Educational Administration: Theory and Practice
2024, 30(10), 233-241
ISSN: 2148-2403
https://kuey.net/

Research Article

Evolution of E-Government in North African Countries: An Analytical Study for the Period (2016-2022)

Azeddine Ghobch[1*], fatimazohra Settou[2]

[1*]University of El oued, Algeria, Ghobch-azeddine@univ-eloued.dz
[2]University of El Oued, Algeria, Settou-fatimazohra@univ-eloued.dz

Citation: Azeddine Ghobch, et.al (2024), Evolution of E-Government in North African Countries: An Analytical Study for the Period (2016-2022), *Educational Administration: Theory and Practice*, 30(10), 233-241
Doi: 10.53555/kuey.v30i10.8074

ARTICLE INFO

Article Submitted: July 23, 2024
Accepted for Publication: October 114, 2024
Article Published Online: October 17, 2024

ABSTRACT

This study aims to assess the progress of North African governments (Algeria, Morocco, Tunisia, and Egypt) in implementing e-governance and the key achievements made during the period from 2016 to 2022, based on the E-Government Development Index (EGDI) and its sub-indices (Online Service Index - OSI, Human Capital Index - HCI, and Telecommunication Infrastructure Index - TII). To conduct this study, we employed the descriptive method to define e-government and the EGDI, the analytical method to analyze the results of the e-government development indicators, and the comparative method to compare the rankings of countries both in Africa and globally based on the different indices. The results indicate that Tunisia leads North African countries in terms of e-government development, being the only African country to achieve an EGDI value that exceeded the global average of (0.6102) in Africa in 2022. Tunisia is followed by Morocco, Egypt, and Algeria in last place. Additionally, North African countries remain far behind global levels in e-government services, highlighting the need for these countries to intensify efforts to achieve their desired goals and reach higher levels of e-governance, which would ultimately improve public services and promote economic growth and development.

Keywords: E-Government, Online Service Index, Human Capital Index, Telecommunication Infrastructure Index.

Introduction:

In recent decades, the world has witnessed rapid technological developments that have impacted various fields of life, as well as the evolution and development of business and service methods, including electronic services. E-business models have been widely adopted, and governments have also embraced the Internet and benefited from information and communication technology (ICT). The past decades have been characterized by a global trend towards deepening the use of modern tools in administrative work and communication, especially since government work in many countries is often marked by lengthy routine procedures, requiring significant time and effort.

The term "e-government," which emerged at the end of the 1990s, has become a practiced reality in many countries. E-government applications have become one of the most prominent contemporary fronts of information technology, responsible for economic growth and sustainable human development. However, countries' experiences in this area have varied: some have made significant strides, others have shown notable progress, while some are still in the early stages of realizing e-government.

Like other countries around the world, North African nations have made efforts to keep pace with this scientific movement in improving the services provided to citizens and all societal actors, regardless of their social and economic roles. E-government serves as a gateway to meeting citizens' needs and a service platform that provides access to a vast array of citizen data, used within a framework of legitimacy and reliability.

Based on the above and in light of the efforts made and the current state of services provided within the framework of e-governments in North African countries, the main research problem of this study is focused on the following central question:

To what extent has e-government developed in North African countries (Algeria, Tunisia, Morocco, and Egypt) during the period (2016-2022)?

In light of the main question, the following sub-questions arise:

- What is meant by e-government, and what are its implementation requirements?
- What are the main obstacles to implementing e-government?
- What is the concept of the E-Government Development Index, and what are its main components?
- What is the current state of e-government in North African countries?

Study Objectives:

This study aims to:

- Provide a definition of e-government through various definitions;
- Identify the requirements, possibilities, and challenges of implementing e-government;
- Address the E-Government Development Index according to the United Nations model and its subcomponents;
- Assess the current state of e-government in North African countries.

Importance of the Study:

The importance of this study stems from the significance of e-government for governmental and non-governmental organizations and researchers in this field. It raises various approaches to adopting this technology, which offers a new gateway for improving the overall status of a country. This study also derives its importance from its quantitative analysis of the E-Government Development Index and its subcomponents for North African countries, as well as their ranking in Africa, the Arab world, and globally. The comparison between these countries could help guide policymakers and decision-makers in the right direction.

Study Methodology:

This study relies on descriptive and analytical methodologies to present and describe the phenomenon, along with the comparative method to compare the E-Government Development Index across North African countries. The study utilizes data available from the United Nations database and the UN E-Government Reports for the period (2016-2022).

Chapters of the Study:

To address the research problem and sub-questions, the study is divided into the following chapters:

Chapter One: Theoretical Framework of E-Government (E-Government)

Chapter Two: E-Government Development Index (EGDI) According to the United Nations Model

Chapter Three: Evaluation of E-Government in North African Countries

Chapter One: Theoretical Framework of E-Government (E-Government)

The concept of e-government first appeared in the late 1990s, and since then, it has garnered increasing attention from governments around the world, both developed and developing (Molna, A., Janssen, M., & Weerakkody, V., 2015, P 160). Researchers, specialists, and stakeholders have also shown growing interest. Over time, the concept of e-government has expanded to be used not only as an application of ICT but also as a crucial tool for managing public services worldwide (Alguliyev, R., & Yusifov, F., 2015, P 29).

First: Concept of E-Government

Numerous definitions of e-government have been proposed, reflecting its complexity and the differing viewpoints surrounding it. Some of the most notable definitions include:

- The United Nations defines e-government as "a permanent commitment by the government to improve the relationship between the private and public sectors through the enhanced, efficient, and cost-effective delivery of services, information, and knowledge" (Shin Y.-J., & Kim, S.T, 2008, P 33).
- The World Bank defines it as "systems owned or operated by the government for ICT that transform relationships with citizens, the private sector, and/or other government agencies to empower citizens, improve service delivery, enhance accountability, increase transparency, and improve government efficiency" (Ndou, V., 2004, P 04).
- The International Telecommunication Union (ITU) defines e-government as "the use of ICT in government to deliver public services, improve administrative efficiency, and promote democratic values, as well as acting as a regulatory framework that facilitates intensive information initiatives and fosters a knowledge-based society" (ITU, 2009, P 01).
- According to a specialized institute, e-government refers to "the ability of various government sectors to deliver traditional government services and information to citizens electronically, with faster methods, lower costs, and effort, and at any time, through the internet" (Ben Saghir Abdelmoumen, 2016).
- Gartner defines e-government as "a government designed and operated to leverage digital data to improve, transform, and create government services" (World Bank Group, 2016, P 12).

In summary, e-government generally refers to the use of the internet and other digital tools by the public sector to deliver services in a way that facilitates operations and provides high-quality services to citizens, fostering

innovation in all aspects of public service. Thus, e-government is a modern, advanced form of management aimed at enhancing administrative performance, improving the work environment, and facilitating all services offered by governmental institutions to citizens, allowing them to complete governmental transactions and even issue official documents electronically with speed and high efficiency.
From the previous definitions, it is clear that e-government is characterized by several key features, which enable it to provide the best possible services, including (Mohammed, 2016, P 28):

- Consolidation of all informational activities and services on a single platform, the official government website;
- Achieving speed and efficiency in linking, coordinating, performing tasks, and executing within and across government departments;
- Providing continuous access to citizens, available 24/7 every day of the year;
- Meeting all informational and service needs of citizens;
- Reducing costs in all elements and achieving better returns from commercially viable government activities;
- Reducing paperwork and enhancing transparency in dealings;
- Overcoming geographical barriers and obstacles related to population, skills, knowledge, and the ability to pay for services.

Second: Importance and Objectives of E-Government

E-government is expected to achieve several goals due to its significance.
A. Importance of E-Government: The importance of e-government lies in the following advantages:

- Increasing transaction speed;
- Reducing costs by minimizing the number of employees;
- Enhancing citizen relationship management efficiency;
- Raising citizen satisfaction when interacting with electronic platforms;
- Reducing bureaucratic procedures as e-government operates continuously (Hamed, 2015, P 199-200);
- Providing easier access to services through computers for all types of users, whether citizens, investors, or others;
- Alleviating issues caused by direct interaction with inexperienced or moody employees;
- Relying on a lean, efficient electronic network rather than a cumbersome hierarchical one (Radwan, 2012, P 27).

B. Objectives of E-Government: The main objectives that can be achieved through e-government include (Ben Aichouba, 2018, P 67-68):

- Improving performance levels by enabling accurate information transfer between government departments, reducing duplication in data entry, and obtaining information from business sectors and citizens;
- Increasing data accuracy by accessing information from the original input source;
- Optimizing the use of human resources by directing personnel to more productive tasks;
- Enhancing productivity and reducing operational costs through better methods of citizen participation in the implementation process;
- Raising employee performance efficiency through the use of ICT and transforming organizational culture;
- Keeping pace with technological development, benefiting citizens, and simplifying procedures in governmental and non-governmental organizations;
- Supporting economic growth by providing a suitable economic infrastructure to support e-government applications.

Third: Requirements for Implementing E-Government

The successful implementation of e-government requires a set of foundational prerequisites. In this section, we summarize several perspectives offered by researchers on the matter (Salhi et al., 2022, pp. 360-361):

- **Political Will:** The leadership of the state plays a crucial role in initiating the transition from traditional government to e-government. This requires actual commitment, a comprehensive strategic vision, and the establishment of a political, economic, social, legal, and technological environment that supports this transformation.
- **Administrative Requirements:** Effective implementation of e-government demands good management that supports and drives development and change. This includes restructuring organizational culture, modernizing administrative methods, eliminating bureaucracy, and simplifying procedures to facilitate interactions with various entities.
- **Qualified Human Resources:** The implementation of e-government requires skilled and trained human resources. This includes not only service providers or administrators but all stakeholders, achieved through necessary social awareness of e-government culture and its requirements.
- **Information and Communication Infrastructure:** A suitable technical infrastructure is essential for implementing e-government. This includes providing appropriate hardware, software, and ensuring internet

access for all, as well as developing wired and wireless communication networks. Cybersecurity and data protection are also critical.

- **Legislative and Legal Requirements:** Digital government requires comprehensive legislative readiness. With new terms, concepts, and practices emerging—such as electronic signatures, digital currencies, and credit cards—countries must enact new legislation to ensure that digital government operations are conducted within a legal framework.

Fourth: Stages of E-Government Implementation

The 2002 European e-government plan for European Union member states outlines four stages for the implementation of e-government projects (Al-Aboud, 2009, pp. 39-40):

- **Transformation:** Public sector data must be immediately available on the network, requiring a certain level of trust to share important information.
- **Interaction:** The network must become more efficient and faster by creating advanced networks and utilizing the latest information network technologies.
- **Transaction:** The difference in cost between traditional and electronic transactions becomes evident, as e-government transactions rely on speed, accuracy, and savings in both time and resources.
- **Integration:** This is the peak stage, where information is instantly available on the network, allowing the public to interact with and respond to the e-government in real-time by completing all transactions digitally.

Fifth: Challenges of Implementing E-Government

The transition to e-government faces several obstacles and challenges (Mohammed, 2016, pp. 44-46):

- **Administrative Challenges:** The transition to e-government changes the relationship between the government and its internal and external environment, necessitating a redesign of administrative processes. Challenges include the absence of change management, unclear vision, and weak planning and future forecasting.
- **Technical Challenges:** Building the basic infrastructure and providing the required technology requires significant financial investment, and there is often a lack of expertise in advanced technologies.
- **Information Security Challenges:** Rapid technological advances have created security vulnerabilities, leading to threats such as hacking, hostile websites, piracy, espionage, and unethical practices in the digital environment.
- **Knowledge Challenges:** Many citizens lack knowledge of modern information technologies, which hinders their ability to use these technologies. Addressing this gap requires time and effort to educate the public.

Chapter Two: E-Government Development Index (EGDI) According to the United Nations Model

The United Nations E-Government Development Index (EGDI), published biennially by the UN's Department of Economic and Social Affairs, is the only global report that assesses the state of e-government in all UN member states. The first UN report on e-government was published in 2001. The index evaluates 193 countries and provides policymakers with a tool to identify strengths and opportunities for improvement in e-government, guiding policies and strategies (Moshri and Lammour, 2022, p. 226).

First: Definition of the E-Government Development Index (EGDI)

The EGDI is a composite index designed to measure the performance of e-government in all UN member states relative to one another. The index is built by collecting data on e-government development for each country, focusing on three key dimensions that allow people to benefit from services and information via the internet: the adequacy of telecommunications infrastructure, the capacity of human resources to enhance and use ICT, and the availability of online services and content (Bannoun & Bousaadia, 2022, p. 1510).

Thus, this index is used to assess the readiness and ability of national institutions and other public bodies to use ICT to deliver public services. It enables government officials, policymakers, researchers, civil society representatives, and the private sector to understand a country's relative standing in using e-government to provide public services.

Second: Components of the E-Government Development Index (EGDI)

The overall composite E-Government Development Index (EGDI) is made up of three sub-indices: the Online Service Index (OSI), the Telecommunication Infrastructure Index (TII), and the Human Capital Index (HCI). Each of these sub-indices is composed of various partial indicators. Below is an explanation of how each of these sub-indices is constructed (Arar & Khalifi, 2021, p. 58):

- **Online Service Index (OSI):**

This index is based on data collected from the UN Department of Economic and Social Affairs' survey on e-services, which aims to assess national online presence by measuring the availability of services and content across the internet in UN member states. This index consists of four levels of service maturity:

- **Level 1:** Emerging information services (providing information);
- **Level 2:** Enhanced information with policies and laws;

- **Level 3:** Transactional services, including two-way interaction (government–citizen);
- **Level 4:** The most advanced level of online services.

- **Human Capital Index (HCI):**

Based on data provided by UNESCO and the United Nations Development Program (UNDP), this index measures the capacity of human resources to promote and use ICT. It consists of four sub-components:

- Adult literacy rate;
- Gross enrollment ratio in education;
- Expected years of schooling;
- Average years of schooling. The last two components have been used since 2014, and the source of the data is UNESCO's Institute for Statistics.

- **Telecommunication Infrastructure Index (TII):**

This index, based on data from the International Telecommunication Union, measures the adequacy of telecommunications infrastructure. It consists of four sub-components:

- Percentage of internet users;
- Mobile-cellular subscriptions per 100 inhabitants;
- Active mobile-broadband subscriptions per 100 inhabitants;
- Fixed-broadband subscriptions per 100 inhabitants.

Third: Method for Calculating the E-Government Development Index (EGDI)

Mathematically, the EGDI is the weighted average of the normalized scores of the three sub-indices: the Online Service Index (OSI), the Telecommunication Infrastructure Index (TII), and the Human Capital Index (HCI). It is expressed by the following formula (Yessad & Bouznane, 2016, p. 59):

$$EGDI = \frac{1}{3}(OSI\ normalised + TII\ normalised + HCI\ normalised)$$

The EGDI is used as the main index for ranking countries. It is a composite index, with values ranging from 0 to 1. Countries are classified into one of four groups based on their EGDI score:

- **Very high:** EGDI values between 0.75 and 1;
- **High:** EGDI values between 0.50 and 0.7499;
- **Medium:** EGDI values between 0.25 and 0.4999;
- **Low:** EGDI values between 0 and 0.2499.

Chapter Three: Evaluation of E-Government in North African Countries

This chapter evaluates the level of e-government in North African countries from 2016 to 2022, comparing them with leading countries globally. The evaluation uses the United Nations' model for measuring the development of e-government in member countries. Before discussing the evaluation, we will first provide an overview of Algeria's e-government project to understand the country's policy on adopting and activating digitization at the national level through its various institutions.

First: The Position of North African Countries According to the United Nations Report for the Period (2016-2022)

Like other countries, North African nations have worked to improve and develop their government services through electronic applications, aspiring to rank among the leading countries in Africa and the world. Their global rankings are determined based on the EGDI values, as reported in the United Nations Department of Economic and Social Affairs' reports for the period (2016-2022). The following table provides an overview:

Table 1: Ranking of North African Countries According to the E-Government Development Index (EGDI) for the Period (2016-2022)

Year	EGDI Value/Rank	Tunisia	Morocco	Egypt	Algeria
2016	EGDI Value	0.5682	0.5186	0.4594	0.2999
	EGDI Rating	High	High	Medium	Medium
	North Africa Rank	1	2	3	4
	Africa Rank	2	4	7	24
	Global Rank	72	85	108	150
2018	EGDI Value	0.6254	0.5214	0.4880	0.4227
	EGDI Rating	High	High	Medium	Medium
	North Africa Rank	1	2	3	4
	Africa Rank	3	6	8	14
	Global Rank	80	110	114	130
2020	EGDI Value	0.6526	0.5729	0.5527	0.5173
	EGDI Rating	High	High	High	High

Year	EGDI Value/Rank	Tunisia	Morocco	Egypt	Algeria
	North Africa Rank	1	2	3	4
	Africa Rank	4	7	9	13
	Global Rank	91	106	111	120
2022	EGDI Value	0.6530	0.5915	0.5895	0.5611
	EGDI Rating	High	High	High	High
	North Africa Rank	1	2	3	4
	Africa Rank	4	5	6	9
	Global Rank	88	101	103	112

Source: Compiled by the researchers based on the UN e-government knowledge base for the years (2016-2022).

From the table, we observe the following:

• **Tunisia** consistently ranked first among North African countries in the EGDI during the seven-year period from 2016 to 2022. It placed second in Africa in 2016, third in 2018, and fourth in 2020 and 2022. Globally, Tunisia ranked 72nd in 2016, 80th in 2018, 91st in 2020, and 88th in 2022. Although its EGDI rating was always classified as "high," its global ranking fluctuated, with its best ranking in 2016 and its worst in 2020. Despite improvements in 2022 compared to 2020, Tunisia's ranking did not return to its 2016 or 2018 levels.

• **Morocco** ranked second after Tunisia among North African countries in the EGDI from 2016 to 2022. Its African rankings were fourth in 2016, sixth in 2018, fifth in 2020, and seventh in 2022. Globally, Morocco ranked 85th in 2016, 110th in 2018, 106th in 2020, and 101st in 2022. Its EGDI rating remained consistently "high," but its global ranking fluctuated, with its best ranking in 2016 and its worst in 2018, before improving between

• **Egypt** ranked third after Tunisia and Morocco in the E-Government Development Index (EGDI) over the past seven years from 2016 to 2022. In Africa, Egypt ranked seventh in 2016, eighth in 2018, ninth in 2020, and sixth in 2022. Globally, its rankings among the 193 UN member states were 108, 114, 103, and 111 for the years 2016, 2018, 2020, and 2022, respectively. The index evaluation was consistently rated as "high" by UN standards, with values increasing over time. However, Egypt's global ranking fluctuated, with its worst ranking in 2018. Its best global ranking came in 2022, where it ranked 103rd.

• **Algeria** ranked last, fourth among North African countries from 2016 to 2022 in the EGDI. It was ranked 24th in Africa in 2016, 14th in 2018, 13th in 2020, and 9th in 2022, which marked its best ranking, as it entered the top 10 African countries in the E-Government Development Index for the first time. Globally, Algeria ranked 150th, 130th, 120th, and 112th in 2016, 2018, 2020, and 2022, respectively. Its index evaluation was always rated as "high" by UN standards, with values improving over time. Algeria's weak online presence compared to Tunisia, Morocco, and Egypt can be attributed to the lack of high-quality government websites and applications, as well as insufficient government information available online for both current and potential users. Additionally, the failure of the "Algeria Electronic" project (2008-2013) reflected Algeria's poor performance in this indicator, both globally and regionally. Despite its continuous improvement from 150th in 2016 to 112th in 2022, a 38-rank improvement, Algeria remains far from achieving the desired goals compared to leading countries globally.

From the above, it becomes clear that although North African countries have worked toward developing their e-governments, the results have been inconsistent, and they remain among the lagging countries in e-government development compared to global leaders. These leading countries, classified as "very high" in the E-Government Development Index, had scores exceeding 0.75. For example, in 2022, Denmark ranked first globally with an EGDI value of 0.9717, Finland ranked second with a value of 0.9533, and South Korea ranked third with a value of 0.9529. Notably, the United Arab Emirates is a leading country in this field, achieving a "very high" score of 0.9010 in 2022, ranking 13th globally, first in the Arab world, and third in Asia after South Korea and Singapore.

In contrast, the North African countries of Morocco, Egypt, and Algeria did not surpass the global average EGDI value of 0.6102, with the exception of Tunisia, which is one of the leading countries regionally, exceeding the global average and achieving advanced ranks in Africa alongside South Africa, Mauritius, and Seychelles. For example, South Africa ranked first in Africa according to the 2022 index, with a value of 0.7457, placing it 65th globally. Mauritius ranked second with a value of 0.7201, placing it 75th globally, while Seychelles ranked third in Africa with a value of 0.6793, placing it 85th globally (Digital Government Africa 2024, 2024).

These outcomes can be attributed to the vision and strategy of these countries for developing their e-governments. In South Africa, the National Development Plan included a vision for e-government and a roadmap for 2030. In Mauritius, the Ministry of Information and Communication Technology collaborated with the business sector to align the digital government transformation with the public sector's business transformation strategy, given that the private sector has been at the forefront of digital transformation in Africa for several years. In Seychelles, the government works with communication services to expand internet access to as many citizens as possible.

A detailed assessment of the three sub-indices (online services, human capital, and telecommunications infrastructure), which make up the main E-Government Development Index (EGDI), can be provided based on the UN reports for the years 2016-2022 to understand the contribution of each factor for each country.

Second: Evaluation of the Online Service Index (OSI)

The Online Service Index (OSI) is one of the three sub-indices that form the overall E-Government Development Index (EGDI). It measures the extent to which governments use information and communication technology (ICT) to deliver public services at the national level. The following table shows the growth and development of this index for North African countries between 2016 and 2022:

Table 2: Online Service Index (OSI) for the Years (2016-2022)

Country	Year	Tunisia	Morocco	Egypt	Algeria
	2016	0.7174	0.7391	0.4710	0.0652
	2018	0.8056	0.6667	0.5347	0.2153
	2020	0.6235	0.5235	0.5706	0.2765
	2022	0.6031	0.4721	0.5730	0.3743

Source: Prepared by the researchers based on the United Nations E-Government Knowledge Base for the years (2016-2022).

From the table above, we can observe the following:

- In **2016**, Morocco led North African countries according to the OSI value, followed by Tunisia in second place, both with high scores exceeding 0.5. Egypt had a medium score, while Algeria ranked last with a low score below 0.25.
- In **2018**, Tunisia ranked first among North African countries with a very high OSI value exceeding 0.75, followed by Morocco in second place with a high score exceeding 0.5. Egypt also had a high score, while Algeria remained last with a low score below 0.25.
- In **2020**, Tunisia maintained its lead in the OSI, followed by Egypt in second place, then Morocco in third, all with high scores. Algeria, however, ranked fourth and last among these countries with a medium score above 0.5.
- In **2022**, Tunisia again led North African countries in the OSI, followed by Egypt in second place, both with high scores above 0.5. Morocco ranked third with a medium score, and Algeria ranked fourth and last with a medium score as well.

Third: Evaluation of the Human Capital Index (HCI)

The Human Capital Index (HCI) is the second sub-index of the overall E-Government Development Index (EGDI). It consists of four partial indicators: the adult literacy rate, the gross enrollment ratio at primary, secondary, and post-secondary levels, expected years of schooling, and average years of schooling. The following table shows the development of this index for North African countries during the period from 2016 to 2022:

Table 3: Human Capital Index (HCI) for the Years (2016-2022)

Country	Year	Tunisia	Morocco	Egypt	Algeria
	2016	0.6367	0.4737	0.6048	0.6412
	2018	0.6640	0.5278	0.6072	0.6640
	2020	0.6974	0.6152	0.6192	0.6966
	2022	0.6911	0.6350	0.6375	0.6956

Source: Prepared by the researchers based on the United Nations E-Government Knowledge Base for the years (2016-2022).

From the table above, we observe the following:

- **In 2016:** Algeria ranked first among North African countries in terms of the Human Capital Index (HCI), followed by Tunisia in second place, Egypt in third place—all with a high index value exceeding 0.6—and Morocco in fourth and last place with a medium index value below 0.5.
- **In 2018:** Both Algeria and Tunisia ranked first in North Africa, sharing the same HCI value of 0.6640. Egypt came in third, and Morocco ranked last. The Human Capital Index that year was rated high, exceeding 0.6 in all the concerned countries.
- **In 2020:** Tunisia ranked first in North Africa in terms of the HCI, with Algeria dropping to second place, followed by Egypt in third, and Morocco in fourth and last place. All countries had a high HCI value exceeding 0.6.

• **In 2022:** Algeria returned to first place in North Africa in terms of the HCI, with Tunisia dropping to second place, followed by Egypt in third, and Morocco in last place. The HCI value was high for all countries, exceeding 0.6. Algeria's lead in the Human Capital Index reflects the country's efforts in providing free and widespread education, along with its policies to combat illiteracy, demonstrating the awareness of both the state and its citizens regarding the importance of education and training.

Fourth: Evaluation of the Telecommunication Infrastructure Index (TII)

The Telecommunication Infrastructure Index (TII) is the second sub-index of the overall E-Government Development Index (EGDI). The TII value ranges from 0, indicating weak telecommunications infrastructure, to 1, indicating strong infrastructure. The following table shows the development of the TII in North African countries from 2016 to 2022:

Table 4: Telecommunication Infrastructure Index (TII) for the Years (2016-2022)

Country	Year	Tunisia	Morocco	Egypt	Algeria
	2016	0.3476	0.3429	0.3025	0.1934
	2018	0.4066	0.3697	0.3222	0.3889
	2020	0.6369	0.5800	0.4683	0.5787
	2022	0.6646	0.6676	0.5579	0.6133

Source: Prepared by the researchers based on the United Nations E-Government Knowledge Base for the years (2016-2022).

From the table above, we observe the following:

• **In 2016:** Tunisia led North African countries in terms of the TII value, followed by Morocco in second place, Egypt in third, and Algeria in fourth and last place. All North African countries had a medium TII value, not exceeding 0.4.

• **In 2018:** Tunisia maintained its lead, followed by Algeria in second place, Morocco in third, and Egypt in fourth and last place. All countries continued to have medium TII values, not exceeding 0.4.

• **In 2020:** Tunisia remained in first place, followed by Morocco in second place, and Algeria in third, all with high TII values exceeding 0.5. Egypt ranked fourth and last with a medium TII value below 0.5.

• **In 2022:** Morocco took the lead in North Africa in terms of the TII value, followed by Tunisia in second place, Algeria in third, and Egypt in last place. All countries had high TII values exceeding 0.5.

Conclusion:

This study examined the state of adoption and implementation of e-government applications and technologies in North African countries (Tunisia, Morocco, Egypt, and Algeria) during the period from 2016 to 2022, using the United Nations E-Government Development Index (EGDI) and its sub-indices. The key findings of the study are as follows:

• Tunisia is the only North African country that exceeded the global average value of the E-Government Development Index, set at 0.6102 for Africa. Tunisia achieved its highest EGDI value of 0.6530 in 2022.

• Tunisia leads North Africa in terms of e-government development from 2016 to 2022 and has the highest values for the sub-indices (online services and telecommunications infrastructure) compared to the other North African countries.

• Algeria ranked last in North Africa in terms of e-government development from 2016 to 2022.

• Algeria had the lowest value for the Online Service Index (OSI) during the study period (2016-2022).

• Algeria ranked first in North Africa for the Human Capital Index (HCI) from 2016 to 2022.

• Morocco had the lowest Human Capital Index value compared to the other North African countries from 2016 to 2022.

• Egypt had the weakest telecommunications infrastructure compared to the other North African countries, ranking last from 2018 to 2022, except in 2016 when Algeria ranked last according to this index.

• North African countries are generally lagging in terms of online services, human capital development, and telecommunications infrastructure. Therefore, these countries need to make greater efforts to achieve their goals and reach higher levels of e-government, which will ultimately improve public services and promote economic growth and development.

Recommendations:

Based on the study's findings, we can propose several recommendations to enhance the development of e-government in North African countries:

• Develop a strategic plan to transform all government services into electronic services;

• Implement comprehensive automated connectivity among various state entities by creating electronic platforms;

• Increase information awareness by fostering collaboration between civil society organizations and government entities to bridge the digital divide, thereby achieving an informed society and enhancing citizen trust in the state's procedures, vision, and plans;
• Organize specialized workshops and awareness sessions on digital transformation to train and qualify human resources, build capacity, and develop skills to ensure the provision of the best services at the highest level;
• Encourage investment in telecommunications infrastructure by involving various stakeholders in both the public and private sectors;
• Promote the use of information and communication technology across all state institutions to improve institutional performance, enhance operational efficiency, and increase effectiveness and productivity with the goal of developing services, making them easily accessible at lower costs, higher efficiency, and faster delivery;
• Increase the number of telecommunications companies in the country and support them to foster effective competition, ensuring that electronic services in the country are elevated to the highest standards;
• Expand telecommunications infrastructure and offer new and improved communication services of high quality to consumers in both fixed and mobile telecommunications markets, as well as internet services;
• Urge the legislative authority to address shortcomings in laws and regulations, such as rules of evidence, authenticity, and credibility. Activating e-government requires a suitable legal and regulatory environment.

References:

1. Alguliyev, R., & Yusifov, F. (2015). *Challenges in E-Government Conceptual Approaches and Views*. The Ninth International Conference on Digital Society. Lisbon, Portugal.
2. Digital Government Africa 2024. (2024). *E-Government Development in Africa*: https://africa-digital.com/2024/e-government-for-africa/. Consulted on: 20/07/2024, 10:47.
3. ITU. (2009). *E-Government Implementation Toolkit*. Geneva: International Telecommunication Union.
4. Molna, A., Janssen, M., & Weerakkody, V. (2015). *E-Government Theories and Challenges: Findings From a Plenary Expert Panel*. The 16th Annual International Conference on Digital Government Research. New York, United States: Association for Computing Machinery.
5. Ndou, V. (2004). *E-Government for Developing Countries: Opportunities and Challenges*. Electronic Journal on Information Systems in Developing Countries.
6. World Bank Group. (2016). *Digital Government 2020: Prospects for Russia*. Washington: World Bank Group and Institute of the Information Society.
7. Y. J., & Kim, S. T. Shin. (2008). *E-Government Concept, Measures, and Best Practices*. New York: Information Science Reference.
8. Ben Sghir, A. (2016). *The Challenge of Implementing E-Government in Algeria: Obstacles and Prospects*. Available at: http://democratic.de/?p=38171. Consulted on: 15/07/2024, 17:42.
9. Ben Aichouba, R. (2018). *E-Government Development in Arab Countries*. (University of Djilali Bounaama) Journal of New Economics, 02(09), 64-79.
10. Bennoun, K., & Bousaadia, M. (2022). *An Analysis of the E-Government Development Index (EGDI) for the Maghreb Countries: A Comparative Study: Algeria, Tunisia, and Morocco (2008-2022)*. (University of Larbi Ben M'Hidi) Journal of Financial, Accounting, and Administrative Studies, 09(02), 1504-1524.
11. Salhi, S., et al. (2022). *E-Government in Algeria: A Comparative Study with North African Countries*. (University of Hassiba Ben Bouali) Journal of North African Economics, 18(29), 355-374.
12. Hamed, F. M. (2015). *E-Administration: Theoretical and Practical Foundations* (First Edition). Jordan: Dar Al-Kindi for Publishing and Distribution.
13. Al Aboud, F. N. (2009). *E-Government: Practical Application of Electronic Government Transactions*. Riyadh, Saudi Arabia: Obeikan Library for Publishing and Distribution.
14. Mechri, M., & Laamour, R. (2022). *Analytical Study of the United Nations E-Government Development Index for Algeria in 2020: A Comparison with North African Countries (Egypt, Tunisia, Morocco)*. (University of Hamma Lakhder) Journal of Advanced Economic Research, 07(01), 217-232.
15. Mohamed, M. M. (2016). *E-Government*. Cairo, Egypt: Arab Group for Training and Publishing.
16. Radwan, M. A. F. (2012). *E-Administration and its Functional Applications* (First Edition). Egypt: Arab Group for Training and Publishing.
17. Ararar, M., & Khalifi, S. (2021). *Indicators for Measuring E-Government: A Case Study of Algeria*. (University of Chadli Bendjedid) Journal of Intellectual Excellence in Social and Human Sciences, 03(03), 53-67.
18. Kafi, M. Y. (2009). *E-Government in the Light of Contemporary Scientific and Technological Revolution*. Damascus, Syria: Dar and Ruslan Foundation for Printing, Publishing, and Distribution.
19. Abd Elrahman, Y., & Bouznane, M. (2016). *E-Government Maturity Indicators: A Comparative Study of Algeria, Morocco, and Tunisia*. (University of Ibn Badis) Journal of Boudiax Notebooks, 10(01), 51-71.