Anticipating the future of digital transformation in Algeria

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Amar LOUCIF *

University of Constantine 2 - Abdelhamid Mehri (Algeria), amar.loucif@univ-constantine2.dz

Abstract

Digital transformation is one of the basic pillars in the management of the global economy, and it means obtaining information, processing it and transforming it into knowledge capable of creating added value. Through this article, we aim to anticipate the future of digital transformation in Algeria and the most important driving forces for it. We relied on the forward-looking analytical approach when studying future scenarios for digital transformation in Algeria, as the study concluded that Algeria's performance in the field of digital transformation remains modest, and is dependent on both infrastructure. Digital, human capital, innovation, knowledge and technology, finance, digital security, and the Internet. The study recommends the need to establish an appropriate ground at the national level for digital transformation, whether it is related to the legal aspect, the human aspect and the material and financial capabilities.

Keywords

Digital Transformation;
Innovation;
Technology;
Digital Security;
The Internet.

استشراف مستقبل التحول الرقمي في الجزائر

ملخص

يعد التحول الرقمي من الركائز الأساسية في تسيير الاقتصاد العالمي، ويقصد به الحصول على المعلومات، معالجتها وتحويلها إلى معرفة قابلة لخلق قيمة مضافة. ونهدف من خلال هذا المقال إلى استشراف مستقبل التحول الرقمي في الجزائر وأهم القوى المحركة له، وتم الاعتماد على المنهج التحليلي الاستشرافي عند دراسة السيناريوهات المستقبلية للتحول الرقمي في الجزائر، حيث توصلت الدراسة إلى بقاء أداء الجزائر في مجال التحول الرقمي متواضعا، ومرهون بكل من البنى التحتية الرقمية، رأس المال البشري، الابتكار، المعرفة والتكنولوجيا، التمويل، الأمن الرقمي، والانترنت.

وتوصي الدراسة بضرورة وضع أرضية مناسبة على المستوى الوطني للتحول الرقمي سواء تعلق الأمر بالجانب القانوني، الجانب البشري، الامكانات المادية والمالية.

الكلمات المفتاحية

التحول الرقمي؛
الابتكار؛
التكنولوجيا؛
الأمن الرقمي؛
الإنترنت.

* *Corresponding author. E-mail:* amar.loucif@univ-constantine2.dz
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I- Introduction:

Economic, social, cultural, and technological developments have impacted the economic development process, leading to the emergence of future projects with a global dimension that represent a new trend or economic model, among which is digital transformation.

Digital transformation is an attempt to transition from a physical state to a non-material or digital state across all fields, based on pillars that facilitate engagement with the future through scientific research and technological development. Digital transformation has undergone several stages, beginning with the first industrial revolution and continuing to the fourth industrial revolution, with each stage driven by innovation. The importance of digital transformation can be attributed to its characteristics, benefits, and goals. Although digital transformation aims to achieve economic efficiency, some challenges persist.

Despite the implementation of a national digital transformation strategy to shift Algeria's economy from a rent-based economy to a digital one, the strategy has not achieved the intended goals. Algeria's economic performance in digital transformation remains modest.

Study Problem:

Considering digital transformation as a topic of foresight that influences the future of societies and economies, we pose the following research question:

What is the future of digital transformation in Algeria?

This primary question opens the door to several subsidiary questions:

- What is the meaning of digital transformation?
- What challenges does digital transformation face?
- What are the various scenarios for digital transformation in Algeria?

Study Hypothesis:

The research hypothesis is formulated based on the research problem as follows:

- The future of digital transformation in Algeria is strong.

Study Significance:

The topic of digital transformation holds great importance due to its vital role in promoting economic development. Through digital transformation, Algeria can evolve toward a more diverse and efficient economy. Additionally, digital transformation is a crucial factor for keeping pace with global advancements in technology and economics, thereby enhancing competitiveness at the international level.

Study Objectives:

The study aims to:

- Define the fundamental concepts of digital transformation;
- Attempt to foresee the future of digital transformation in Algeria by describing the state of digital transformation and its driving forces, thereby developing possible scenarios.

Study Methodology:

Our study topic leads us to:

- Rely on the descriptive method, which is valuable in providing a conceptual framework for digital transformation;
- Select a foresight analysis approach to project the future of digital transformation in Algeria.

Study Structure:

To address the research problem, we have divided our study into two sections:

- The conceptual framework of digital transformation;
- Future scenarios for digital transformation in Algeria.

Literature Review:

- *Study by Wahiba Amel and Kara Ibtisam (2022), titled: "Digital Transformation in Algeria: Prospects and Challenges."* This study aimed to highlight digital transformation in Algeria by presenting digital performance indicators at both the infrastructure level and Algeria's position within global and Arab rankings. The study employed the analytical method by examining various numbers and statistical indicators. It concluded that Algeria is making significant strides in digital transformation, though it remains among the lowest in terms of Arab or international indicators.

- *Study by Khaira Chaouchi and Zahra Khelouf (2023), on "Digital Transformation in Algeria."* This study addressed the reality and prospects of digital transformation in Algeria, using a descriptive-analytical method to gather data. It emphasized the need for Algeria to adopt digital transformation across all sectors by providing the necessary infrastructure to facilitate its adoption in all areas.

In comparison with previous studies, our research shares elements of the theoretical framework specific to digital transformation but differs in the practical aspect. Our study describes the state of digital transformation in Algeria, analyzing its driving forces and potential scenarios, unlike previous studies, which focused on the information and communication technologies sector and Algeria's position in global and Arab rankings.

I. I.1. The Conceptual Framework of Digital Transformation:

In this section, we will examine the concept of digital transformation, its developmental stages, characteristics, benefits, objectives, and the challenges it faces.

I. 1.1 The Concept of Digital Transformation and its Developmental Stages:

Through this element, we aim to discuss the concept of digital transformation and its developmental stages.

I. 1.1.1 The Developmental Stages of Digital Transformation:

The scientific chronology of digital transformation begins with the industrial revolution, which sought to minimize human involvement in some activities. Based on this, the developmental stages of digital transformation can be divided into four phases:

- The First Industrial Revolution The industrial revolution emerged in the Western world in the 18th century and in the Arab world during the 19th and 20th centuries. A key feature of this phase was the advancement of industrial machinery, the expansion of its use, and the establishment of large factories **(Al-Sa'ati & Al-Awasa, 2020, p. 18)**. The first industrial revolution was characterized by the steam engine, coal energy, steel, and the textile industry. During this period, classical economists like Adam Smith and David Ricardo excluded intangible production from the factors of production **(Allawwa, 2022, pp. 87-88)**. Some impacts of the industrial revolution during this period include **(Denden, 2021, pp. 22-23)**:
    - A significant shift from reliance on animal power, human muscle, and biomass for energy to the use of mechanical energy and fossil fuels, where machines replaced human physical effort;
    - A decline in traditional production patterns in rural areas and subsequent rural-to-urban migration due to industrial expansion.
- The Second Industrial Revolution The second industrial revolution emerged with the invention of electricity at the start of the 20th century, and thus it is often referred to as the "Electric Revolution" **(Al-Suwaidi, 2020, p. 151)**. This phase was marked by numerous discoveries and significant inventions, such as the internal combustion engine, which revolutionized the transportation industry (e.g., automobiles and airplanes), the transition to petroleum as a primary energy source, the mass production of consumer goods, and the rise of the consumer

society. Needs became more diverse and abundant, with increased competition to satisfy these needs, alongside a recognized need for standardized education and the development of specialization **(Saeed, 2019, p. 25)**.

- The Third Industrial Revolution The third industrial revolution began in the late 20th century, with electronic inventions paving the way for personal computers, remote and wireless communications **(Al-Dulaimi, 2020, p. 77)**. This phase is also known as the "Techno-Information Revolution," as it marked a revolution in new communication technologies for information transmission and a revolution in computers for information processing. The foundation of the information revolution lies in two main factors: the substantial increase and widespread availability of knowledge and information, and the growing importance of knowledge in wealth creation **(Al-Alaq, 2020, p. 331)**.

- The Fourth Industrial Revolution The term "fourth industrial revolution" gained widespread recognition after it was used as the slogan for the 46th World Economic Forum in 2016. The concept of the fourth industrial revolution refers to a new wave of applications grounded in the industrial sector's fourth phase, particularly in advanced fields such as robotics, artificial intelligence, 3D printing, the Internet, nanotechnology, blockchain, quantum computing, and autonomous vehicles, among others. This signifies that the fourth industrial revolution is built on the digital revolution, representing a new trend where technology becomes an integral part of societies **(Al-Bursan, 2022, p. 216)**.

I. 1.1.2 The Concept of Digital Transformation:

To clarify the meaning of digital transformation, it is essential to understand it from different perspectives.

The Linguistic Meaning of Digital Transformation

I. 1.1.3 Digital transformation is composed of two words:

- The term “transformation” in English translates to "Transformation," derived from "Transform." This word consists of two parts and literally means a radical change in form through qualitative shifts **(Al-Salam & Mousa, 2017, p. 1070)**;

- The term “digital” in English translates to "Digital" and in French to "Numérique." Both English and French agree on it as an adjective describing anything that uses numbers to represent quantities, data, or symbols to convey specific content or measure **(Zakia, 2016, p. 22)**.

II- The Economic Implications of Digital Transformation

The economic implications of digital transformation can be illustrated by the perspectives of several thinkers, as follows:

- Economist Bharadjwa defines digital transformation as "the use of digital resources to create economic value."

- Economist Woodard describes it as "a form of deliberate competitive action taken by a company through the provision of digital services."

- Economist Hess sees digital transformation as "the changes that digital technologies can bring to a company’s business model, leading to changes in products, organizational structures, or process automation **(Srinivas, Shankar, & Jyothi, 2021, p. 02)**."

- The Organisation for Economic Co-operation and Development (OECD) defines digital transformation as "the economic and societal impacts resulting from digitization **(Mathilde & Sow, 2021, p. 06)**."

- Economist Klaus Schwab defines digital transformation as "a digital revolution that blends multiple technologies and restructures boundaries between the physical, digital, and biological realms **(Abdel Zaher, 2019, p. 15)**."

Based on these concepts, we can define digital transformation as "the technological shifts across economic and social domains regarding economic business models."

II. 1. Characteristics, Benefits, and Objectives of Digital Transformation

Time and cost management form the starting point in the objectives of digital transformation, with its effectiveness determined by the clarity of its characteristics and benefits.

II. 2.1. Characteristics of Digital Transformation

Digital transformation is characterized by several features, including:

- It is location-independent, no longer limited by geographic or institutional boundaries, relying solely on appropriate digital infrastructure;
- It is productive by nature, compatible with digital readiness and digital citizenship;
- It guides the direction of product or service development and business model evolution **(Luo & Nambisan, 2022, p. 52)**;
- It enables access to information and the ability to convert it into actionable knowledge;
- It supports rapid adaptability by identifying and meeting current and future needs **(Al-Sayed, 2019, pp. 88-89)**.

II. 2.2. Benefits of Digital Transformation

Digital transformation offers numerous advantages, including **(Ghrissi, El-Hachimi, & Al-Absi, 2021, p. 103)**:

- Time and cost control, which enhances the institution's economic efficiency;
- Improved digital innovation through digital technology outputs, allowing for the delivery of high-quality products and services that increase customer satisfaction;
- Enhanced competitiveness within the institution's environment and access to new market shares.

II. 2.3. Objectives of Digital Transformation

The objectives of digital transformation include **(Ghani, 2022, p. 56)**:

- Promoting the development of more innovative and collaborative technological, cultural, and financial systems within institutions and society;
- Reforming the educational system to provide new skills and guide individuals toward future digital work and community excellence;
- Establishing, maintaining, and ensuring access to digital communications infrastructure;
- Strengthening data protection, transparency, and autonomy requirements to build trust;
- Applying innovative business models, and improving the regulatory framework and technical standards.

II. 3. Challenges of Digital Transformation

Digital transformation faces various challenges, including Administrative Challenges, such as **(Al-Sawat & Al-Harbi, 2022, p. 660)**:

- Conceptual Ambiguity: Many governments and organizations still lack a clear understanding of digital transformation, necessitating conceptual clarity and intellectual groundwork;
- Resistance to Change: Implementing digital transformation involves substantial changes at the organizational level, including departments, teams, and the redistribution of roles and responsibilities, which often requires leadership and functional changes. This can lead to resistance from managers and employees.
- Financial Challenges: These refer to the financial resources required to provide information technology, particularly on a national scale. Additionally, digital transformation is constantly evolving, making it difficult to keep up with these advancements.

- Security Challenges: These include cyberattacks, which pose a threat to national information security. The increasing interconnectivity among institutions and the growing reliance of organizations, countries, and communities on digital information and electronic means for storing, transmitting, and displaying information also heighten these security risks.

II. 4. Future Scenarios of Digital Transformation in Algeria

In this section, we will discuss the state of digital transformation in Algeria, its digital infrastructure, and various scenarios for the country's digital transformation.

II. 4.1. Description of Digital Transformation in Algeria

This section aims to describe the state of digital transformation in Algeria by addressing both the national strategy for digital transformation and the digital infrastructure.

II. 4.1.1. National Strategy for Digital Transformation

The national strategy for digital transformation in Algeria aims to improve the governance of public services and the economic sector through interconnectivity and the widespread use of information and communication technology in public services. This strategy has led to the development of 454 operational public services online, along with 178 public services still in progress (Office of the Prime Minister, 2022). The national strategy is focused on the following areas (Office of the Prime Minister, 2022):

- Establishing a favorable environment for digital transformation;
- Developing e-governance and accelerating administrative digitization;
- Creating an ecosystem conducive to the development of the digital economy;
- Promoting digital citizenship.

II. 4.1.2 Digital Infrastructure

The digital transformation in Algeria has been supported by the development of digital infrastructure through the following initiatives:

II. A. Government Data Center Project

The establishment of a government data center aims to meet the current and future needs of public institutions and administrations in terms of organizing, processing, storing, and depositing large volumes of data, ensuring service continuity and data security (Office of the Prime Minister, 2022).

II. B. Establishment of Electronic Certification Authorities

In the field of electronic certification, a national network comprising three authorities has been established:

- Economic Certification Authority (Autorité économique de certification électronique - AECE): Established in 2015, the Economic Certification Authority oversees electronic certification activities for electronic exchanges between companies, between companies and citizens, and between citizens themselves. This authority regulates and monitors electronic certification service providers offering signing and certification services to the public (Economic Authority for Electronic Certification, 2022). Its responsibilities include (Economic Authority for Electronic Certification, 2022):
    - Ensuring fair and genuine competition by taking necessary measures to develop or restore competition among trusted service providers;
    - Issuing licenses to trusted service providers;
    - Approving the certification policies of trusted service providers and ensuring compliance through regular audits;
    - Maintaining expired electronic certificates and data related to their issuance by trusted service providers for possible presentation to competent judicial authorities when required;
    - Ensuring service continuity if a trusted service provider is unable to provide the service;

- Resolving disputes between trusted service providers or between providers and users in accordance with applicable legislation;
- Preparing the terms of reference defining the conditions and methods for performing trusted services and submitting them to the national authority for approval.

– National Electronic Certification Authority (Autorité Nationale Certification Electronique - AGCE): The National Electronic Certification Authority, responsible for issuing electronic certificates, is regulated by Law No. (15-04) of 2015 (Government Authority for Electronic Certification, 2022). This authority employs several tools in its electronic certification policy, with varying levels of assurance, including (Government Authority for Electronic Certification, 2022):
  - Using secure electronic exchange methods, such as receiving a file with a non-encrypted electronic signature through a professional email controlled definitively by the individual attributed with the signature, where the email used is verified through the E-Tawki3 platform;
  - Relying on audit trails specific to the application used for signing, which should include integrity, alongside long-term storage technologies like PDF/A. The E-Tawki3 platform offers features for generating and reviewing workflow evidence reports. Additionally, all document formats uploaded are converted to PDF/A (ISO 19005);
  - Adding a qualified electronic signature of the witness (Witness signature) or an electronic seal witnessing the operation (Eseal witness signature).
– Government Electronic Certification Authority (Autorité Gouvernementale de Certification Electronique - AGCE): Established under Law No. (15-04) of 2015 concerning electronic signatures and certification, the Government Electronic Certification Authority is an administrative entity with legal personality and financial independence. It is responsible for monitoring and overseeing electronic certification service providers offering signing and certification services for government stakeholders specified in Article (2) of Law No. (15-04), including public institutions, self-managed national entities, banks, and social partners (Government Authority for Electronic Certification, 2022), According to Article (28) of Law No. (15-04), its functions include (Government Authority for Electronic Certification, 2022):
  - Developing and overseeing the national policy for electronic certification;
  - Approving the certification policies of trusted service providers and ensuring their compliance;
  - Maintaining expired electronic certificates and data related to their issuance by trusted service providers for possible presentation to competent judicial authorities when required;
  - Issuing electronic certificates with public keys for the national electronic certification authority;
  - Regularly or upon request, providing the national electronic certification authority with information regarding electronic certification activities;
  - Relying on audit records of trusted service providers related to the electronic certification policy.

II. C. Development of the International Digital Data Transport Network

To ensure the security of the international digital data transport network, Algeria has been connected to the global Internet through five international cables, with a capacity of 2.8 terabytes per second since 2021. This development positions Algeria as a nation with significant potential in terms of Internet services (Office of the Prime Minister, 2022).

II. D. Ministry of Knowledge Economy and Startups

The Ministry of Knowledge Economy and Startups has contributed to the development of digital infrastructure by digitizing numerous procedures related to the creation, funding, and support of enterprises. This was achieved through digital platforms such as "startup.dz," which allows startups to obtain the "Startup" label, and "ASF.dz," which enables startups to submit funding applications (Office of the Prime Minister, 2022).

II. E. Higher Education and Scientific Research Sector

Since July 2020, the Higher Education and Scientific Research Sector has worked on digital transformation to keep pace with modern technologies. Three main areas of action have been identified to digitize the sector (Ministry of Higher Education and Scientific Research, 2022):

II. a. Paperless Strategy

This strategy aims to reduce paper usage and consumption by:

- Eliminating paper correspondence between higher education and research institutions, making it 100% online;
- Reducing administrative documents for registration and transfers, in addition to implementing electronic payment for fees;
- Expanding digitalization in scientific research activities.

II. b. Information and Communication Technologies (ICT)

The sector has adopted a distance education approach, leveraging ICT as follows:

- Establishing platforms for aggregating lectures;
- Creating agreements with Internet service providers to facilitate access to these platforms by offering special rates and advantages for users.

II. c. Digital Transformation

The introduction of digital platforms or applications for various uses—such as doctoral positions, certificate authentication, registration, appointment scheduling, and grievance submission—aims to combat bureaucracy.

II. 5. Understanding the Dynamics and Driving Forces of Digital Transformation in Algeria

This section identifies the key variables influencing the future of digital transformation in Algeria, based on a set of indicators from the Arab Digital Economy 2022 report, which covers 22 countries.

II. 5.1. Institutional Index

The following table illustrates the level of digital performance in Algeria according to the Institutional Index for the year 2022.

Table (01): Level of Digital Performance in Algeria Based on the Institutional Index (2022)

Pillar	Indicator	Indicator Value	Ranking
Institutions	Infrastructure	44.6	12
	Regulatory Framework	49.85	
	Ease of Doing Business	55.19	
Total Indicator Value		50.15	

Source: (Arab Federation for Digital Economy, 2022, pp. 201-202)**.**

From the table, we observe that Algeria ranks 12th among Arab countries in the Institutional Index, scoring 50.15 points. This ranking is primarily attributed to the Ease of Doing Business indicator, which scored 55.19 points. This improvement reflects better public service delivery, largely driven by the adoption of information and communication technology (ICT) in public facilities. This is further supported by the values of the Infrastructure and Regulatory Framework indicators, which scored 44.6 and 49.85, respectively.

II. 5.2. Digital Foundations

The following table illustrates the digital foundations in Algeria based on the Infrastructure Index for the year 2022.

Table (02): Digital Foundations in Algeria Based on the Infrastructure Index (2022)

Axis	Pillar	Indicator	Indicator Value	Ranking
Digital Foundations	Infrastructure	Access to Information Technology Services	60.2	8
		Use of Information Technology Services	53	
		Capital Formation as a Percentage of GDP	37.5	
		Logistics Performance	18.6	
Total Indicator Value			42.33	

Source: (Arab Federation for Digital Economy, 2022, pp. 201-202).

The table indicates that Algeria ranks 8th among Arab countries in the Infrastructure Index. This ranking is primarily due to the Access to Information Technology Services indicator, which scored 60.2 points, and the Use of Information Technology Services indicator, which scored 53 points. These indicators are crucial for advancing the digital foundations of the Algerian economy. However, there is a notable weakness in the indicators for Capital Formation and Logistics Performance. Addressing these shortcomings is essential for Algeria to achieve a fully developed digital economy.

II. 5.3. Digital Readiness of Citizens

The following table illustrates the digital readiness of citizens based on the Workforce Index for the year 2022.

Table (03): Digital Readiness of Citizens Based on the Workforce Index (2022)

Axis	Pillar	Indicator	Indicator Value	Ranking
Digital Readiness of Citizens	Workforce	Current Workforce	53	9
		Skills of the Current Workforce	48	
		Future Workforce	65.2	
		Skills of the Future Workforce	50.7	
		Workforce Diversity	72.41	
Total Indicator Value			57.86	

Source: (Arab Federation for Digital Economy, 2022, pp. 201-202).

The table illustrates that Algeria ranks 9th among Arab countries, with a score of 57.86 on the Workforce Index, which is considered a good indicator. This performance can be attributed to the Workforce Diversity Index, with a score of 72.41, and the Future Workforce Index, with a score of 65.2. Conversely, the scores for the Current Workforce, Current Workforce Skills, and Future Workforce Skills are modest, highlighting the need for Algeria to implement reforms in the training and management of human resources. These reforms would enhance its digital readiness to face the challenges of the future workforce.

II. 5.4. Digital Government

The following table demonstrates Algeria's readiness to transition to a digital government in 2022.

Table (04): Algeria's readiness to transition to a digital government in 2022

Axis	Pillar	Indicator	Indicator Value	Rank
Digital Government	Digital Government	Telecommunication Infrastructure Index	57.87	
		Digital Government Services Index	27.65	11
		Human Capital Index	69.66	
Overall Indicator Value			51.73	

Source: (Arab Federation for Digital Economy, 2022, pp. 201-202).

The table shows that Algeria ranks 11th among Arab countries in terms of digital government out of 22 countries, which is considered a good indicator. This ranking can be attributed to the focus on both telecommunication

infrastructure and human capital, as reflected in the respective scores of 57.87 and 69.66. However, there is a noticeable weakness in the Digital Government Services Index, which is primarily due to delays in the operation of the government data center and the ongoing development of certain public services. Therefore, Algeria should prioritize the establishment and development of its government data center.

II. 5.5. Digital Innovation

The following tables illustrate digital innovation in Algeria in terms of innovation, knowledge, and technology for the year 2022.

Table (05): Digital Innovation in Algeria by Innovation Index for 2022

Axis	Pillar	Indicator	Indicator Value	Rank
Digital Innovation	Innovation	Future Orientation of the State	51.52	12
		Multilateral Cooperation	66.67	
		Published Scientific Papers	73.7	
		Patents per Million Population	0.5	
		R&D Expenditure as a Percentage of GDP	11.63	
		Entrepreneurship Culture	52.34	
Overall Indicator Value			43.54	

Source: (Arab Federation for Digital Economy, 2022, p. 203).

Table (06): Digital Innovation in Algeria by Knowledge and Technology Index for 2022

Axis	Pillar	Indicator	Indicator Value	Rank
Digital Innovation	Knowledge and Technology	Quality Certification (ISO 1009)	3.34	12
		Program Expenditure as a Percentage of GDP	0.1	
		ICT Service Exports as a Percentage of Total Trade	3.42	
		Development of New Business Models Using ICT	49.34	
Overall Indicator Value			14.05	

Source: (Arab Federation for Digital Economy, 2022, p. 203).

The two tables indicate the following:

- Algeria ranks 12th among Arab countries in terms of innovation, with a score of 43.54 points. This reflects the Algerian economy's orientation toward innovation and its reliance on scientific research, enabling it to keep pace with digital transformation. Additionally, Algeria facilitates the establishment of businesses, as evidenced by the scores of the following indicators: Future Orientation of the State (51.52 points), Multilateral Cooperation (66.67 points), Published Scientific Papers (73.7 points), and Entrepreneurship Culture (57.24 points). However, there is notable weakness in the indicators for Patents and R&D Expenditure, which is due to limited and inefficient budgets. This necessitates a reconsideration of scientific research budgets, their allocation, implementation, and the promotion of inventions to make them a key factor in digital transformation.
- Algeria also ranks 12th among Arab countries in terms of knowledge and technology, with a score of 14.05 points, which is a weak indicator. This can be attributed to low levels of creativity and innovation, as well as slow growth in information technology. This is confirmed by the scores for the following indicators: Quality Certification (ISO 1009) (3.34 points), Program Expenditure (0.10 points), and ICT Service Exports (3.42 points). On the other hand, the indicator for Developing New Business Models Using ICT stands at 49.34 points, which is due to the state's support, particularly from the Ministry of Knowledge Economy and Startups, in facilitating the creation, funding, and support of businesses through digital platforms.

II. 5.6. Digital Business

The following tables illustrate digital business in terms of market forces and financial market development for 2022.

Table (07): Digital Business by Market Forces Index for 2022

Axis	Pillar	Indicator	Indicator Value	Rank
Digital Business	Market Forces	Ease of Access to Loans	10	12
		Ability to Protect Minority Investors	20	
		Increased Competition at the Local Level	55	
Overall Indicator Value			28.33	

Source: (Arab Federation for Digital Economy, 2022, p. 203).

Table (08): Digital Business by Financial Market Development Index for 2022

Axis	Pillar	Indicator	Indicator Value	Rank
Digital Business	Financial Market Development	Local Credit as a Percentage of GDP	24.3	12
		Financing of Small and Medium Enterprises (SMEs)	69.09	
		Availability of Funding Funds	67.31	
		Market Capitalization	0.2	
		Bank Soundness	59.7	
		Non-performing Loans as a Percentage of Total Loans	76.2	
		Time to Start a Business (Number of Days)	82.9	
		Cost of Starting a Business	94.1	
Overall Indicator Value			59.23	

Source: (Arab Federation for Digital Economy, 2022, p. 203).

From the two tables, the following observations can be made:

- Algeria ranks 12th among Arab countries with a score of 28.33 on the Market Forces Index, which is a weak indicator. This weakness is attributed to the difficulty in accessing loans and the limited ability to protect minority investors, as shown by the respective scores of 10 and 20 points. At the same time, there is an increase in local competition, with a score of 55 points.
- Algeria also ranks 12th among Arab countries with a score of 59.23 on the Financial Market Development Index, which is a good indicator. This performance is reflected in the financing of small and medium enterprises (SMEs), the availability of funding funds, bank soundness, and the cost of starting a business, with respective scores of 69.09, 67.31, 59.7, and 94.10 points. These figures indicate the state's support for SMEs to benefit from digital business, thereby reducing their operational costs and enhancing their competitiveness. However, weaknesses are observed in local credit to the private sector as a percentage of GDP (24.3%), market capitalization in ICT services (0.20), the percentage of non-performing loans (76.20%), and the time required to start a business (82.9 days).

II. 5.7. Sustainable Development Index

The following table presents the Sustainable Development Index for Algeria in 2022.

Table (09): Sustainable Development Index for Algeria in 2022

Axis	Pillar	Indicator	Indicator Value	Rank
Digital Business	Sustainable Development	Eradication of Poverty	96.93	7
		Zero Hunger	56.56	
		Good Health and Well-being	75.57	
		Quality Education	91.21	
		Decent Work and Economic Growth	62.2	
		Industry, Innovation, and Infrastructure	45.4	
		Partnerships for the Goals	74.1	
Overall Indicator Value			71.71	

Source: (Arab Federation for Digital Economy, 2022, p. 203).

The table indicates that Algeria ranks 7th among Arab countries, with a score of 71.71 on the Sustainable Development Index. This ranking reflects Algeria's progress in achieving the sustainable development goals, including poverty eradication, zero hunger, good health and well-being, quality education, decent work and economic growth, and partnerships for achieving these goals. The respective scores for these indicators are as follows: 96.93, 56.56, 75.57, 91.21, 62.20, and 74.10 points. However, the Industry, Innovation, and Infrastructure Index is 45.4 points, highlighting the need for Algeria to reconsider this indicator and emphasize it as a driver for digital transformation.

Based on the previous indicators, it can be concluded that digital transformation in Algeria depends on the following factors: digital infrastructure, human capital, innovation, knowledge and technology, investment in scientific research and technological development, the facilitation, funding, and monitoring of IT companies, internet access, and digital security.

II. 6. Various Scenarios for Digital Transformation in Algeria

Digital transformation in Algeria faces the following scenarios:

II. 6.1. Possible Scenario: The potential success of the digital transformation project in Algeria

this scenario reflects the likelihood of success for the digital transformation project, supported by sufficient indicators within the Algerian economy, including (ESCWA (Economic and Social Commission for Western Asia), 2021):

- Clear political will expressed by the state;
- A strong legal environment keeping pace with developments in information and communication technologies (ICT);
- Expansive and continuously updated digital infrastructure;
- Qualified human resources prepared for digital transformation;
- Financial resources allocated for ICT development;
- International cooperation in ICT, based on mutual benefit.

II. 6.2. Probable Scenario: The absence of a mechanism to protect information systems threatens the success of the digital transformation project

The absence of mechanisms for information system security is a probable risk that could lead to the failure of the digital transformation project, due to (African Union, 2022):

- Incidents, threats of electronic breaches, and the spread of viruses and malware;
- Lack of awareness campaigns about digital security for both individuals and businesses;
- Rising costs of cybercrime;

- Workforce shortages in the field of digital security;
- The increase in digital business activities, resulting in difficulties managing the volume of data flows, particularly personal data.

II. 6.3. Preferred Scenario: Transition from a rentier economy to a digital economy

This scenario represents the desired direction for Algeria's economic development, though its realization faces significant constraints. To achieve this, Algeria must (United Nations, 2018, pp. 89-92):

- Develop a forward-looking digital plan at both national and regional levels to promote the digital economy;
- Involve the private sector in the transition to a digital economy;
- Improve internet speed and availability while addressing connectivity fluctuations;
- Open new markets for the digital economy;
- Facilitate access to adequate financing for entrepreneurs in the IT sector;
- Increase investment in scientific research and technological development;
- Strengthen the protection of intellectual property rights and enforce effective competition laws in the IT sector;
- Enact legislation to protect personal data.

III– Conclusion:

Digital transformation is one of the fundamental pillars for accelerating economic development, serving as a tool for acquiring information and converting it into actionable knowledge that transcends geographical and institutional boundaries. Digital transformation plays a crucial role in enhancing economic efficiency by optimizing time and costs in the context of globalization, international economic blocs, and the rapid advancements in information and communication technology (ICT). For digital transformation to succeed, robust infrastructure is essential, including legal frameworks, human resources, financial and material capabilities, and internet connectivity.

Algeria's adoption of a national digital transformation strategy aims to provide suitable infrastructure for this transition. This includes establishing a government data center, electronic certification authorities, the Ministry of Knowledge Economy and Startups, securing the international data transport network, and digitizing the higher education and scientific research sector. These initiatives are expected to foster a digital economy that supports economic growth.

Despite Algeria's efforts in the realm of digital transformation, its performance remains modest. The challenge lies in the necessity of transitioning to a digital economy by reevaluating key areas such as innovation, invention, information technology, knowledge, and technology, as well as addressing the shortcomings in financing and research. Maintaining and strengthening infrastructure and the workforce is essential for future adaptability, particularly in response to technological advancements.

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