents several strategic initiatives fundamental to the adoption of artificial intelligence. Achieving 100% digitisation of the internal management of the public sector yields standardised and structured data. This facilitates the automation of processes and the analysis of administrative performance using artificial intelligence technologies, by providing high-quality inputs for intelligent models (Janssen, Charalabidis, & Zuiderwijk, 2012, pp. 260–261). Furthermore, the complete digitisation of administrative procedures for citizens and organisations generates vast amounts of interaction and usage data. This enables the training of AI algorithms to improve the citizen experience and tailor government services to their needs (Zuiderwijk, Janssen, & Dwivedi, 2015, p. 330). Additionally, enhancing the public sector's appeal to digital talent contributes to reducing talent migration by 20% and attracting data science and artificial intelligence specialists. This influx of talent is critical to supporting the sustainability of smart projects at the local level (McKinsey Global Institute, 2019, pp. 14–15).

In the areas of economy and innovation, the objectives related to the fourth pillar, "digital economy," contribute to establishing a digital environment conducive to the growth of artificial intelligence. By "eliminating cash payments for transactions exceeding 500,000 dinars," a vast amount of accurate and up-to-date financial data on consumer and business behaviour is made available. This effectively supports artificial intelligence models in credit risk analysis and fraud detection (Siddquee, 2025, p. 395). Moreover, the use of digital systems in 80% of small and medium-sized enterprises expands the available operational database. This enables artificial intelligence to provide effective recommendations for improving operations and supply chains (Traxtech, 2025, Key Takeaways).

Additionally, the creation of 100,000 start-ups active in the field of digitalisation promotes diversity and innovation in smart solutions. This entrepreneurial ecosystem provides a vital gateway for the development and testing of artificial intelligence models at the local level (World Economic Forum, 2025, p. 8). Achieving 20% of gross domestic product from digitalisation translates into an

increase in technical investments and research and development budgets, which enhances the resources available for artificial intelligence projects (Bughin et al., 2017, p. 15).

In addition, achieving $500 million in exports of information and communication technology products and services opens up new markets for collecting international usage data. This enriches the data sets available for training artificial intelligence models on diverse languages and contexts, thereby increasing their global scalability (Tornatzky & Fleischer, 1990, p. 27). Finally, "ensuring the emergence of 50 international digital pioneers" promotes the presence of leading models in the application of artificial intelligence. These models contribute their expertise to building local capacities and guiding projects towards adopting global best practices (Yeung, 2017, p. 122).

Furthermore, **"attracting $1 billion in foreign direct investment"** provides significant funding for the adoption of advanced artificial intelligence technologies, accelerating the transfer of knowledge and modern technologies to the local market (Bharadwaj et al., 2013, p. 482). Finally, the presence of **"10 major international players active in the digital field within Algeria"** contributes to the integration of expertise and technical knowledge. It provides access to advanced platforms in the field of artificial intelligence, thereby raising the level of technical maturity in the country (Kitchin, 2014, p. 88).

The objectives of the strategy under the fifth pillar also serve as a basis for establishing strong societal foundations that support the spread and development of artificial intelligence. Ensuring equal and comprehensive access to digital technologies and services expands the scope of databases to include all segments of society. This inclusivity helps reduce bias in models and enhances their accuracy and fairness in predictions and services (Mehrabi, Morstatter, Saxena, Lerman, & Galstyan, 2021, pp. 8–9).

In addition, increasing population participation in public life through the digital space generates large amounts of behavioural and public opinion data. These datasets can be used to train AI models to understand social trends, analyse sentiments, and formulate evidence-based policies (Stieglitz, Brockmann, & Dang-Xuan, 2018, pp. 784–786). Finally, promoting national digital content aimed at all segments of society provides customised training data that reflects local culture and language. This improves the performance of AI applications—such as natural language processing and computer vision—within the local context (Joshi, Trivedi, & Choudhary, 2020, pp. 15–16).

Based on the foregoing analysis, it is evident that national digital transformation strategies—upon achieving their stated goals—will form the cornerstone for promoting AI adoption across various fields. These strategies foster an integrated environment that secures the necessary success factors. By prioritizing infrastructure that provides fast communication networks and secure data centres, they enable the collection of big data required for algorithm training. Simultaneously, they focus on developing human competencies and qualifying specialists in data science and machine learning, while striving to curb the brain drain to ensure a robust local workforce.

Furthermore, these strategies establish robust governance and regulatory frameworks to guarantee data quality and digital identity reliability. This enhances trust in smart systems and supports objective decision-making. Economically, these strategies stimulate innovation and attract investment to support start-ups, thereby accelerating the development and testing of smart solutions. Finally, they contribute to building a social and cultural foundation that supports artificial intelligence. By providing diverse digital content and ensuring universal access to technology, they help guarantee algorithm fairness and accuracy, ultimately ensuring a positive societal impact.

3. Analysis of the Mechanisms and Initiatives of the Strategy to Promote Digital Skills

The Algerian National Digital Transformation Strategy, through its integrated objectives, represents a methodological framework for developing digital skills from multiple perspectives. The strategic axes do not operate in isolation; rather, they intersect to form a cohesive structure that contributes to building an advanced digital society and economy. Consequently, these pillars constitute an integrated system wherein digital skills serve as an essential foundation for achieving overall strategic objectives.

3.1 Infrastructure as a Key Driver

The objectives of the first pillar, focused on "basic infrastructure for information and communication technologies," extend beyond merely providing a physical foundation. Instead, they constitute a prerequisite that renders the process of enhancing digital skills both possible and effective. International reports indicate that "digital infrastructure is the cornerstone of digital skills development, without which it is not possible to achieve inclusiveness or develop the technological capabilities of society" (OECD, 2020, p. 21).

Providing 100% internet access represents a fundamental step in reducing the digital divide. This ensures that individuals and institutions have equal access to educational content, training platforms, and the digital tools necessary to acquire and apply skills, as confirmed by the International Telecommunication Union (ITU, 2022, p. 47).

In this regard, the pursuit of "national data centres" and the ambition to export "cloud computing services" necessitate high competencies in areas such as data management, cloud computing, and information security. This transition from being merely a technology consumer to a producer and source of digital services serves as a fundamental incentive for training and qualifying human resources. This ensures the workforce is capable of meeting competitive market requirements, thereby directly linking infrastructure investments to human capital development (Oughton et al., 2023, p. 7).

3.2 Human Capital and Retention

In a related context, the second pillar, entitled "Human capital and training," forms the cornerstone of the effort to enhance digital skills. It achieves this through a direct focus on developing competencies and providing an environment conducive to retaining them. The goal of providing 500,000 specialists in the field of information and communication technologies is pursued by encouraging "continuous training" programmes. These are considered the primary mechanism for developing digital skills both quantitatively and qualitatively. This endeavour contributes to preparing a workforce capable of "creating and managing innovative digital solutions," thereby enhancing the ability of the public and private sectors to keep pace with the digital transformation (Oughton et al., 2023, p. 5). Furthermore, "education and training policies that focus on modern digital skills increase the competitiveness of the public and private sectors in the face of the challenges of digital transformation" (World Bank, 2024, Human capital section).

Additionally, the pillar attempts to address the issue of "brain drain," a major challenge facing many countries, with the specific goal of reducing it by 40%. Achieving this target will contribute to building a sustainable and competitive digital ecosystem. The presence of specialised talent at the national level motivates the younger generation to learn digital skills through the availability of leaders and mentors who can share their expertise. This provides greater incentive to invest in digital skills, as individuals see promising job opportunities and clear career paths within the country (INCLUDE Platform, 2023, pp. 10–12; Bhorat et al., 2023, p. 13).

In the same context, the objectives of the third pillar, which focuses on "digital governance,"

are closely linked to the promotion of digital skills. They serve as a key driver in creating the right environment for development and investment. This is evident given that "the transition to digital governance and the digitisation of public administration requires the creation of a strong environment for the development of digital skills, not only for technical specialists but for all government employees, as the comprehensive digitisation of public services is a multiplier for the demand for digital skills at all levels" (OECD, 2021, p. 16).

The objective of "increasing the attractiveness of the public sector to digital skills" recognises the importance of human capital in the success of digitisation projects. "The existence of clear career opportunities and digital career paths within the public sector supports a culture of appreciation and empowerment, motivating individuals to develop their digital skills in response to new opportunities announced nationally" (OECD, 2021, p. 17). This contributes to "reducing brain drain" and establishes a culture of appreciation for digital skills, motivating individuals to acquire and develop them to take advantage of locally available job opportunities.

More broadly, objectives such as "establishing principles of multi-sector collaboration" and "data sharing" require advanced skills in cybersecurity and systems engineering. This encourages the development of specific skills capable of bringing about a real shift in the management of state and society affairs. "The success of multi-sector cooperation and data sharing between government and private institutions requires cadres with advanced skills in cybersecurity, data management and systems engineering, creating strong incentives to invest in sustainable qualitative training programmes in these vital areas" (World Bank, 2024, Data & Cybersecurity section).

3.3 The Digital Economy as an Economic Goal

The objectives of the fourth pillar, "Digital Economy," represent the main driver linking the strategy to economic reality, as these objectives create a tangible market for jobs and opportunities that rely heavily on digital skills. On one hand, the reduction in cash transactions and the increased use of digital systems in institutions create an urgent need for basic digital skills on a large scale within the private sector (OECD, 2020, p. 27). On the other hand, the ambitious goals of creating 100,000 start-ups and achieving 20% of gross domestic product from the digital sector directly link economic growth to the development of digital skills (Oughton et al., 2023, p. 26).

Furthermore, the goals of "attracting foreign direct investment" and "attracting major international players" to Algeria demonstrate that the strategy's architects are well aware that digital skills form the foundation for attracting foreign capital. Indeed, "a dynamic business environment, supported by national digital skills, attracts foreign capital and contributes to multiplying opportunities for continuous learning and innovation in the local market" (OECD, 2020, p. 118).

Reports from the United Nations Conference on Trade and Development (UNCTAD) also indicate that "the availability of national digital skills and material and moral incentives are among the most important factors attracting international companies to invest in developing markets, as a qualified workforce enables companies to effectively integrate into global value chains and enhance local competitiveness" (UNCTAD, 2023, p. 64). In turn, the entry of these companies into the local market "contributes positively to knowledge transfer and skills development through practical training and strategic partnerships with universities and local actors" (UNCTAD, 2023, p. 66). This necessarily leads to the enhancement of skills through knowledge transfer and training opportunities, fostering a competitive environment that stimulates continuous development.

3.4 The Digital Society as an Active Player

In this regard, the objectives of the fifth pillar, "Digital Society," are inseparable from the process of enhancing digital skills. Rather, they reflect the outcomes of this process while simultaneously constituting a societal incentive to expand and generalize its scope. "Objective 23"

aims to ensure "equitable and inclusive access to digital technologies and services". This entails raising the level of digital inclusion and motivating individuals to acquire the basic skills necessary to engage with technology in their daily lives (OECD, 2023, pp. 19–20).

Goal 24, which focuses on "increasing people's participation in public life through the digital space," adds a new dimension to digital skills. It extends them beyond technical and economic aspects to the civic domain, as participation in "participatory democracy" and online decision-making requires citizens to possess the skills necessary to access and evaluate information (UNDP, 2022, pp. 14–15). Consequently, this encourages the development of "digital awareness" and "online communication" skills. Similarly, "promoting national digital content" serves as a powerful incentive for developing creative digital skills in areas such as graphic design and video production (ITU, 2017, p. 18). Over time, investment in digital production skills becomes a central element of career growth and entrepreneurship among young people (ITU, 2017, p. 19).

3.5 Strategic Foundations as an Imperative

In conclusion, the role of the strategic foundations of digital transformation, represented by the "legal and regulatory framework" and "information systems security," cannot be overlooked. These foundations constitute the imperative environment that necessitates and stimulates the acquisition of specialised and qualitative skills.

The legal framework, which aims to establish "comprehensive legislation regulating the field of digitisation," requires competencies capable of linking an understanding of technology and its operational requirements with the drafting of regulating legal texts. This "contributes to creating a secure and reliable regulatory environment and creates a growing demand for specialists who combine technical knowledge with an understanding of the legal and regulatory developments associated with technology" (OECD, 2020, p. 138).

Furthermore, "the development of digital legislation requires specialised expertise capable of linking technical aspects (data security, governance, privacy) with the drafting of legal texts that ensure enforceability and accountability" (ITU, 2017, p. 21). Consequently, this results in a demand for a new type of expert with cross-cutting skills combining digital law, data security and e-governance (UNCTAD, 2021, p. 113).

The focus on "information system security" as a prerequisite for the success of the strategy reinforces the need for advanced skills in the field of "cybersecurity." It renders network and application security experts an indispensable element in all stages of digital transformation. Indeed, "The success of national digital transformation strategies depends fundamentally on the integration of information system security as a central element, highlighting the growing need for cybersecurity experts capable of protecting networks and applications at all stages of digital system development" (ITU, 2022, p. 74).

4. The Strategy's Contribution to Stimulating an Environment of Innovation and Supporting Start-ups

Stimulating innovation and supporting start-ups rely on a set of key pillars that form an integrated ecosystem for growth and prosperity. Therefore, through its defined objectives, the strategy seeks to make a substantial contribution to establishing an environment conducive to innovation and start-up development. These objectives provide a solid foundation enabling these enterprises to thrive. The impact of these objectives on stimulating innovation and supporting start-ups can be summarised as follows:

4.1 Providing the Basic Environment for Innovation

The goals of "ensuring quality connectivity for all" and "connecting public bodies and institutions" constitute the cornerstones without which innovation cannot thrive. Providing universal access to high-quality internet offers innovators and start-ups the platform they need to develop and test their products and services, while reaching a wide customer base. In this regard, the Organisation for Economic Co-operation and Development (OECD) explains that "Achieving high-quality connectivity for all groups and institutions is a prerequisite for any digital environment that supports innovation. Digital infrastructure enables innovators and start-ups to test new products and services and access markets effectively" (OECD, 2020, p. 79).

In addition, "the comprehensive connectivity of public bodies and institutions supports the rapid growth of innovation by opening up networks of cooperation and exchange of digital services between the private and public sectors" (OECD, 2020, p. 81).

Regarding "the widespread use of the national domain (.dz)," this initiative strengthens the digital identity of start-ups and contributes to building trust with local customers, thereby supporting their growth in the national market. In this context, the International Telecommunication Union (ITU) notes that "The widespread use of the national domain has a significant impact on establishing the digital identity of start-ups and enhancing the confidence of local customers, as local institutions become more distinctive and present in the national market, which supports their competitiveness vis-à-vis large international institutions" (ITU, 2022, p. 33).

In addition, other objectives in the strategy provide information infrastructure that is indispensable for innovation. Ensuring digital identity is a fundamental pillar of many digital services, especially in sectors such as financial technology and e-commerce. According to the International Telecommunication Union (ITU) report, digital identity "is the cornerstone of the development of secure digital services, particularly in the fintech and e-commerce sectors, where it enables start-ups to build trusted applications without the need to build complex or costly identification systems". Consequently, this "accelerates innovation, increases user confidence and reduces the risk of digital fraud".

Establishing the principles of multi-sector collaboration, or interoperability, enables start-ups to build services that integrate data from different sectors, enhancing their ability to create integrated and innovative solutions. A report by the Organisation for Economic Co-operation and Development (OECD) emphasizes that "Interoperability and data sharing between different sectors are essential enablers for building integrated digital solutions and products. This integration-oriented environment provides start-ups with the opportunity to develop new services based on combining health, financial, transport and education data in a way that creates superior innovation and added value".

On the other hand, establishing the principles of openness and data sharing constitutes a "new resource" for start-ups. They can utilize open government data to develop data-driven applications and solutions, thereby promoting innovation based on analytics and artificial intelligence. Indeed, "opening up government data to start-ups is a critical resource for supporting digital innovation".

4.2 Supporting the Technological Infrastructure of Start-ups

The objectives of "owning national data centres" and "providing competitive service offerings for the export of cloud computing services" provide vital support to start-ups. Cloud computing forms the technical backbone of many of these enterprises, enabling them to "reduce initial costs" by eliminating the need to invest in private servers and data centres.

Reliance on national data centres and cloud computing services allows start-ups to reduce capital costs and take advantage of flexible pay-as-you-go models. This grants them the potential to develop and market digital projects more quickly without the burden of investing in physical infrastructure (OECD, 2023, p. 75). Consequently, this frees up capital for investment in product development.

Furthermore, "cloud export strategies not only support the national economy by creating new jobs, but also give start-ups the ability to scale rapidly and absorb fluctuations in demand in the digital market, which is critical to the survival and growth of these enterprises" (ITU, 2022, p. 61). This affords them "flexibility and scalability," helping start-ups expand easily and quickly as demand grows, which is crucial in the early stages.

Moreover, "cybersecurity" contributes to the availability of data centres and cloud computing services within a secure data environment. This enhances the credibility of start-ups. Indeed, "cybersecurity provided by local professional data centres is essential for building trust among customers and partners, with information security being a prerequisite for start-ups to successfully deliver their digital services with high reliability" (UNCTAD, 2021, p. 144).

4.3 Stimulating Economic Ambition

In this regard, the objectives of **"increasing investment returns"** and **"exporting digital services**" motivate start-ups to think beyond national borders. Recognising the existence of potential regional and international markets facilitates their growth and development, encouraging them to devise innovative and globally competitive solutions. As noted by UNCTAD, "Encouraging the export of digital services and investment in global markets motivates start-ups to adopt innovative business models and develop scalable technological solutions, providing new horizons for sustainable growth and enhancing the competitiveness of the national economy in the international arena" (UNCTAD, 2021, p. 97). This directly supports the broader growth of the digital economy.

The objectives of the second pillar, "Human Capital and Formation," are equally vital for stimulating innovation and supporting start-ups, as qualified human resources serve as the primary driver of growth in the digital sector. Absent skilled personnel, ideas cannot be transformed into innovative projects, preventing start-ups from flourishing. In this context, World Bank reports emphasise that "qualified human capital is the decisive factor for the growth and competitiveness of start-ups in the digital age, as innovative ideas cannot be transformed into scalable products without skilled talent; An experienced workforce enables start-ups to transform knowledge into economic value through continuous innovation" (World Bank, 2024, Human Capital & Innovation section).

4.4 Providing Human Capital for Innovation

The first objective of this axis—to provide "500,000" specialists in information and communication technologies—directly contributes to stimulating innovation and supporting start-ups by expanding and diversifying the available talent pool. "Expanding the pool of specialised digital talent provides start-ups with multiple sources of developers, experts and designers, which directly impacts their ability to build innovative digital products and deliver high-quality solutions to the local and international market" (World Bank, 2024, Human Capital section).

Furthermore, "the creation of large numbers of digital specialists enhances opportunities for collaboration and knowledge exchange among innovators in the ecosystem, making the emergence of collective innovation and the transformation of entrepreneurial ideas into scalable digital companies more likely" (OECD, 2023, p. 62).

Thus, forming this substantial workforce of 500,000 skilled professionals contributes to the creation of a fertile environment for new ideas. It increases opportunities for collaboration and knowledge exchange between individuals, which necessarily leads to the emergence of innovative entrepreneurial ideas and their transformation into effective digital solutions. Furthermore, "ecosystems rich in digital talent encourage collective management of innovative projects and give start-ups a unique ability to innovate and develop advanced digital solutions, especially with the availability of diverse types of technical and creative talent" (INCLUDE Platform, 2023, p. 21).

4.5 Retaining Talent as a Pillar of Sustainable Growth

In this context, the second objective, which seeks to "reduce the brain drain," serves as a fundamental pillar for ensuring the continuity of innovation. "The stability and availability of digital talent internally is not only a key factor for the commercial growth of start-ups, but also a gateway to attracting quality investment and expanding digital employment opportunities for new generations" (Bhorat et al., 2023, p. 13). Start-ups also rely heavily on stable and qualified teams, as studies confirm that "stable and qualified teams enable start-ups to develop their projects at a steady pace and accumulate the experience necessary for leadership" (OECD, 2021, p. 14).

When the strategy succeeds in achieving this goal of "retaining 40% of talent," it contributes to providing the "necessary expertise" by making available experienced professionals who can serve as mentors and advisors to start-up projects. "Sustaining the availability of digital expertise locally creates strong incentives for young people to enter the digital labour market and enables intergenerational knowledge transfer through mentoring and experience-sharing programmes, leading to higher rates of new business creation and sustained innovation in the national market" (INCLUDE Platform, 2023, p. 11).

It also contributes to "building investor confidence," as a sustainable digital environment and available talent are attractive factors for both local and foreign investment, which enhances the growth capacity of start-ups. The availability of talent also stimulates the emergence of new projects, which in turn enhances the attractiveness of the sector and even serves as a "gateway to attracting quality investments and expanding digital job opportunities for new generations" (Bhorat et al., 2023, p. 13). This encourages more young people to specialise in digital fields, thus integrating the objectives to form a cycle that promotes innovation and supports start-ups.

The objectives of the third pillar, "digital governance," contribute indirectly but fundamentally to stimulating an environment of innovation and supporting start-ups by providing a regulated and transparent framework that enables these institutions to grow and prosper. "Digital governance provides a flexible and transparent regulatory framework that supports start-ups in adopting innovation and expanding their activities, as clear digital regulations and standards are a cornerstone for stimulating investment and reducing regulatory risks for entrepreneurs" (OECD, 2020, p. 161).

Furthermore, "the regulatory framework for digital government facilitates interaction between the public and private sectors and enables start-ups to participate in the provision of digital services and the innovation of new products based on clear and equitable rules for all" (European Commission, 2022, p. 36). In other words, digital governance creates the necessary environment that facilitates business and provides new opportunities for innovation.

4.6 Simplifying the Administrative Environment and Creating a New Market

The objectives related to "digitising the internal management of the public sector" and "digitising administrative procedures for citizens and businesses" are of particular importance for start-ups. "Digitising administrative systems and public procedures reduces bureaucracy and facilitates the entry of start-ups into the market through simpler and more transparent registration

procedures. It also increases the efficiency of compliance with legal regulations and reduces the associated costs" (OECD, 2020, p. 167).

More importantly, this digitisation in the public sector creates a "new market" and new economic opportunities for start-ups, as it expands the market for digital solutions and services that these enterprises can offer. This effectively strengthens the partnership between the public sector and digital entrepreneurship (World Bank, 2024, Public Sector Digitalisation section). Consequently, this enables start-ups to provide digital solutions and services to support the public sector in achieving its goals, thereby becoming potential partners for these institutions.

4.7 Developing the National Digital Industry

The objectives related to the development of the national digital industry are considered the cornerstone of supporting innovation. The goal of "creating 100,000 start-ups" is a direct recognition of the importance of entrepreneurship in the digital economy, creating an environment that encourages risk-taking and the transformation of ideas into commercial projects. "Encouraging the creation of start-ups in the digitalisation sector is a fundamental pillar for driving economic innovation, as digital entrepreneurship allows new ideas to be transformed into value-added products and services that promote national economic growth" (OECD, 2020, p. 95).

Furthermore, the ambition to make "digitalisation a means of wealth creation" and increase its contribution to gross domestic product provides a strong incentive for innovators to create companies that offer solutions with high economic value. "Increasing the contribution of digitalisation to gross domestic product and stimulating technological entrepreneurship creates a dynamic environment that encourages investors and innovators to turn ideas into companies capable of competing in regional and international markets" (UNCTAD, 2021, p. 53).

The objectives of "exporting digital products and services" and "promoting digital leaders" also motivate start-ups to develop globally competitive products and services. "Encouraging the export of digital products and services drives start-ups to develop high-quality solutions that meet international standards, which raises the level of local innovation and supports its competitiveness in global markets" (UNCTAD, 2021, p. 247).

On the other hand, "competition in global markets drives digital start-ups to adopt sustainable development policies and continuous learning, a factor that doubles the quality of local innovation and raises the ceiling of ambitions towards excellence and leadership" (OECD, 2020, p. 107).

4.8 Providing the Right Economic Environment

The objectives related to the "digital transformation of enterprises and merchants" contribute to the creation of a real market for start-ups. Furthermore, encouraging the "shift to electronic payment" and "increasing the use of digital systems in small and medium-sized enterprises" creates demand for digital solutions and services that start-ups can provide, such as cloud accounting systems, digital marketing tools, and customer relationship management platforms (OECD, 2020, p. 121).

On the other hand, "increasing foreign direct investment" and "attracting international players" provide indirect support to start-ups. These initiatives increase the attractiveness of the digital sector, encourage capital inflows, and enable start-ups to access global partners. Consequently, start-ups can benefit from their expertise and contribute to global value chains (UNCTAD, 2023, pp. 72, 136).

In the same context, the objectives of the fifth pillar, "Digital Society," contribute to stimulating innovation and indirectly supporting start-ups. Spreading digital awareness and expanding the user base benefiting from digital services enhances the demand for local innovation. It works to build a broad and digitally aware user base, and creates demand for locally-based digital products and services (OECD, 2023, p. 38), which constitutes a fertile market for innovators. This is confirmed by United Nations Development Programme (UNDP) reports, which state that "active digital communities create a fertile environment for entrepreneurs and innovators by accelerating the adoption of new services and multiplying the chances of success for products aimed at the local market" (UNDP, 2024, p. 8).

4.9 Building a User Base

The goal of "ensuring equitable and inclusive access to digital technologies and services" is vital for start-ups. The success of any digital product or service is fundamentally linked to the size of its potential user base. This objective provides start-ups with a large and accessible market, encouraging them to develop innovative solutions that meet the needs of different segments of society. Indeed, "Wider access enables these organisations to develop solutions that respond to the needs of diverse segments, fostering innovation and expanding the target market" (OECD, 2023, p. 38).

Furthermore, "increasing the participation of the population in public life through the digital space" deepens the integration of technology into the daily lives of citizens. This can inspire start-ups to create applications and solutions in areas such as civic engagement and e-government services (UNDP, 2022, pp. 13–15).

4.10 Creating Demand for Local Content

The goal of "promoting national digital content for all segments of society" acts as a direct incentive for start-ups in the creative and cultural sectors. This objective generates demand for authentic and culturally rich content. Such "growing demand for local digital content supports the nurturing of talent and innovation in cultural sectors, helping start-ups to establish themselves in a market that values community and cultural values" (OECD, 2020, p. 132).

It also encourages investment in areas such as digital video production, game development, and educational applications that promote national identity. This "helps start-ups in these sectors to stimulate innovation and develop services that are in line with local cultural interests" (ITU, 2017, p. 18).

Furthermore, "promoting national identity through the production of authentic digital content encourages capital and investment in local start-ups and increases the attractiveness of digital products to local and regional markets" (UNCTAD, 2021, p. 161). Ultimately, this assists start-ups in securing their market position by offering content that resonates with the interests and values of local users, thereby increasing their chances of success.

4.11 Creating Demand for Local Content

The strategic foundations of digital transformation, namely the legal and regulatory framework and information system security, are key factors in stimulating innovation and supporting start-ups. They achieve this by providing a stable and reliable working environment that reduces risk and boosts confidence in the digital market.

A. The Legal Framework as a Regulatory Factor

The legal and regulatory framework supporting digitalisation, which the strategy aims to establish, serves as a fundamental pillar for start-ups. Without clear laws regulating areas such as e-commerce, personal data protection, and intellectual property, start-ups may face significant

obstacles, which discourage innovation. A comprehensive and flexible legal framework can contribute to the following (OECD, 2020, p. 165; ITU, 2017, p. 44):

- **Setting the rules of the game:** It provides start-ups with the legal certainty they require to operate and invest.
- **Encouraging innovation:** It ensures the protection of intellectual property, encouraging innovators to put forward their ideas without fear of theft or imitation.
- **Building trust:** It boosts consumer and investor confidence in the digital marketplace, encouraging the growth of e-commerce and digital services.

B. System Security as a Catalyst for Growth

Information system security is not merely an option, but a prerequisite for the success of any start-up. Security represents a critical factor in building trust with customers. Prioritising security in all digital transformation projects (OECD, 2020, pp. 141-142) (ITU, 2022, pp. 86–87) contributes to:

- **Attracting investors:** Investors seek organisations with secure and reliable infrastructure.
- **Data protection:** Start-ups can reassure their customers that their personal and financial data is secure, which constitutes a competitive advantage.
- **Competitiveness:** Start-ups that adhere to high security standards can compete with large companies and enter new markets that require strict security standards.

Overall, these foundations contribute to creating an environment that reduces risk, builds trust, and provides start-ups with a solid foundation on which to build innovative and successful projects

5. Shortcomings in the Strategy

5.1 Unrealistic Absolute Targets

The strategy exhibits shortcomings in defining quantitative targets, often setting absolute and unrealistic percentages that fail to account for social and geographical disparities. Regarding connectivity and quality targets, absolute percentages (e.g., 100%) are frequently established without addressing these differences or creating a clear, gradual timetable. Studies confirm that the digital divide is exacerbated by ignoring such geographical and social nuances. Furthermore, adopting absolute targets (such as 100% universal coverage) without considering the specific conditions of rural and vulnerable areas leads to individual reluctance and weak actual digital inclusion. Strategy planning should be based on phased plans and multiple scenarios rather than a one-size-fits-all approach (Clarida, 2016, p. 87; OECD, 2023, p. 4; UNDP, 2024, p. 5).

In terms of developing digital skills, international reports highlight very ambitious figures (such as 500,000 specialists) proposed without accompanying implementation plans for training or partnerships with universities and the private sector. Indeed, reports indicate that most digitalisation strategies in Africa set ambitious digital targets lacking clear implementation roadmaps, educational partnerships, or systematic reforms in education and training policies (INCLUDE Platform, 2023, p. 6; IFC, 2019, p. 11).

In the context of digital economy growth, large absolute figures (such as 100,000 start-ups or $1 billion in investments) are proposed without established implementation mechanisms or realistic time indicators. International literature indicates that "setting ambitious quantitative targets without clear implementation mechanisms or realistic milestones often leads to partial or complete failure to achieve the desired digital transformation" (World Bank, 2024, Monitoring and evaluation section).

5.2 Absence of Implementation Plans and Milestones

The strategy focuses on broad goals without setting out clear action plans for their implementation and monitoring. The INCLUDE study emphasises that, despite the importance of

national strategies, "shortcomings in the integration of technical and vocational education and partnerships between sectors remain among the main reasons for the failure to achieve the required number of digital specialists" (INCLUDE Platform, 2023, p. 18).

5.3 Lack of Prioritisation

The strategy exhibits a failure to prioritise, particularly regarding the digitisation of administrative procedures. Objectives often focus on 100% digitisation without specifying sectoral priorities or a clear timetable. Such an approach "often leads to counterproductive results and creates organisational and implementation bottlenecks," as successful programmes rely on sectoral priorities, flexible phased plans and well-defined change management principles (OECD, 2023, p. 7; State of digital government review, 2025, Implementation section).

Furthermore, the UN review explains that comprehensive digitalisation strategies without a priority implementation roadmap or systematic transformation guidelines lack operational realism (UNDP, 2024, p. 11).

5.4 Omission of Supporting Policies

In the context of effective digital inclusion, while the strategy focuses on "ensuring universal access," it lacks real digital inclusion policies for vulnerable groups. UN and OECD reports emphasise that "abstract universal goals in digital policies are not enough to bridge the digital divide for vulnerable groups. Concrete inclusion plans for rural groups, people with special needs and the elderly are required, through the design of tailored solutions and field support programmes" (UNDP, 2024, pp. 8–9; OECD, 2023, pp. 19–20). Furthermore, a UNESCO (2017) study on digital inclusion shows that the absence of partnership programmes with civil society and local actors exacerbates the isolation of vulnerable groups despite the availability of infrastructure (UNESCO, 2017, p. 15).

Conclusion

In conclusion, having analysed the pillars of Algeria's national digital transformation strategy for the period 2025-2030 and examined its impact on addressing the digital skills gap, promoting innovation, and driving the growth of start-ups, it can be confirmed that the vision of this strategy extends beyond the mere creation of advanced digital infrastructure. It is, in essence, a comprehensive framework aimed at building human capacities capable of investing in and developing these systems.

A critical review of the complementary relationship between the various pillars of the strategy reveals that digital skills development is not an end in itself, but rather an inevitable outcome of the integrated implementation of this strategy. Its multiple pillars, spanning from infrastructure to governance, economy, and society, work in harmony to create an environment that encourages the acquisition of these skills and an appreciation of their importance.

The study also highlighted that providing basic infrastructure is a prerequisite for developing these skills. In the same context, the economic objectives of creating start-ups and attracting investment translate efforts made in other areas into tangible economic value, which serves as a strong incentive to promote these skills. At the governmental and societal levels, the impact of digitising public administration and supporting civic engagement extends beyond the need for technical experts; it encompasses training all individuals to use these tools effectively. Finally, the focus on legal and security aspects reinforces the need for advanced skills in cybersecurity and digital law, raising the status of these skills and positioning them as central elements in the various stages of transformation.

Testing Hypotheses

Testing the First Hypothesis

The analysis presented in the first axis of this study examined the objectives of the National Digital Transformation Strategy's main pillars and demonstrated their integrated interconnection. It confirmed that all basic elements necessary for the sustainable spread and development of artificial intelligence solutions are provided. Specifically, the infrastructure pillar facilitates data flow, while the human capital pillar guarantees the availability of expertise and competencies. The governance pillar establishes the legal and legislative framework, whereas the economy pillar enhances financial support. Finally, the society pillar ensures the provision of comprehensive data that reduces bias.

This tight interconnection between the pillars renders the strategy a powerful and effective catalyst for the integration and deployment of AI technologies on solid foundations. Consequently, the hypothesis stating that Algeria's National Digital Transformation Strategy (2025-2030) serves as a key driver for the adoption of artificial intelligence is confirmed.

Testing the Second Hypothesis:

This hypothesis consists of two main parts:

- **Relying on the modernisation of education and training curricula:** The second axis of the study focuses on the strategy's efforts to develop skills through the "human capital and training" pillar. This axis aims to train 500,000 ICT specialists by promoting "continuing education" programmes. These efforts seek to cultivate a workforce capable of "creating and managing innovative digital solutions." World Bank reports confirm that "education and training policies that focus on modern digital skills increase the competitiveness of the public and private sectors." This validates the first part of the hypothesis.
- **Neglect of large-scale retraining programmes:** Despite the strategy's ambitious training goals, the fourth axis—which addresses shortcomings—points out that these objectives "may neglect large-scale retraining programmes for the current workforce in traditional sectors." This criticism is consistent with the second part of the hypothesis, as the strategy fails to provide sufficient details on addressing the gap within the current workforce requiring retraining or reskilling.

Thus, it can be concluded that Algeria's National Digital Transformation Strategy indeed focuses on the academic aspect and continuous training for human capital development. However, the criticism levelled at it—which aligns with the hypothesis—is that it does not specify broad mechanisms for retraining the current workforce in sectors that have not traditionally been digitalised. Consequently, the study supports the validity of the second hypothesis.

Testing the third hypothesis:

This hypothesis comprises two primary components, both of which find support in the study's analysis:

- **The strategy's contribution to stimulating innovation and supporting start-ups:** The third axis clearly emphasises that the strategy promotes innovation through various channels. Notably, the construction of a "robust and inclusive digital infrastructure for high-quality connectivity" is identified as a prerequisite for start-up operations. Additionally, the digitisation of "public administration" and "data sharing" creates new opportunities for start-ups to offer innovative digital solutions while reducing bureaucratic complexities. Furthermore, the strategy positions "human capital" as a key driver of innovation, recognising that the availability of qualified talent is fundamental to these organisations' ability to transform ideas into scalable products. This demonstrates the strategy's positive contribution in this domain.

- **Shortcomings in addressing broader aspects of the innovation ecosystem:** Despite the positive focus observed in the third pillar, the fourth pillar—dedicated to "shortcomings"—indicates that the strategy's actual contribution may be significantly constrained. This limitation stems from weaknesses in the regulatory framework (laws and legislation), financing, and market access—areas the strategy fails to address adequately. These deficiencies restrict the positive impact of human capital development, suggesting that the strategy overlooks critical components of the innovation ecosystem, thereby weakening its overall effectiveness.

Consequently, it can be concluded that while the strategy clearly aims to stimulate innovation through human capital development and the provision of supportive infrastructure, its potential contribution remains limited. This is primarily because the strategy overlooks other vital aspects of the innovation ecosystem, such as the regulatory framework and financing. Thus, the study supports the validity of the third hypothesis.

Testing the Fourth Hypothesis

Based on the analysis presented in the fourth axis of the study, the hypothesis that Algeria's National Digital Transformation Strategy suffers from multiple shortcomings is confirmed. This conclusion is supported by an analysis of the criticisms levelled at the strategy, specifically: its lack of realism, the absence of precise implementation plans, the neglect of supporting policies, and the failure to clearly prioritise objectives.

Recommendations

Drawing upon the study's results—which confirmed the validity of the hypotheses and highlighted the strategy's shortcomings in several areas—the following recommendations are proposed to enhance its effectiveness and ensure its translation into tangible achievements:

a. Formulate realistic and clear implementation plans: Strategy stakeholders must develop "detailed action plans" that ground ambitious quantitative targets in reality, incorporating measurable milestones and specific timelines. These plans should provide a clear roadmap for achieving major numerical goals—such as training 500,000 specialists or creating 100,000 start-ups—rather than relying solely on absolute figures.

b. Strengthen public-private-academic partnerships: Effective collaboration between the government, universities, and the private sector is essential to guarantee the availability of the requisite skilled workforce. The strategy must establish "strong partnerships" to develop practical, labour market-oriented training programmes. This ensures that the skills acquired by individuals align with the specific needs of the private sector and the entrepreneurial ecosystem.

c. Prioritise the digitisation of sectors: Instead of attempting the simultaneous digitisation of all administrative procedures, it is advisable to establish a "clear roadmap of priorities." Economically influential sectors should be identified and digitised in a phased and flexible manner. This approach ensures rapid, tangible results and helps navigate regulatory obstacles.

d. Develop specific policies for digital inclusion: To prevent the widening of the digital divide, "concrete digital inclusion policies and programmes" targeting vulnerable groups—such as rural populations, people with special needs, and the elderly—must be developed. Merely stating the goal of "universal access" is insufficient; practical plans must be crafted in collaboration with civil society and local actors to design tailored solutions that ensure effective digital inclusion for all societal segments.

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