The role of information and communication technology in Algeria's transformation into a digital country during the emerging crisis of the Corona virus (Covid 19)

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Abstract:

The study aims to explore the digital transformation in Algeria and the novel corona virus (COVID-19) crisis, by identifying the ICT infrastructure, by examining a set of indicators that illustrate the infrastructure. The extent to which the spread of the new virus in the use of information and communication technologies by Algeria has contributed to the functioning of various sectors of its vital sector in order to respect the measures taken and to support its economic activity .The study was based on the descriptive and analytical approach in the applied area, and through this study the findings were among several interrelated factors to make the full transformation toward digitization, including the building of a digital strategy and improvements in the ICT infrastructure. Identify the requirements for investing in information and communication technology as well as developing the field of technological research, education and training of citizens in the use of technology.

Key Words: Digital transformation, Information Technology, Communication Technology, Corona crisis, Algeria.

JEL Classification: L86, O14, O39.

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1. INTRODUCTION

The world today is experiencing tremendous technological development, involving all spheres of social, economic, and political life. Today, products, services, and entire industries are increasingly using ICT creatively to improve our lives. This effect was evident during the crisis of the new Corona virus (Covid-19), which spread to all countries of the world, destabilizing their internal stability and threatening the global economy and all vital sectors of nations. Algeria is among the States infected by the new corona virus through some cases coming from Europe. This has led Algeria to take a series of preventive and precautionary measures to prevent the spread of the pandemic among people, including the closure of all its maritime, air, and land borders, the closure of schools and universities, and the freezing of various economic and social activities in order to preserve the safety of its citizens.

The Corona crisis has driven the digital transition in Algeria because of the policy of isolation and social distancing through the use of ICT in several vital sectors of the country. This was done in order to ensure the continuity of their normal activity under these prevailing conditions, emphasizing that many sectors were suddenly forced to digitize, performing office work from home, in addition to virtual cooperation, etc.

The following question could therefore be asked:

How did the crisis of the emerging Corona virus (Covid-19) accelerate Algeria towards digital transformation using ICT?

In order to answer this question, we ask the following sub-questions:

- What are the reasons for investing in the use of ICT?
- What are the most important procedures to counter the new corona virus (Covid-19)?
- What is the reality of the ICT infrastructure in Algeria?
- What are the Algerian State's endeavors to counter the emerging Corona virus (Covid-19) in vital sectors?

Study hypothesis:

- ***H1***: One of the reasons for investing in ICT is the emergence and evolution of the knowledge economy as well as the emergence of the so-called digital company.
- ***H2***: Reducing the transmission of infection between citizens by applying the policy of isolation and social distancing.
- ***H3***: The existence of a good ICT infrastructure in Algeria helps digital transformation.

- ***H4***: The new Corona virus has contributed significantly to Algeria's use of information and communication technology (ICT) in the conduct of its various vital sectors in order to respect the actions taken and to sustain its economic activity.

Study importance:

The importance of this study lies in the fact that it deals with an important and critical topic, which is:

- Digitization and rapid developments in ICT as a result of scientific discoveries that save time and effort, as well as the spread of digitization in all economic, social, cultural, and political spheres that surround the individual and society's life, or what is known as the digital environment that is indispensable and requires interaction with it.
- Today's conditions are a result of the spread of the new Corona virus (Covid-19) and its transformation into a global epidemic, which has led to a policy of closure, isolation, and social distancing at the national and global levels.

Study objectives:

- To highlight the importance of Algeria's shift towards digitization through the use of information and communication technology during the crisis and to continue to do so in order to keep pace with the world as a whole, as ICT is the new global trend.
- To know the extent to which different sectors have benefited from the use of information and communication technology during the Corona crisis (Covid-19), and learn about the reality of the digital structure in Algeria.

Study approach:

The analytical descriptive approach has been used to test the hypotheses of the study and reach the goals laid down.

2. Theoretical framework: An overview on information and communication technology

2.1 Basic concepts about information and communication technology

ICT concept: The concept of information and communication technology (ICT) is a widespread concept in many areas of life of our time. The definitions were therefore numerous:

It is defined as: a range of hardware, software, and networks (Fanni , 2018, p. 289). Furthermore, it is defined as automated information processing, i.e. digitization of information developed under modern technologies. This information can be stored,

processed, sent, and retrieved by other information devices for reuse when needed. It can be distributed to a group of people who need it at once. The ability to transmit and broadcast remotely is among the most distinctive features of ICT (Fanni , The impact of ICT in the processes of knowledge management in Algerian public banks, an applied study to a sample of Algerian public banks leadership, 2019, p. 271).We can say that ICT is a set of modern tools, means, and techniques through which data and information are received, stored, and processed. It is retrieved using multimedia software, whether audio, visual, or text, which is then connected or received via various communications devices to or from anywhere in the world, as well as easy and fast access at any time without barriers or constraints.

2.1.1 ICT infrastructure: It is the infrastructure on which different digital networks operate, using all physical means and software to connect and control different ICT services (Karroubi , 2018-2019, p. 97). Information technology consists of five core components: physical components, software, databases, telecommunications networks, human resources:

- **Physical components (Hardware):** we mean electronic computers, physical parts, and peripheral devices (Sokar , 2018-2019, p. 22), where they receive and store data and then process them by conducting a set of computational and logical processes on them according to a series of processes (programs) stored in their memory, and then producing the processing results on different output units (Ammara , 2018, p. 303) .
- **Software:** it includes all instructions and commands controlling the computer as well as performing various tasks and actions (Ben Ahssan & Hamlawi , 2017, p. 38).
- **Databases:** are a set of files that are related to each other and serve to store and consolidate data (Karroubi , 2018-2019, p. 99)**.**
- **Telecommunication networks:** are the means used to transmit and receive data and information, consisting of a group of stations located in different locations and linked to media that allow users to carry out transmissions and reception (Salawi , 2015-2016, p. 43)**Human resources:** they are the individuals who work on the system, or use its output. This element is the mental aspect of the system (Karroubi , 2018-2019, p. 99).
- **Human resources.**

2.1.2 Causes and indicators of investment in ICT:

a. **Reasons for accelerating investment in ICT:** Investment in ICT is one of the most important strategies of the last decade to increase the rate of economic growth and to reform the economic, commercial, and financial mechanisms of the State for a number of reasons, including: (Ammaria & Septi, 2018, pp. 972-973)
b. **Successive Internet developments and technological interactions:** the revolution in the area of computer information and communications networks is a clear reality,

as there are 4 large industries moving towards building common platforms and bases: hardware, software, consumer electronic industries, telecommunications industries, and content industries such as text, music, and research.

c. **Emergence and evolution of the knowledge economy**: All current economies are based on the information and knowledge that has become a core asset of time-based production and competition strategy.
d. **Growth in the globally connected economy:** it is known as globalization, in which there is management and control of global market websites, and there are globally distributed work, as well as global distribution systems and communication.
e. **Shifts in business projects:** the emergence of ICT has made it possible to do business outside the company's borders with the same efficiency, resulting in a change in the company's traditional boundaries.
f. **The emergence of the so-called digital company**: all technological changes are accompanied by primarily organized redesign. The main actions are done through the networks.
g. **Improving services**: through the improvement of existing services and the introduction of new services that were not previously available.

ICT indicators: in order to assess the reality of ICT use, the state relies on several indicators issued by credible global bodies. Among the most important bodies, we find (ITU, 2010) the International Telecommunication Union (ITU) and the Organization for Economic Cooperation and Development (OECD):

- ICT infrastructure and access indicators.
- Indicators of access to and use of ICT by families and individuals.
- Indicators of corporate access to and use of ICT.
- ICT sector indicators and trade in ICT goods.
- ICT indicators in education.
- ICT indicators in government.

2.1.3 Modern information and communication technology guidance:

a. **Cloud computing:** Cloud computing means providing on-demand information technology resources via the Internet with cost pricing by use. Instead of purchasing, owning, and retaining actual data centers, you can use technology services, such as computing, storage, and databases in a needs-based manner through a cloud service provider such as Amazon Web Services (AWS). (AMAZON) When a company chooses to "move to the cloud," it means that its IT infrastructure is stored outside it in a data center maintained by a cloud computing service provider (such as Oracle), where cloud computing provides customers with greater ease of use, expansion, and flexibility instead of spending money and resources on old IT systems, and therefore clients can focus on more strategic

tasks. Without a lot of advance investment, companies can easily access the computing resources they need, and pay for just what they need. (ORACLE)

b. Big data: refers to all digital data resulting from the use of new technologies for personal or professional purposes, including company data (E-mails, documents, databases, business processing history etc.) in addition to sensor data and web content (images, videos, sounds, and texts), e-commerce transactions, social network exchanges, and data transmitted by connected objects (Electronic posters, smart meters, and smart phones), and geographic data, etc. (FUTURA TECH)

Globally, the market for big data technology and related services is expected to grow about seven times faster than the ICT market as a whole, a leading information technology research and consulting company, big data are now at the peak of the inflation phase and are expected to reach a productive peak in five to 10 years, a few years after cloud computing. There are several factors that contribute to the high expectations for today's big data, including: (ICT, QATAR, 2014, pp. 3-4)

- Rapid growth of large-scale high-speed smart phone.
- The growing energy of cloud computing.
- Access to big data technologies in easier and cheaper ways.
- Progress of communication between machines (machine to machine).

However, the use of large data remains relatively low, and a global study reveals that 6% of enterprises implemented big data initiatives in 2012.

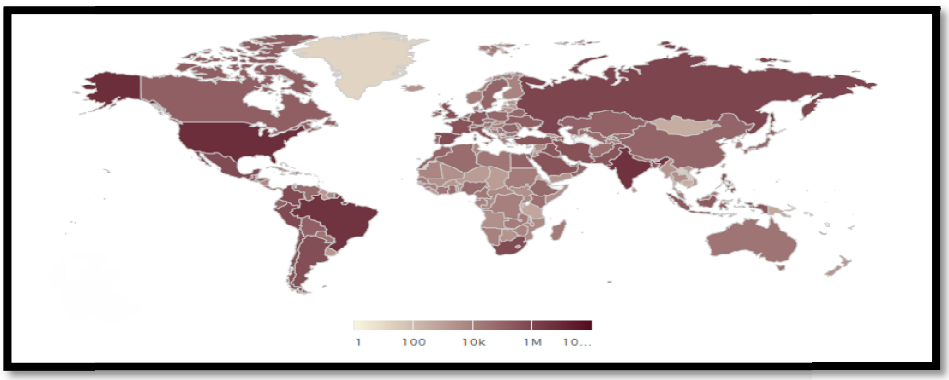
Second: What is the new Corona virus (Covid-9)?

2.2 Concept of the virus: at the end of 2019, a new virus called Severe Acute Respiratory Syndrome Virus Corona 2 (SARS-CoV-2) was discovered as the cause of an outbreak of a new disease that began to spread in the Chinese city of Wuhan in December 2019. This disease is called the New Corona virus 2019 or Covid-19. The disease has become an epidemic that has affected and continues to affect many countries of the world. (Pritish)

Thus, in late January 2020, the World Health Organization (WHO) announced that the new Corona virus (Covid-19) had become a global health emergency, and in March of the same year, it was declared a global epidemic. One of the most common symptoms of Covid-19 is fever, fatigue, and dry cough. Some may experience other, less common symptoms such as pain and aches, Nasal Congestion, headaches, conjunctivitis (pink eye), throat pain, diarrhea, loss of taste or smell... etc. Symptoms may appear two to 14 days after exposure to infection, and about 80% of infected people recover without special treatment, but almost one in five people with Covid-19 have difficulty breathing. The risk of severe complications increases among the elderly and people with other health problems such as blood pressure, heart and lung disease, diabetes or cancer. (World Health Organization, 2020) The impossibility of finding a cure or vaccine until the preparation of the present study has led to a total of 28 million infections worldwide

and the death rate reached 2.3% of the number of infections. The following figure shows the global prevalence of the new corona virus (Covid-19) until September 10, 2020:

Figure 1: Map of the global spread of the new corona virus (Covid-19)



Source: (worldometers, 2020)

2.3 Measures taken to confront it:

The rapid spreads of the virus and the rise in the number of infections worldwide have left all States with one major challenge: how to cope with the virus by reducing transmission among citizens, how to treat those infected, and maintain economic activity. States, therefore, have taken a series of measures to address this crisis, including**:** (Ibrahim & Ibrahim, 2020, p. 216)

-Isolating individuals at their place of residence or another suitable place of residence for infected people.

- A total ban on all individuals and activities within the State.

-Curfew for individuals (freedom of movement).

-The closure of enterprises for some time (freedom of trade and industry).

-Temporary suspension of citizens and residents travel except for evacuation, shipment, and trade flights, with taking the necessary precautions (freedom of movement).

-The prohibition of visits to religious sites (mosques, churches, temples) (freedom of religious practice).

-Stopping the export of medical and laboratory products (freedom of trade).

-Suspension of classes in schools and universities (freedom of education).

-Postponement of cultural activities, sports, and entertainment (right to culture/sports/entertainment).

-The use of technology by some States to monitor the movement of individuals to contain the virus (right to privacy).

-Arrest individuals and force them to perform the virus tests (restriction of personal liberty).

-Some countries have imposed penalties (in some cases imprisonment) on those who violate the measures taken (restriction of personal liberty).

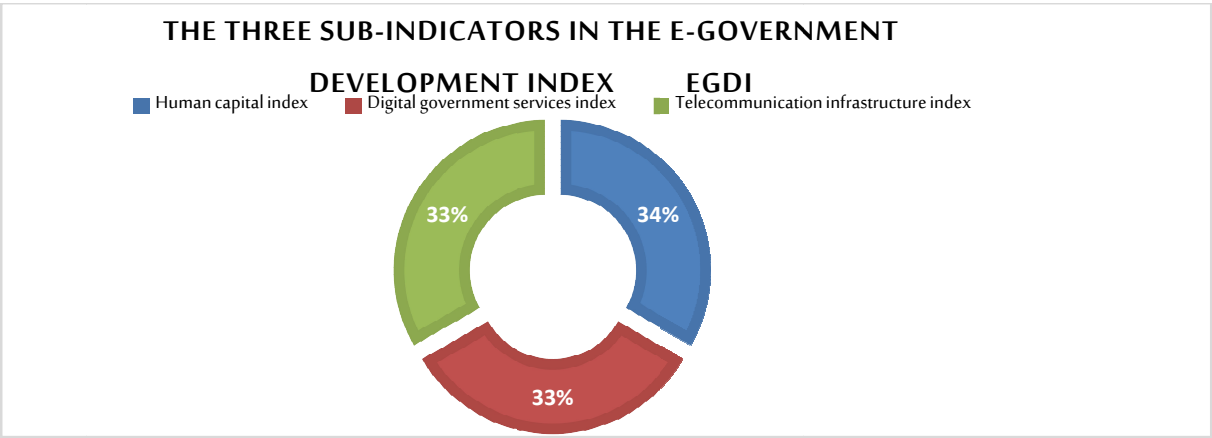
-Some countries use a smart phone program to identify people who may have met people with corona virus to track the spread of the virus (right to privacy).

3. Practical part:

First: The reality of Algeria's digital transformation infrastructure during the Corona pandemic:

According to the 2020 United Nations report Algeria has succeeded to an acceptable extent in developing its technological infrastructure, as compared to previous years, which has contributed to the response to the Corona virus pandemic and subsequent economic crises. Furthermore, Algeria ranked 120th out of 193 countries in the E-Government Development Index, which consists of three sub-indexes: Telecommunications Infrastructure Index, Human Capital Index, and Digital Government Services Index. The latter index ranges from 0 to 1 and is divided into four main categories: very high, high, medium, and low. Algeria's E-Government Development Index (EGDI) was estimated at 0.5173, placing in the high category (0.5-0.75), while in the previous year, it was in the medium category. This already demonstrates Algeria's commitment to improving digital services and overcoming the constraints imposed by levels of telecommunications infrastructure and human capital, as the key elements of measuring the development of e-governance infrastructure and the key index of digital transformation. Figure (02) demonstrates the aforementioned:

Figure 2: The three sub-indexes in the e-government development index



Source: (E-Governance Report , 2020, p. 232)

The development of the telecommunications and digital sectors is one of the priorities that Algeria has set for itself. Since 2000, the opening of the telecommunications market to competition following the publication of Public Law No. 03/2000 of 05 August 2000, which sets out general rules on post and communications, has radically changed the approach of authorities in the field of telecommunications and has made it possible to achieve significant results, particularly in the mobile technology market, which introduced 2G in 2001, 3G in December 2013 and 4G in September 2016 (Ministry of Post and Telecommunications, 2020, p. 02)**.** In the past month of July, experimental 5G antennas were installed by Mobilis.

To analyze the reality of the infrastructure for the transition to a digital economy, the evolution of the ICT sector over the last three years (2017-2018-2019) must be identified due to the fact that it is the fundamental pillar of the transition by examining the following basic ICT infrastructure indexes:

3.1 Basic ICT infrastructure indexes:

3.1.1. Landline network indexes:

a. Development of the number of subscribers to the landline network in Algeria:

Table 1: Development of the number of subscribers to the landline network in Algeria

Index	2017	2018	2019	2020
Number of subscribers to the landline network	4.100.982	4.164.039	4 .635.217	4.945.220
Landline network access rate	53%	52%	57%	65%

Source: (Ministry of Post and Telecommunications, 2020, p. 02)

In the last three years, the number of landline subscribers in Algeria has grown positively. In 2020, Algeria had more than 4.9 million landline subscribers, an increase of 12% compared to 2018. This rate represents 61% of the capacity of the total calls, which is 7.542.246 possible calls. In 2017, the use of WLL, which was intended for rural areas, was terminated, in line with the state's strategy to provide these areas with more efficient and effective telecommunications infrastructure such as 4G LTE.

b. Development of the number of subscribers by type of subscription (residential or occupational):

Table 2: Development of the number of subscribers to the landline network in Algeria

Index	2017	2018	2019	2020
Residential subscription	3.611.735	3.711.765	4.190.162	4.272.004
Occupational subscription	489.247	452.274	445.055	437.370
Total	4.100.982	4.164.039	4.635.217	4.709.374

Source: (Ministry of Post and Telecommunications, 2020, p. 02)

The table notes that landline subscriptions were dominated by occupational subscribers, who in 2017 represented 88.07% of total subscribers. In 2018, residential subscriptions were 89.13% of all subscriptions, and in 2019 they reached 90.40%,in 2020 increased 92%.

Cell phone network indexes:

Currently, three mobile operators are active in the Algerian market: (Mobilis) Algeria's Telecommunications Mobile, (Ooredoo) Algeria's Wataniya Telecommunications, and (Djezzy) Algeria's Orascom Telecommunications.

a. Development of the number of subscribers by type of payment method:

Table 3: Development of the number of subscribers by type of payment method in Algeria

Index		2017	2018	2019	2020	Development rate (2018-2019)
Development of subscribers' number by type of payment method	Prepaid	41.943.543	41.036.380	42.261.130	42.760.380	+2,98 %
	Postpaid	3.902.122	6.184.408	4.820.001	3.740.422	-21,90 %
Total		45.845.665	47.154.264	47.081.131	44.411.730	-2,28 %

Source: (Ministry of Post and Telecommunications, 2020, p. 03)

Despite a 22% decrease in postpaid subscriptions between 2017 and 2018, the total number of mobile subscribers has stabilized. This decrease can be attributed to the variety of monthly offers provided by prepaid subscriptions, as we believe there is a significant trend toward this type of subscription. Prepaid subscriptions continue to dominate the mobile phone market, accounting for 89.76% of the mobile market, compared to 10.24% for postpaid subscriptions in 2019.

B. Development of mobile density (mobile network access ratio) (GSM, 3G, 4G) (%):

Table 4: Development of mobile density (GSM, 3G, 4G) in Algeria:

Index	2017	2018	2019	2020
Development of mobile density	109,95%	111%	110,3%	109%

Source: (Ministry of Post and Telecommunications, 2020, p. 04)

According to the above table, access to the mobile phone network rose from 109.95% in 2017 to 111% in 2018 with an increase of 1.05%. However, there was a 0.7% decrease in 2019 and 2020 to 109%, which is seen as a slight drop.

b. Number of subscribers per operator and its share in the mobile market:

Table 5: Number of subscribers per operator in Algeria

	2017	2018	2019	2020	Development rate
Mobilis (ATM)	18.365.148	19.106.401	19.716.333	19.654.330	+15,24%
Algeria's Telecommunications **Orascom** (OTA)	14.947.870	15.848.104	14.752.419	13.952.347	-0,07%
Wataniya Telecommunications (WTA)	12.532.647	12.199.759	12.612.379	11.850.053	+0, 05%
Total	45.845.665	47.154.264	47.081.131	45.456.730	-0,01%

Source: (Ministry of Post and Telecommunications, 2020, p. 05)

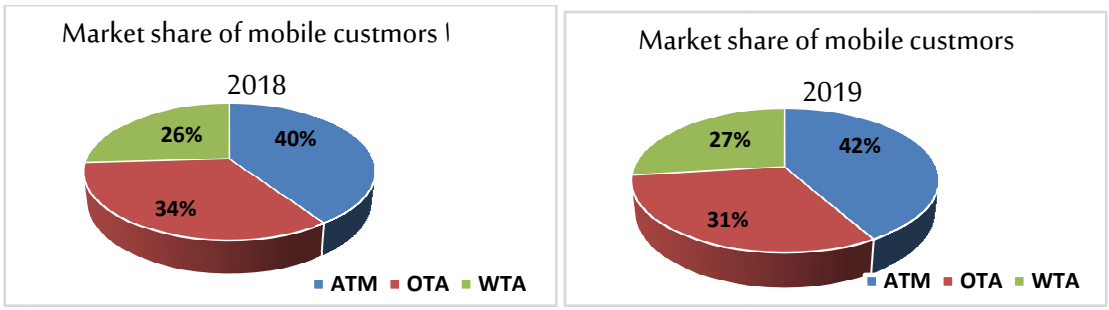
The analysis of market share measures the performance of operators, the density of competition, or the location of the operator in the market sector. Market share is obtained by taking the ratio between the operated share and total shares.

Table 6: Market shares among mobile phones operators in Algeria

Index	Operator	2017	2018	2019	Development rate (2018-2019)
Market shares among operators	ATM	40,06%	40,52%	41 ,88%	**+1,36**
	OTA	32,60%	33,61%	31,33%	**-2,28%**
	WTA	27,34	25,87%	26,79%	**+0,92%**

Source: (Ministry of Post and Telecommunications, 2020, p. 05)

Figure 3: Market shares among mobile phones operators in Algeria between 2018 and 2019



Source: (Ministry of Post and Telecommunications, 2020, p. 05)

With regard to the distribution of market shares among operators, (ATM) owns the largest market share in 2019 by 42%, confirming that it is the market leader for the third consecutive year since 2017, followed by Orascom (OTA) by 31% and (WTA) by 27%.

c. Number of subscribers by mobile network technology:

Table 7: Number of subscribers by mobile network technology in Algeria

	2017	2018	2019	2020
GSM	8.964.862	10.811.663	14.385.131	7.151.778
3G	12.526.915	17.422.312	21.592.863	36.967.783
4G	25.589.354	18.920.289	9.867.671	
Total	**47.081 .131**	**47.154.264**	**45.845.665**	**47.080.001**

Source: (Ministry of Post and Telecommunications, 2020, p. 06)

In 2019, more than 54% of total mobile subscribers are fourth-generation subscribers i.e. an increase of 14% compared to 2018. This is explained by the choice of technology that offers the best speed. Moreover, the number of GSM subscribers has declined since the launch of third and fourth generation mobile technologies, and the same for the third generation after the launch of the fourth generation at the end of 2016. The latter is due to a shift in subscriber preferences toward large-scale Internet offers.

3.2. Internet Network Indexes:

a. Fiber optic networks:

Table 8: Fiber optic networks in Algeria

	2017	**2018**	**2019**	**2020**
Fiber optic length (km)	127.372	145.120	172.000	181.202
International Internet bandwidth (Mbps)	1.015.220	3.374.277	3.564.556	16.343.120

Source: (Ministry of Post and Telecommunications, 2020, p. 07)

As part of the modernization of infrastructure and the improvement of services, efforts are continuing to connect to fiber optics. In 2018, the length of fiber optics reached 145.120 km; by the beginning of 2019, the length had increased by 18.5% to 17,200 km. In order to meet the needs of Algerian Internet users and provide high-quality service, international bandwidth continued to grow, reaching 3.564.556 MB/s at the end of 2019.

b. Development of the number of fixed Internet subscribers

Table 9: Development of the number of fixed Internet subscribers by technology type:

Tec type	2017	2018	2019
ADSL	2.246.918	2.172.096	2.334.005
FTTX	714	11.369	43.115
G LTE Fix 4	920.244	920.244	861.235
WIMAX	621	619	444
LS	34.008	11.516	11.280
Total	3.202.505	3.063.835	3.580.456

Source: (Ministry of Post and Telecommunications, 2020, p. 07)

At the end of 2019, the number of fixed Internet subscribers increased by 517,356 compared to 2018, an increase of 16%.

- **Development of the number of mobile internet subscribers:**

✓ **Active mobile Internet subscribers:** the mobile Internet market consists of the following elements:

– Mobile Internet through Internet keys (data cards, modems, USB keys and tablets).
– Mobile Internet except for Internet keys (3G / 4G) that relate to users who connect via a mobile station.
– M2M (Machine to Machine communications).

The following table shows the types of subscriptions to mobile Internet service:

Table 10: Table 11: Active mobile Internet subscribers in Algeria

Index	2017	2018	2019	Development rate
Number of Mobile Internet subscribers except for Internet keys (3G / 4G)	31.460.534	36.342.601	38.116.269	4,88%
Number of Mobile Internet subscribers through Internet keys	507.400	1.623.570	1.957.357	-20,56%
Number of M2M subscription	37.367	206.170	58.622	-71 ,57%
Number of mobile broadband subscriptions	32.005.301	38.172.341	40.132.248	+5,13%

Source: (Ministry of Post and Telecommunications, 2020)

In 2019, the number of mobile Internet subscribers was 40.132.248, a slight increase of 5.13 compared to 2018.

✓ Mobile Internet development by technology type (apart from modems, Internet keys, and M2M):

Table 11: Mobile Internet development by technology type (apart from modems, Internet keys, and M2M) in Algeria

	2017	2018	2019
3G	21.592.863	17.422.312	12.526.915
4G	9.867.671	18.920.289	25.589.354
Total	31.460.534	36.342.601	38.116.269
Mobile Internet Density	63%	75%	89%

Source (Ministry of Post and Telecommunications, 2020)

In 2019, the number of mobile Internet subscribers increased slightly compared to 2018 by a density of 89.08%. More and more subscribers are shifting from third to fourth-generation mobile technology. Concerning the mobile Internet, in just 3 years of offering, 4G reached over 25 million subscribers, while 3G subscribers (a technology introduced in 2013), which in 2016 rose to 24.227.985, reached 12.5 million in 2019.

The decrease in the number of third-generation mobile subscribers is essentially justified by the transition to 4G networks.

- ✓ **Rapid development of mobile Internet (except for modems, keys (3G/4G), and M2M) by the operator:**

Table 12: Rapid development of mobile Internet (except for modems, keys (3G/4G), and M2M) by the operator in Algeria

Index	Operator	2107	2018	2019	2020	Development rate
Number of mobile Internet subscribers except for Internet keys (3G/4G/)	**ATM**	13.709.805	15.611.921	16.476.954	18.654.330	+0,27%
	OTA	8.922.325	11.259.211	11.308.591	13.953.347	+0,36%
	WTA	8.828.404	9.471.469	10.330.724	11.850.053	+0,25%
	Total	31.460.534	36.342.601	38.116.269	44.411.730	+0,68%

Source: (Ministry of Post and Telecommunications, 2020, p. 09)

At the end of 2020, the number of mobile Internet subscribers (excluding 3G/4G and M2M keys) was 44.411.730 with a slight increase of +0, 68% compared to 2018. ATM, followed by OTA and WTA, remains in the first places.

3.3. Number of telecommunications operators and service providers:

The following table shows the number of operators and service providers active in the telecommunications market:

Table 13: number of operators and service providers active in the telecommunications market

Index (Algeria)	2018	2019	2020
Landline phone	01	01	01
Mobile phone GSM	03	03	03
Mobile phone 3G	03	03	03
Mobile phone 4G	03	03	03
VSAT	03	02	02
GMPCS	01	01	01
VOLP operators	02	01	01
Internet access provider (FAI) ISP	30	22	15
Audiotex	08	08	7
Calls centers	89	81	84

Source: (Ministry of Post and Telecommunications, 2020, p. 10)

In summary, the number of landline telephone subscribers in Algeria for the last three years has developed significantly, with an estimated increase of 12% for 2019

compared to 2018. Furthermore, the number of landline telephone subscribers (residential) was more than occupational subscribers, where the latter reached 9.60% compared to the total subscribers of 2019. As for the mobile network in Algeria, there are three main operators: Mobilis Telecommunications (ATM), ORACOM Telecommunications of Algeria (OTA), and WATANIYA telecommunications of Algeria (WTA). The largest operator in Algeria is Mobilis Telecommunications which has the largest market share (the largest number of subscribers) of 42%, an increase of 1.36% compared to 2018. This is because Mobilis provides the best offers, services, and prices compared to other operators. Concerning the number of subscribers by mobile network technology in Algeria, more than 54% of total mobile subscribers were fourth-generation subscribers in 2019, an increase of 14% compared to 2018. This is justified by choosing the technology that offers the best speed.

As part of the modernization of infrastructure and improvement of Internet services in Algeria, the length of fiber optics reached 17.200 km in 2019, an increase of 18.5%. In order to meet the needs of Algerian Internet users and provide high-quality service, international bandwidth continued to grow, reaching 3.564.556 MB/s at the end of 2019, and the number of landline Internet subscribers increased by 517.356 subscribers in 2019 with an increase of 16% compared to 2018. Moreover, mobile Internet subscribers during 2019 reached 40.132.248 subscribers with a slight increase of 5.13% compared to 2018. In just 3 years of introduction, 4G reached over 25 million subscribers, while 3G subscribers (a technology introduced in 2013), which in 2016 rose by 24.227.985 subscribers, dropped to 12.5 million in 2019. The transition to 4G networks explains the decline in the number of third-generation mobile subscribers.*

In order to provide Internet service to all citizens and subscribers during the Corona pandemic, Algeria Telecommunications Corporation has prepared new prices. The flow price of 8 MB was reduced to 2599 DZD per month instead of 3599 DZD per month, the same price applied to the 4 MB offer. In addition, the flow price of 20 MB was reduced to 4999 DZD per month instead of 7900 DZD per month, while the flow price of 100 MB became 9999 DZD per month instead of 24500 DZD per month. All these changes aimed to provide a very high Internet flow accessible to all.

Despite all these efforts, the speed of the Internet's flow has not changed; on the contrary, it has become somewhat slow as a result of the large number of subscribers' access to the Internet.

Second: State efforts to address the virus in various sectors using ICT

The Corona virus pandemic (Covid-19) has prompted the Algerian State, like other countries of the world, to take a series of precautionary measures in order to mitigate the

impact of the pandemic on various sectors of the country. During this pandemic, ICT was of great importance.

A. Health sector:

The Ministry of Health, Population, and Hospital Reform, in collaboration with the World Health Organization (WHO) in Algeria, has worked to develop an information plan as a precautionary procedure to the new Corona virus. The launch of this information measure follows the activation of the surveillance and warning system in February at the national level as soon as the World Health Organization (WHO) announced the spread of the corona virus. This system was strengthened after the first case of the Corona virus was recorded in Algeria on 25 February 2020 for an Italian citizen working in the south of the country, who arrived on 17 February in Algeria from Italy.

This procedure consists of setting up a call center on the 30-30 free number, which was launched in Bordj El Kiffan at the central level. Since its opening last Thursday, the Center has received several appeals from citizens seeking clarification about the corona virus (its transmission ways and its prevention methods). (cipalgerie) In addition, a digital platform was created by EADN (Digital Development Support Company) as an information and awareness platform (http://covid19.sante.gov.dz/) for the Ministry of Health and Hospital Reform. This digital gateway includes the map of the epidemiological reporting of the new Corona virus (COVID-19), where the ministry can publish daily statistics on the development of the epidemic in Algeria, with cases classified by type of cases, by state, by gender, by age group, ... etc.

B. Education sector:

The Corona Pandemic in Algeria prompted the government, after the suspension of the study, to resort to distance education (e-learning), as a measure to contain the epidemic. On April 5, the Ministry of Education launched the Support Program via the internet for fourth-year middle school and third-year secondary school students through digital platforms of the State Office of Distance Education and Training. The Ministry has also set up a digital platform for students in the fifth year of primary school. This step reflects the plan drawn up by the Ministry of Education as part of the measures taken to counter the interruption of education in 48 states and to reduce the spread of corona in the school environment, according to the Ministry.

Concerning the Ministry of Higher Education, it had also resorted to distance education by creating a platform to ensure that students continued to receive distance classes at the level of each university, such as the University of Algiers 3: https://elearning.univ-alger3.dz/. Some professors also used social media to continue classes such as Facebook or WhatsApp by creating groups and pages to post lessons and

answer student questions. They used Google Classroom, or Zoom Cloud Meetings to facilitate communication with students, complete all classes, and preserve the health of students under such conditions.

C. Financial services sector:

The financial services sector is one of the most important recent trends in contemporary economies, given its significant contribution to overall production. However, the growth of the services sector during the Corona crisis declined by 2.8% during the first quarter of this year and the trade balance deficit rose by 79%. Moreover, the foreign exchange reserve (intended to finance the balance of payments deficit, specifically import rather than provide liquidity) slipped to 60 billion dollars in March 2020. Furthermore, the budget deficit increased significantly from 1500 billion dinars, equivalent to 11.71 billion dollars in the Finance Law of 2020, to 2000 billion dinars, equivalent to 15.62 billion dollars in the Supplementary Finance Law of this year. The Algerian economy as a whole contracted by 3.9% in the first quarter of 2020 after growing by an estimated 1.3% in the same period last year.

The Corona pandemic accelerated the shift towards the adoption of financial technology. Mobile payments were encouraged, while banks and financial institutions enhanced their online solutions, channels, and services as part of their preventive measures to immunize its customers against corona in parallel with the development of e-payment systems and solutions, e-money transfers, e-wallets, and the introduction of innovations for point-of-sale and billing services as well as a plan to introduce technological innovations in financing and exchange services, in addition to financing platforms for collective projects.

The Algerian Post launched a new payment service through a mobile phone app called Baridi Pay to facilitate payments. Several Algerian banks, such as the National Bank of Algeria and the Agriculture and Rural Development Bank, also launched a remote bank service. This service consists of: (BADR BANK), (BNA BANK)

- Digitized Data Exchange Service.
- Electronic banking services.
- Phone banking service.
- Online Electronic Payment Service.

4. RESULTS AND DISCUSSION : In conclusion, the new Corona virus (Covid-19) has had a significant impact on Algeria's digital transformation as a strategic step towards a future crisis through the Algerian State's reliance on information and communication technology during the crisis in various vital sectors. So proving ***H1*** hypothesis, and confirm second hypothesis that says: ***H2***: Reducing the transmission of

infection between citizens by applying the policy of isolation and social distancing.

The third hypothesis ***H3*** is correct: in comparison to global developments, the use of ICT has been limited to many digital gateways adopted as an emergency measure by national institutions and bodies, namely quarantine, domestic lockdown, and social distancing. Hence, digital transformation has become an inevitable option. During the new Corona virus crisis (covid-19), reliance on digitization and investment in information and communication technology (ICT) is a fertile ground for the post-pandemic in order to adopt digital transformation at the level of institutions, bodies, and individuals and make Algeria a digital State. This shift has important advantages, as it facilitates communication where one can attend scheduled meetings from home without bothering to go to the meeting headquarters, as well as shortening cost and saving effort and time. A person may carry out his administrative needs while sitting at his home or work without incurring material and moral costs on movement to the administrations' headquarters, this proves that ***H4*** is true.

Results:

- Algeria's E-Government Development Index has risen to an estimated value of 0.5173, demonstrating its commitment to improving digital services and overcoming the constraints imposed by telecommunications infrastructure and human capital levels.
- Algeria has a fairly good ICT structure, which during the crisis contributed to the spread of the new trend towards digitization.
- There are three mobile Internet service providers and one fixed-line Internet service provider, limiting competition and preventing subscribers from receiving competitive services and offers.
- The Corona crisis has been instrumental in finding solutions for Algeria to run its vital sectors and to counter the threat of the spread of the virus. The only inevitable solution is its resort to information and communication technology, which has accelerated Algeria's steps towards digital transformation.

Recommendations:

- Digital transformation is no longer an option, but a necessity.
- Develop a real strategy on digitization in the country in the short, medium, and long term.
- Define a road map to clarify the steps of Algeria's digital transformation.
- Algeria must strive to keep pace with all developments in the world by taking advantage of the opportunities available for its transformation into a digital State.

- Attention must be paid to disadvantaged or vulnerable groups using ICT technology and digital skills development.
- The need for private investment to ensure better quality services for citizens and institutions.

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