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DIGITAL TRANSFORMATION GAPS IN ALGERIA: A COMPARATIVE ANALYSIS OF THE GLOBAL DIGITAL TRANSFORMATION AND TECHNOLOGY INDICES FOR 2024

Bassimane Abdelmalek[1], Yacine Mahdjar[2]

[1]Department of Management Sciences Faculty of Economic, Commercial and Management Sciences, University of Ghardaia, Algeria
[2]Department of Psychology and Educational Sciences Faculty of Humanities and Social Sciences, University of Ouargla, Algeria

bassimane2017@gmail.com[1]
yacine7730@gmail.com[2]

Abstract

This study aims to provide a comprehensive analysis of the maturity of digital transformation in Algeria, focusing on two global indices for 2024: Huawei's Global Digitalization Index and the United Nations' Technology Index. The choice of the Global Digitalization Index stems from Algeria's adoption of a digital transformation strategy under the vision *"Digital Algeria 2030"*, in which the Chinese partner, Huawei, played a major role by supporting Algeria in implementing one of the key requirements of this strategy through a direct-negotiation deal to establish data storage centers across the country. On the other hand, the Technology Index adopted by the United Nations was selected as a foundation for the analysis to assess the scale of the digital transformation gap in Algeria compared to neighboring North African countries.

The study applied content analysis from the "Huawei Tech" platform in the practical section by examining the enabling factors of the Global Digitalization Index and the value of the Technology Index, in addition to using benchmarking as an analytical tool within the comparative descriptive method applied to several North African countries (Algeria, Egypt, Tunisia, and Morocco), which are all classified as beginner-level countries in both indices.

The results showed that Algeria suffers from low levels of investment in infrastructure, uneven distribution of connectivity services—especially in rural areasweak computing and data center infrastructure, low adoption rates of cloud computing, and a Technology Index score below the global average.

Keywords: Digital economy, digital transformation, Global Digitalization Index, Technology Index, comparative analysis, digital gap.

I. Introduction

In light of the rapid developments in public administration, Management Information Systems (MIS) have become a fundamental pillar in reshaping government models around the world. These systems provide advanced tools for organizing and managing data, thereby contributing to improving decision-making effectiveness and enhancing the quality of advanced services offered to citizens. Most administrative bodies, particularly municipalities and public administrations, are undergoing major digital transformations that enable the adoption of more accurate, transparent, and socially responsive services tailored to the diverse needs of different social groups.

In Algeria, significant progress has been made in generalizing the use of information technologies and improving administrative performance through advanced systems such as the *Chifa Card* to ensure healthcare services, and biometric passports and ID cards that rely on electronic chips to establish digital identity. Despite these achievements, critical challenges remain, such as fragmentation and lack of integration between biometric databases and various public institutions, which creates duplication in administrative documents and hinders the establishment of a comprehensive and coherent information system connecting different government entities.

In this context, Algeria, like other North African countries, faces relative delays in the maturity of its digital infrastructure and comprehensive communication networks, which affects the speed and efficiency of digital transformation in public institutions.

Therefore, the subject *"Digital Transformation Gaps in Algeria"* gains special importance. This study relies on an analysis of the *Global Digitalization Index 2024*, one of the most prominent

international indices measuring the extent to which governments adopt emerging technologies and integrate them into administrative and service sectors. The newly issued *United Nations Technology Index* was also adopted, as it highlights disparities in countries' performance in this field.

Based on these considerations, the need for an in-depth study of the gaps hindering digital transformation in Algeria is increasing. The significance of this study lies in its reliance on the *Global Digitalization Index 2024*, a key international benchmark for assessing governments' adoption of emerging technologies and their integration into administrative processes. The analysis is further complemented by the *Technology Index* in the United Nations 2024 report, which reflects the global governmental digitalization landscape and highlights gaps and challenges in states' digital trajectories.

Research Problem

To what extent does the availability of digital development requirements in Algeria affect the maturity of digital transformation compared to North African countries?

In order to answer the study's main problem, the following sub-hypotheses were proposed:

1. Algeria scores poorly on enabling factors in the key indicators of digital transformation.
2. Algeria ranks among the weakest North African countries in enabling indicators compared to its peers, which achieve higher rates despite being classified as beginners.
3. Algeria possesses the qualifications and potential to reach leading levels in the digital economy.

StudyObjectives:

- To assess the maturity level of digital transformation in Algeria according to Huawei's *Global Digitalization Index 2024*, with a focus on key enabling factors such as inclusive connectivity, digital infrastructure, clean energy, policies, and ecosystem.
- To measure the extent to which governments adopt emerging and evolving technologies using the *Technology Index*, a new component of the United Nations 2024 report.
- To compare Algeria with North African countries (Egypt, Morocco, Tunisia) in order to identify gaps in its digital infrastructure and determine opportunities for improvement.

Significance of the Study

The importance of this study lies in the following:

- Revealing regional gaps in digital transformation to foster the growth of the digital economy in Algeria;
- Providing a comparative analysis of "beginner" North African countries in the field of digitalization, which helps in understanding the existing challenges and also provides policy recommendations;
- Making optimal use of modern global indices such as Huawei's enabling indicators and the United Nations Technology Index to support government decision-making, using this study as a tool to strengthen the orientation of countries in the region, especially Algeria, toward adopting and applying information and communication technologies (ICTs).

PreviousStudies

- **First Study (Belmir, S., & Saadi, W., 2024):**
  This study aimed to explore ways to raise the level of digital maturity by increasing operational efficiency and improving productivity to access new markets and expand business through e-commerce and marketing based on digital leadership. The study relied on the case study methodology, using semi-structured interviews and the Westerman matrix to analyze digital maturity levels in some branches of Ooredoo in eastern Algeria, chosen as the focus of the study. The results indicated that Ooredoo does not enjoy a high level of digital maturity, despite having transformative digital leaders. However, it still needs to make optimal use of the available technology to develop working methods and create excellence and added value.

- **Second Study (Benjelloun, W., 2023):**
  The study aimed to bridge the digital divide to provide equal opportunities for access to disadvantaged students as well as those in remote geographical areas. It also included training faculty members to create content and benefit from available platforms to facilitate access to ICTs in general, and particularly to the Internet and learning platforms at the Virtual University of Tunisia, compared with Cadi Ayyad University (Marrakesh, Morocco). In addition to addressing the challenges posed by the increasing number of students, the mix of self-learning, blended learning, e-learning, distance learning, and classroom assignments, along with the resulting hybrid forms of education, offers opportunities that encourage students to unlock their full potential, thereby improving employability in a region where unemployment rises with the level of education. This mix also allows for internationalization, regional cooperation, and curriculum exchange at the national level. The study highlights changes in the role of faculty members, learning methods, institutional investments, and labor market preparedness in light of digital divide policies, while assessing their impact on higher education in North Africa.

- **Third Study (Al-Rafai, M.S., & Saad, M.A., 2024):**
  This study examined the impact of e-government on a set of governance indicators in a sample of 17 Middle Eastern and North African countries during the period 2003–2019.
  Methodology: The analysis was based on advanced econometric tools, consisting of second-generation panel data techniques that allow for controlling cross-sectional dependence and slope homogeneity, while estimating the short- and long-term effects of e-government on governance.
  Findings: The preliminary analysis indicated slope homogeneity and cross-sectional dependence in the data, while the second-generation unit root test showed that all variables were stationary at first difference. The second-generation cointegration test confirmed the existence of long-term relationships between e-government adoption and governance indicators. Furthermore, the PMG-ARDL model confirmed the role of e-government in reducing corruption and improving the rule of law in the long run. On the other hand, no significant effects were found for e-government on voice and accountability, government effectiveness, or regulatory quality. The short-term analysis also revealed no significant effects on governance.
  Conclusion: These results are crucial for improving institutional quality in the MENA region through the adoption of e-government.

- **Fourth Study (Miguel Angel Pérez-Castro, Miriem Mohamed-Maslouhi, & Miguel Angel Montero Alonso, 2021):**
  This study aimed to analyze the economic and digital gap between countries that share deep-rooted economic and cultural ties. The sample consisted of a set of Mediterranean countries which, in addition to traditional relations, are bound by recent Euro-Mediterranean partnership agreements between the European Union and North African and Middle Eastern countries, aiming, among other things, at scientific, technical, and technological cooperation. The research sought to identify the potential relationship between the Human Development Index (HDI) and the ICT Development Index (IDI), and whether this relationship could improve the way countries evaluate their development levels. The descriptive analysis of HDI and IDI trends showed that human and technological development progressed at average growth rates of 23% and 2.5%, respectively. The differences between countries narrowed by 7.4% for HDI compared to a 5.2% decrease in IDI. When converted to the same scale, there was an average gap of 0.2 points between the two indices. Thus, the studied Mediterranean countries were closer to achieving convergence in human development than in technological development. Policymakers,

especially in developing countries, could use this study as a tool to support their intentions to promote the adoption and application of ICTs.

Fifth Study (Anouar Aboulkacim, Dimitrios Lemperos, & Lazar Rusu, 2025):

This study aimed to identify the most influential barriers to digital transformation in public institutions, focusing on structural and cultural obstacles to digital transformation within Swedish municipalities. The research relied on a survey, and data were collected through semi-structured interviews with IT managers and directors from fourteen municipalities undergoing digital transformation, in addition to internal documents analyzed using thematic analysis.

The study identified a total of seventeen barriers to digital transformation, including nine newly observed barriers and eight others confirmed by previous research literature. The study further aimed to provide a deeper understanding of the key barriers to digital transformation that managers must focus on in order to successfully lead digital transformation in these public institutions in Sweden.

I-1- The Concept of Digital Transformation:

Some specialists view digital transformation as the integration of technologies such as artificial intelligence, the Internet of Things, cloud computing, and big data to enable organizations to survive and thrive amidst technological disruptions. It represents a transformation where companies must adapt to mass extinction events resulting from digital innovation or risk disappearing. It also involves leveraging digital tools for predictive analytics, automation, and enhancing decision-making in business processes (Siebel, 2019).

Others argue that digital transformation is the integration of digital technology into all areas of community activities and processes. It revolves around transforming organizational and societal structures by introducing digital information systems and flows, and managing these structures and procedures using such flows. Thus, digital transformations rely heavily on digital information systems, which have long been used to support various institutional activities and contributed to steadily reducing processing and communication times, but now they are transforming almost all sectors of societal activities (Coster et al., 2023; Verhoef et al., 2021).

From the two definitions above, it can be said that digital transformation is the re-imagining of business strategies and services provided by institutions for the benefit of stakeholders, through the use of information and communication technology tools, with the aim of seizing opportunities and addressing future challenges in a world that is rapidly moving toward the development of digital technologies.

I-2 Characteristics of Digital Transformation:

The main characteristics include technology integration, organizational change, a focus on innovation, and adaptability, detailed as follows:

I-2-1 Technology Integration:

This involves artificial intelligence, the Internet of Things, cloud storage, and data analytics in core processes (Li et al., 2024; Coster et al., 2023; Siebel, 2019).

I-2-2 Organizational and Cultural Transformation:

It emphasizes people, leadership, and culture more than pure technology, requiring mindset shifts (Verhoef et al., 2021; Westerman et al., 2014; Kane et al., 2019).

I-2-3 Innovation and Adaptability:

It fosters continuous adaptation, network effects, and value creation in disruptive markets (Rogers, 2016; Chen, 2021; Kraus et al., 2022).

I-2-4 Multi-dimensional Impact:

It affects strategy, society, and the environment (such as sustainability and decarbonization) (Trenz et al., 2023; Urbinati et al., 2021; Lee et al., 2023).

I-2-5 Process-oriented Stages:

It evolves from digitization to full transformation, with a focus on performance (Verhoef et al., 2021; Brous et al., 2024; Lamarre et al., 2023).

I-3 Definition of the Digital Divide:

The digital divide refers to the gap between those who have access to digital technologies and those who do not, influenced by social, economic, geographic, and readiness-related factors (Andrea Urbinati et al., 2021; Paul Brous et al., 2024). This divide includes disparities in digital readiness, skills, and usage, which are often defined from a policy perspective (Seyedeh Hoda Mousavi et al., 2023). In contexts such as rural and urban areas, or among people with disabilities, this gap highlights inequalities in access to and benefits from digital tools (Muhammad Qasim Murtaza et al., 2025).

I-4 Definition and Characteristics of the Digital Economy

I-4-1 Definition of the Digital Economy

The digital economy refers to economic activities that rely on digital technologies, connecting individuals, companies, and processes through the use of data, digital innovations, and virtual participation (Coster et al., 2023; Kraus et al., 2022). This economy includes electronic goods and services in addition to digital processes, and it has a significant contribution to GDP, reaching, for example, 6.5% in 2016 (Verhoef et al., 2021; Lee et al., 2023).

I-4-2 Characteristics of the Digital Economy

- The digital economy is data-driven and innovation-based, integrating technologies such as artificial intelligence, mobile applications, and e-commerce to enhance economic activities (Coster et al., 2023; Kraus et al., 2022).
- It relies on open, virtual participation and knowledge as key drivers, enabling the exchange of resources and information seamlessly through digital platforms (Coster et al., 2023; Verhoef et al., 2021).
- It contributes to boosting productivity, supporting sustainability, and achieving high-quality development by improving efficiency and innovation in economic processes (Lee et al., 2023; Verhoef et al., 2021).

II- Method and Tools

II-1 Research Method Used:

The study adopted the descriptive method in the theoretical framework, relying on studies and books available across various platforms. Content analysis from the *Huawei Tech* platform was applied in the empirical study, based on two global indicators for the year 2024: Huawei's Global Digitalization Index, focusing on the key factors represented in: the overall score of the Global Digitalization Index (GDI), universal connectivity, digital transformation policies, digital foundation, and ICT laws and regulations.

The scores were set on a scale of 0–120 for enabling factors, which were themselves aggregated from sub-index assessments measured on a scale of 1–10. The study also relied on the Technology Index adopted by the United Nations to measure the extent to which governments adopt emerging technologies, particularly focusing on Algeria.

Benchmarking was used as an analytical tool within the comparative descriptive method, comparing Algeria with some North African countries (Algeria, Egypt, Morocco, and Tunisia), which are classified as beginners within the Global Digitalization Index. A quantitative analysis of scores and sub-indicators was conducted to reveal the gaps in Algeria's digital infrastructure and to identify opportunities for improvement.

2-II Definition of the Global Digitalization Index (GDI) by Huawei Tech[1]:

The Global Digitalization Index 2024 tracks the digital development of 77 countries and shows a positive correlation between this index and GDP. The 77 countries are classified into three groups: Frontrunners, Adopters, and Starters, according to their maturity level in information and communication technology and their economic development. This index covers countries representing 93% of global GDP and 80% of the world's population, providing a good indicator of overall progress in global digital transformation (Huawei GDI, 2024).

The Global Digitalization Index (GDI) also classifies countries based on 42 indicators to assess the maturity of their digital infrastructure. The data are sourced from reliable organizations, including the Organisation for Economic Co-operation and Development (OECD), the International Telecommunication Union (ITU), the GSM Association (GSMA), the World Economic Forum (WEF), the World Bank, the United Nations, Ookla, the International Renewable Energy Agency (IRENA), and the International Data Corporation (IDC) (SAMENA Telecommunications Council, 2024).

The pillars of the Global Digitalization Index consist of four main axes:
- Universal connectivity
- Digital foundation
- Green energy
- Policies and ecosystem

This comprehensive system of indicators enables countries to quantitatively measure the extent of their digital transformation.

III- Results and Discussion

1-III The Maturity of Digital Transformation in Algeria as a Starter Country

According to the report, Algeria is classified as a Starter country in the 2024 GDI, as shown in the following table:

Table (01): North African Starter Countries within the Global Digitalization Index (GDI).

Country	Global Digitalization Index Score	Rank among Starters	Global Ranking
Morocco	34.3	5	57
Egypt	32.7	8	60
Tunisia	32.6	10	62
Algeria	28.4	17	69

Source: (Huawei GDI, 2024).

Table (01) shows that Algeria ranks 69th globally with an overall score of 28.4, making it one of the least developed countries in the field of the digital economy at the international level. This classification reflects an initial stage in the digital transformation process, characterized by low levels of investment in infrastructure, uneven distribution of connectivity services, and a digital base that is still emerging.

The category of Starter countries, such as Algeria, includes developing economies that face slow beginnings in digital transformation, with major obstacles including limited broadband penetration, a lack of efficient data centers, and a primary reliance on basic ICT services. Consequently, these countries suffer from noticeable gaps in mobile broadband coverage and access to fiber-optic networks, requiring focused efforts to strengthen basic connectivity in order to reduce the digital divide and support broader applications such as e-commerce and digital financial services.

Algeria's score indicates gradual progress toward a "Smart World" model expected by 2030, where trends such as 10-gigabit-per-second connectivity, spatial computing, and AI-based innovation development will be essential elements of advancement. However, with a GDI score far below the global average (around 50–60 for Adopters and more than 60 for Frontrunners), the impact of the digital economy in Algeria remains limited in supporting GDP growth, especially compared to neighboring countries.

Nevertheless, there are clear opportunities to leverage rich natural resources and supportive low-carbon development policies, such as integrating renewable energy sources (e.g., solar power in desert regions), to promote sustainable and efficient digital growth.

Challenges remain, as Algeria ranks 116th out of 193 countries in the United Nations E-Government Development Index (EGDI) by 2024, improving from 0.5611 in 2022 to 0.5956. However, the country's focus on e-administration and digital government through platforms such as *"Bouatak"* reflects Algeria's commitment to simplifying services and keeping pace with global digital trends. These ongoing efforts highlight the government's progress in laying a solid digital foundation for the future (MEA Tech Watch, 2025).

III-2Analysis of Algeria's Key Indicators
III-2-1Universal Connectivity (Enabling Factor Score: 25.6/120):
This enabling factor measures supply, such as fiber coverage, 4G and 5G networks, and demand (such as broadband, affordability).
Algeria's score of 25.6 out of 120 is low, reflecting major gaps in infrastructure, with limited fiber-to-the-home/business (FTTH/FTTB) coverage and an average mobile broadband experience. Sub-indicators such as fiber coverage up to 10/3: C, up to 10/5: B, and 4G and 5G coverage (likely low, given beginner characteristics) indicate concentration in urban areas, with rural areas remaining poorly served.
Affordability is a barrier, as mobile/fixed connectivity costs are relatively high compared to national gross income. This aligns with the report's conclusion that beginner countries need cooperative FBB/MBB development to foster e-commerce, where Algeria lags behind (e-commerce transactions per capita are low due to speeds below 80 Mbps mobile / below 150 Mbps fixed).
From these findings, Algeria can be classified among "beginner" countries in the universal connectivity index, with main challenges being weak fiber optic and mobile networks infrastructure, high connection costs, and insufficient rural coverage. To bridge this gap, Algeria needs significant investments in expanding fiber optic coverage, along with improving affordability to enhance access and benefit from the digital economy, including e-commerce.

III-2-2 Digital Foundation (Enabling Factor Score: 25.2/120):
This covers computing, storage, cloud, and data centers. The score of 25.2 out of 120 places Algeria among the lowest, indicating weak core infrastructure for data processing and artificial intelligence. Sub-indicatorevaluations are as follows:

- **Data Center Investment Index (Sub-indicator Score: 4/10):**
  This measures investment in IT infrastructure for data centers (per GDP). Algeria's low score indicates limited spending (e.g., less than USD 0.17 trillion globally benchmarked downward), with few advanced facilities. This limits cloud storage adoption (low rate) and data creation (low per capita, p. 50). The report notes that beginner countries struggle with data centers due to investment gaps, hindering efficiency in industries like oil/gas (Algeria's main sector). For improvement, Algeria needs alignment with global trends such as 3.3 ZFLOPS computing power by 2030[2].

III-3-2 Enabling Factor: Policies and Ecosystem (Score: 36.0/120):

- **Digital Transformation Policies Index (Sub-indicator Score: 5/10):**
  This assesses policies that promote the digital economy, entrepreneurship, and investment based on ITU G5 standards (p. 51). Algeria's medium score reflects some efforts, such as the 2022 National Digitalization Strategy aimed at e-government and SME digitization, but implementation remains slow. The report highlights supportive policies as "fertile ground" (p. 36), and Algeria could benefit from models such as Singapore's phased plans (p. 37).

- **ICT Laws and Regulations (Sub-indicator Score: 7/10):**
  Based on the ITU ICT Regulatory Tracker (p. 51), this is a relative strength for Algeria, indicating solid frameworks for data protection, cybersecurity, and ICT governance (e.g., the 2018 Data Protection Law) (Mechta Nesrine &Benabd Ikhlas, 2021). However, implementation gaps persist, limiting innovation.

The higher enabling factor score (36.0) indicates that policy is Algeria's strongest area, with potential in ICT patents and talent (though "STEM-to-ICT conversion" is low at 15% in beginner countries, p. 38).

The term "STEM-to-ICT conversion low at 15% in beginner countries" refers to the challenge or gap faced by beginner countries (those still developing digital and technological infrastructure) in transforming educational skills in science, technology, engineering, and mathematics (STEM) into practical and professional skills in information and communication technology (ICT).

In other words, this percentage reflects the reduced efficiency or ability of these countries to transfer or convert graduates and students proficient in STEM fields into actual professionals in the ICT sector compared to expected levels or to more advanced countries. This 15% deficit indicates the presence of a gap in training and education or in ICT infrastructure in those countries, which affects the speed of ICT sector development.

The report emphasizes that beginner countries need to further improve their educational and vocational training capacities in the ICT field to reduce this gap, through partnership programs between educational institutions and technology companies, providing accredited certifications, and offering continuous training and professional development in ICTsimilar to what major companies such as Huawei do in cooperation with universities and educational institutions.

III-3-3 Comparative Analysis of the Global Digital Development Index of Algeria with North African Countries

The comparative analysis covers four North African countriesAlgeria, Egypt, Tunisia, and Moroccoexcluding Mauritania and Libya as they are not included in Huawei's Global Digital Index.

Table No. 02: Comparative Analysis of the Global Digitalization Index of Algeria with North African Countries.

Enabler Index / Countries	Algeria	Egypt	Tunisia	Morocco
Overall GDI Score	28.4/120	32.7/120	32.6/120	34.3/120
Universal Connectivity	25.6/120	20-28	30-28	32-30
Low Fiber/5G Coverage; Mobile Speeds Below 80 Mbps	20–28 (There is improvement in broadband range through expansion of the 4G network, but gaps remain in rural fiber coverage)	28–30 (Observation: G4 moderate, G5 low)	30–32 (Strongest in the region in terms of fiber optic projects)	(Strongest in the region in terms of fiber optic projects)
Digital Transformation Policies	5/10 (Moderate; national digital strategy exists but rollout is slow)	~5–6 Supported through Egypt Vision 2030, with focus on e-government	~5–6 (Inferred;Tunisia Digital Plan 2025)	~6–7 (Morocco Digital 2025; strong entrepreneurship policies)
Digital Foundation (including Data Center Investments)	25.2/120 (Data centers: 4/10; limitedinvestment)	~27–29 (Inferred; growing data centers, with low cloud migration)	~27–29 (Inferred; basic storage, limited AI)	~29–31 (Inferred; higher investment, e.g., 73 new

				data centers such as Mexico Center)
ICT Laws and Regulations	7/10 (Relatively strong index; good data protection framework)	~6–7 ProtectedunderCybersecurity Law 2018	~6–7 Protected under telecommunications law updates	~7–8 Presence of advanced digital rights laws

Source: Huawei (GDI), 2024.

Table 02 shows that, with regard to the overall GDI score, Algeria lags behind its neighbors by a margin ranging between 4 to 6 points, which indicates a less advanced stage of digital transition. Morocco stands out as the strongest country in the region, benefiting from larger investments in the ICT sector, such as the USD 125 million allocated to digital infrastructure projects. All these countries are classified within the "beginners" category, but with differences in the speed of progress. The digital divide in North Africa appears clearly, as the impact of GDI on GDP per capita remains limited to about USD 175 per point.

Algeria is also the lowest performer in North Africa in the "Universal Connectivity" index, which assesses the quality and penetration of internet networks, including fiber optic coverage, 4G/5G networks, download speeds, accessible and affordable availability, as well as the cost of internet connection. This decline deepens the "digital divide," reducing digital inclusion and limiting digital economic opportunities. Algeria also ranks 116th worldwide in EGDI with a value of 0.5956, which represents a medium level that reflects difficulties in OSI (0.33200, indicating weakness in e-government services) despite good performance in HCI (0.64179, indicating an acceptable educational level). At the regional level, Algeria is in the middle, while Tunisia and Morocco outperform in digital integration. However, Algeria's efforts include investments in infrastructure such as the expansion of wired and wireless networks and the establishment of new data centers to store data locally. (United Nations, 2024).

While Algeria holds a mid-level position in this index, the report emphasizes the importance of policies in creating a favorable environment for digital growth. Morocco's gradual approach, similar to models like Singapore, provides it with an advantage in return on investment (6.7 times compared to traditional infrastructure). Regional policies also enhance talent development in STEM fields (25% of graduates), but with a decrease in the proportion transitioning into the ICT sector.

Algeria's low ranking in data centers limits its readiness for artificial intelligence (linked to the IMF AI index). Morocco leads the region thanks to investments that strengthen connectivity (a multiplier effect exceeding 50 points). All countries remain below 30, which threatens the loss of opportunities to leverage data as a key resource.

In the ICT laws and regulations index, Algeria's good performance in this field strengthens the capacity of its digital policies (36/120). All countries receive an average evaluation, but implementation varies; reports indicate that laws support innovation systems. Morocco and Tunisia outperform in regulatory maturity according to ITU standards.

III-4Technology Index:

The Technology Index (TI) is a new component in the 2024 United Nations report. It measures governments' adoption of emerging technologies such as Artificial Intelligence, Blockchain, Cloud Computing, Data Sharing, and Cybersecurity, in addition to Open Data. This index contributes to the calculation of the overall E-Government Development Index (EGDI) as a fourth component alongside (OSI) Online Services, (TII) Telecommunications Infrastructure, and (HCI) Human Capital. The Technology Index values range from 0 to 1, where a higher value reflects better adoption of technologies.

Table 03: Comparative Analysis of the Technology Index for Algeria with North African Countries.

Country	Technology Index Value	Compared to Global Average (≈0.46)
Egypt	0.6875	Higher
Morocco	0.5000	Higher
Tunisia	0.4375	Close to or slightly lower
Algeria	0.3750	Lower

Source: United Nations, 2024.

According to the United Nations Technology Index (TI), Algeria's performance in this index is valued at 0.3750, representing a medium-to-low level in adopting emerging technologies compared to the global average of 0.46. This indicates a delay in adopting advanced technologies such as Artificial Intelligence, Cybersecurity, Open Data, and Cloud Computing in government and economic services.

At the regional level, compared with some North African countries, Algeria ranks last among the four countries, lagging behind Egypt, which tops the region with a score of 0.6875, thanks to its investments in advanced technologies. Morocco follows with a score of 0.5000, which is above the global average, while Tunisia ranks third with a score of 0.4375, close to or slightly below the global average.

From the above, the challenges and the need for development highlight weaknesses in integrating advanced technologies into government services, which affects the overall efficiency of catching up with regional countries such as Egypt.

Accordingly, it can be said that Algeria is classified at a medium-to-low level in the United Nations Technology Index with a value of 0.3750, which is below the global average, and that Algeria ranks last among North African countries, facing major challenges in adopting emerging technologies such as Artificial Intelligence and Cloud Computing.

**III-5Challenges and Opportunities for Digital Transformation in Algeria (2023–2030)**

Based on the data provided in the International Telecommunication Union (ITU) report *(ICT Development Index, 2025, p.27)*, Algeria's ICT Development Index (IDI) shows a continuous and noticeable improvement over the past three years. In 2023, it reached 77.8 points, then increased to 80.9 in 2024 (an improvement of about 4%), and reached 86.1 in 2025 (an additional improvement of about 6.4%). This development reflects overall progress in digital transformation, supported by increased usage and coverage, but it also shows a slowdown in some areas such as pricing.

Thus, the improvement is positive, as Algeria surpassed the global average (around 75 points in 2025) and improved its global ranking from around 89 in 2023 to 74 in 2025, according to official sources such as the Algerian Ministry of Post and Telecommunications.

In the Universal Connectivity Pillar, the score increased from 72.3 in 2023 to 75.4 in 2024 and then to 82.6 in 2025. This improvement is mainly due to the increase in the percentage of individuals using the internet (from 66.2% to 76.9%) and the percentage of households with internet access (from 78.3% to 92.6%), in addition to improved network coverage such as 4G, which rose from 79.9% to 90.4%. However, 3G coverage remained relatively stable at about 98%. This indicates that efforts were focused on expanding access, particularly in urban areas, as confirmed by the 2024 ITU report, which points to similar growth in middle-income countries.

As for the Meaningful Connectivity Pillar, it improved from 83.2 in 2023 to 86.3 in 2024 and then to 89.5 in 2025. The main improvement came from the increase in mobile data traffic (from 58.7 GB to 97.8 GBper subscription) and fixed data traffic (from 1518.8 GB to 2273.1 GB), reflecting greater internet use. The Algerian telecommunications sector also contributed to the rise in the

number of households connected with FTTH fiber optic networks from 53,394 households in 2020 to 478,172 households by the end of 2022, reaching 1.7million households by the end of 2024.

Development of the number of households connected to the fiber-to-the-home (FTTH) network
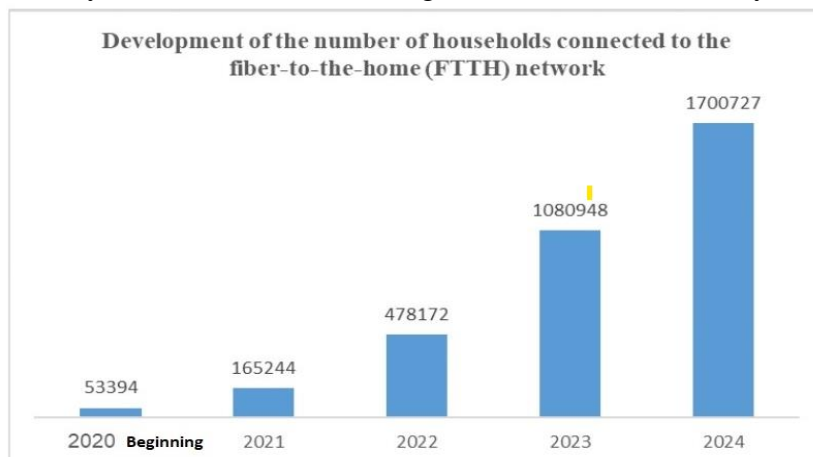
Source: Fiber Optic Transition Initiative.https://www.mpt.gov.dz

This is consistent with LinkedIn's analysis, which indicates a 4%growth in usage in 2024. According to Algeria's 2024 Digital Report from *Datareportal*, the number of LinkedIn users in Algeria reached 3.9 million at the beginning of 2024, equivalent to 13.1% of the eligible audience (individuals over 18 years old). LinkedIn advertising data also showed an increase in the number of ad-targetable members by 21.9% over one year, from the beginning of 2023 to the beginning of 2024, with a quarterly increase of 5.4% between October 2023 and January 2024. This indicates actual growth in LinkedIn usage in Algeria during this period. The ratio reflects an estimated 4% increase in usage among the general population in 2024 or higher (Datareportal, 2024).

The Algerian authorities have also adopted the National Digital Transformation Strategy, which is based on five (05) strategic pillars. Two of them constitute the fundamental basis for the success of digital transformation: the "basic infrastructure," primarily consisting of high-quality communication networks and data centers, and "human resources, training, and research & development." The other three pillars target the state components: public authorities that govern and manage through the "Digital Government" pillar; the economy, which generates growth through the "Digital Economy" pillar; and civil society, which achieves digital inclusion through the "Digital Society" pillar. Each pillar encompasses a set of strategic objectives, totaling twenty-five (25) strategic goals, each with a target to be achieved within the period 2025–2030 (Haut-Commissariat à la Numérisation, 2024).

Based on these indicators, Algeria faces major challenges in affordability, as basket prices (such as 2.0% for mobile and 3.2% for fixed in 2025) remain relatively high compared to income, limiting access in rural and low-income groups. Although network coverage has improved, it is still incomplete (90.4% for 4G in 2025), hindering development in remote areas. In addition, there may be a digital skills gap, as the general report notes that middle-income countries like Algeria face difficulties in effective use despite access. These challenges are confirmed in the 2025 ITU Report, which highlights gaps in Arab countries, and in a World Bank ICT indicators study, which shows affordability slowdown due to inflation.

On the opportunities side, the rise in data traffic (e.g., 97.8 GB mobile in 2025) represents an opportunity to strengthen the digital economy, such as e-commerce and online education. The improvement in subscriptions (104.2 per 100 people in 2025) also supports investments in 5Gnetworks, which could reduce the digital divide. Other opportunities include international partnerships, such as ITU initiatives to support Arab countries, and a focus on reducing prices to achieve full UMC. A study published in January 2025 on Algeria's digital impact confirms that an

IDI of 80.9 in 2024 opens the door for e-commerce growth of up to 20%, provided that investment in skills is made.

IV – Conclusion

This research paper presents a comprehensive analysis of the maturity of digital transformation in Algeria, based on two global indices for the year 2024: Huawei's Global Digital Index (GDI) and the United Nations Technology Index (TI). The GDI was chosen in line with Algeria's Digital Algeria 2030 strategy, in which the Chinese partner, Huawei, played a major role by securing a direct-negotiation contract to establish several data storage centers across Algeria.

The United Nations TI was selected as a support for the analysis to identify the scale of Algeria's digital transformation gap compared to its North African neighbors. By compiling theoretical aspects, particularly previous studies, we conducted content analysis of Huawei's digital indices, with a focus on the core factors: overall score, universal connectivity, digital transformation policies, digital foundation, and ICT laws and regulations, particularly in Algeria. Benchmarking was used as an analytical tool within the descriptive comparative method with selected North African countries (Algeria, Egypt, Morocco, and Tunisia), classified as beginners in the GDI. Quantitative analysis of scores and sub-indicators was applied to reveal Algeria's digital infrastructure gaps and define opportunities for improvement. The results of analyzingboth indices show thatAlgeria:

- Has low levels of investment in infrastructure, uneven distribution of connectivity services, and a digital foundation still under development according to the GDI. It is classified at a medium-to-low level in the Technology Index (TI) (0.3750), below the global average (≈0.46), ranking last among North African countries, with major challenges in adopting emerging technologies such as artificial intelligence and cloud computing. Accordingly, Algeria ranks 116th out of 193countries in the United Nations EGDI, improving from 0.5611 in 2022 to 0.5956 in 2024.

- Shows significant gaps in mobile broadband coverage and access to fiber optic networks, requiring focused efforts to enhance basic connectivity to reduce the digital divide and support broader applications. High connectivity costs and insufficient coverage in rural areas remain obstacles. To improve its status, Algeria needs significant investments in expanding fiber, 4G, and 5G networks, as well as improving affordability to strengthen access and benefit from the digital economy, including e-commerce. This places Algeria among the "beginners" in the Universal Connectivity Index.

- Is classified among the "beginners" in the Digital Foundation Index, with weak computing and data center infrastructure, limited investments, and low cloud computing adoption. To improve its status, Algeria needs major investments in data centers and cloud computing to support key industries and the digital economy, aligning with global trends to enhance digital transformation capacities by 2030.

- In the Policy and Ecosystem Index, Algeria is classified as a "beginner," with an average performance that is the strongest among the enabling factors (36.0/120). It has a relatively good regulatory framework in data protection and cybersecurity, along with some digital initiatives. However, slow implementation and a STEM-to-ICT skills transfer gap (15%) hinder innovation and digital growth. To improve, Algeria needs to accelerate the implementation of digital policies, strengthen vocational training, and build partnerships with the private sector to support the digital economy and entrepreneurship.

- In ICT Laws and Regulations, Algeria, along with other North African countries, receives an average evaluation, which reinforces Algeria's relatively good performance in this area of digital policy capacity.

From these results, the following recommendations can be made:

- Increase public and private investments in digital infrastructure to reduce the digital divide through national programs to expand internet access in rural and remote areas.

- Implement support programs for the private sector to develop infrastructure, with tax incentives for companies contributing to network expansion, supporting e-commerce and broader digital applications.
- Launch awareness and training campaigns for citizens to increase the effective use of connectivity, focusing on reducing the urban–rural digital divide.
- Allocate government budgets to establish local data centers and strengthen cloud computing to address weaknesses in infrastructure and limited investments, in line with global trends to support key industries.
- Encourage foreign and domestic investment in cloud computing through supportive legislation, with a focus on integrating renewable energy (such as solar energy in the Sahara) to ensure sustainable and low-carbon digital growth.
- Increase investments in adopting emerging technologies such as artificial intelligence and cloud computing, to raise the TI from 0.3750 (below the global average of 0.46) and improve Algeria's ranking within North Africa.

Footnotes

[1]GDI : Global Digitalization Index

[2]The 3.3 ZFLOPS Index refers to the global general computing power, where this figure represents 3.3 ZettaFLOPS, meaning a trillion trillion (10^{21}) calculations per second. This metric reflects the massive computing capacity used in artificial intelligence technologies and general computing worldwide.

References

1. Al-Refai, M.S., Saad, M.A. (2024). *E-government development and governance in MENA countries: an empirical study*. Access to Science, Business, Innovation in the Digital Economy, ACCESS Press, 5(1), 7–20. https://doi.org/10.46656/access.2024.5.1(1)
2. Anouar Aboulkacim, Dimitrios Lemperos, Lazar Rusu. (2025). *Structural and Cultural Barriers to Digital Transformation in Swedish Public Organizations*. CENTERIS – International Conference on ENTERprise Information Systems / ProjMAN – International Conference on Project Management / HCist – International Conference on Health and Social Care Information Systems and Technologies 2024, Procedia Computer Science, 256, 106–113. Available online at www.sciencedirect.com
3. Belmir, S., & Saadi, W. (2024). *The shift towards digital leadership as a strategic option to enhance digital maturity at Ooredoo Algeria: a study based on the Westerman matrix and colleagues*. International Journal of Innovative Technologies in Social Science, 4(44). https://doi.org/10.31435/ijitss.4(44).2024.3007
4. Benjelloun, W. (2023). *Bridging the Digital Divide in Higher Education: North African Challenges and Initiatives*. In Badran, A., Baydoun, E., Hillman, S., &Mesmar, J. (eds.), *Higher Education in the Arab World*. Springer, Cham. https://doi.org/10.1007/978-3-031-33568-6_10
5. Brous, P., Janssen, M., & Herder, P. (2024). *Digital transformation: A multidisciplinary perspective and future research agenda*. International Journal of Consumer Studies. https://doi.org/10.1111/ijcs.13015
6. Datareportal. (2024). *Digital 2024: Algeria*. https://datareportal.com/reports/digital-2024-algeria (Visited 17/08/2025, 18:20).
7. Haut-Commissariat à la Numérisation (HCN). (2024). *National Strategy for Digital Transformation in Algeria*. https://hcn.dz/SNTN-Ar.pdf (August 2024 version).
8. Huawei. (2024). *Global Digitalization Index (GDI) 2024, Overview*. https://www.huawei.com/en/gdi (Visited 14/08/2025, 14:16).

9. ITU. (2025). *ICT Development Index: Measuring Digital Development*. https://www.itu.int/itu-d/reports/statistics/idi2025/ (Visited 16/08/2025, 20:10).

10. Iqbal, M. M., & Tahir, M. S. (2023). *Classification of barriers to digital transformation in higher education using grey relational analysis: The perspective of education experts*. Education Sciences, 13(3), 323. https://doi.org/10.3390/educsci13030323

11. Kraus, S., Breier, M., Lim, W. M., Dabić, M., Kumar, S., Kanbach, D., Mukherjee, D., Corvello, V., Piñeiro-Otero, J., Liguori, E., Schiavone, F., Battisti, C., Ferraris, C., & Ail, U. (2022). *Digital transformation in business and management research: An overview of the current status quo*. International Journal of Information Management, 63, 102466. https://doi.org/10.1016/j.ijinfomgt.2021.102466

12. Lee, M., Ryu, S., Song, Y. W., & Hur, J.-Y. (2023). *Digital transformation trends in service industries*. Service Business, 17(1), 1–24. https://doi.org/10.1007/s11628-022-00516-6

13. Cöster, M., Danielson, M., Ekenberg, L., Gullberg, C., Titlestad, G., Westelius, A., & Wettergren, G. (2023). *Digital Transformation: Understanding Business Goals, Risks, Processes, and Decisions*. Cambridge, UK: Open Book Publishers. https://doi.org/10.11647/OBP.0350

14. MEA Tech Watch. (2025). *Algeria's Ambitious Digital Transformation Plan: Over 500 Projects Set for 2025–2026*. https://meatechwatch.com/2025/01/08/algerias-ambitious-digital-transformation-plan-over-500-projects-set-for-2025-2026/ (Visited 16/08/2025, 09:00).

15. Mechta, N., &Benabd, I. (2021). *Legal protection of personal data under Law 7/18 on the protection of natural persons in the field of processing of personal data*. Algerian Journal of Law and Political Science, 60(6/01), 675–690.

16. Pérez-Castro, M. Á., Mohamed-Maslouhi, M., & Montero-Alonso, M. Á. (2021). *The digital divide and its impact on the development of Mediterranean countries*. Technology in Society, 64, 101452. https://doi.org/10.1016/j.techsoc.2020.101452

17. Mousavi, S. H., Zaefarian, R., & Hultman, M. (2023). *Exploring the digital transformation gap: Evidence from organizations in emerging economies*. Journal of Business Research, 165, 114075. https://doi.org/10.1016/j.jbusres.2023.114075

18. Murtaza, M. Q., Fengju, X., Khalid, A., & Tan, T. M. (2025). *Unveiling the barriers to digital transformation in higher education institutions: A fuzzy DEMATEL approach*. Smart Learning Environments, 12(1), 2. https://doi.org/10.1186/s40561-024-00295-7

19. SAMENA Telecommunications Council. (2024). *Global Digitalization Index (GDI) 2024*. https://www.samenacouncil.org/initiatives/industryissues/gdi-2024-en.pdf

20. Siebel, T. (2019). *Digital Transformation: Survive and Thrive in an Era of Mass Extinction*. RosettaBooks. Retrieved from https://www.perlego.com/book/2433384/digital-transformation-survive-and-thrive-in-an-era-of-mass-extinction-pdf

21. United Nations. (2024). *E-Government Knowledgebase*. https://publicadministration.un.org/egovkb/en-us/Data/Compare-Countries

22. Urbinati, A., Bogers, M., Chiesa, V., &Frattini, F. (2021). *Digital transformation: An overview of the current state of the art of research*. Sage Open, 11(3). https://doi.org/10.1177/21582440211047576

23. Verhoef, P. C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Dong, J. Q., Fabian, N., & Haenlein, M. (2021). *Digital transformation: A multidisciplinary reflection and research agenda*. Journal of Business Research, 122, 889–901. https://doi.org/10.1016/j.jbusres.2020.09.022

24. Zhao, X., Chen, Q., Yuan, X., et al. (2024). *Study on the impact of digital transformation on the innovation potential based on evidence from Chinese listed companies*. Scientific Reports, 14, 6183. https://doi.org/10.1038/s41598-024-56345-2