



The Impact of Digital Transformation on Attracting Foreign Direct Investment to Algeria during (1993-2022)

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Abstract :

The study aims to measure the impact of digital transformation on attracting foreign direct investment to Algeria, using annual data for the period 1993 to 2022, by model ARDL. The results revealed the existence of a co- integration relationship between digital transformation on attracting foreign direct investment in the long term, the study also showed the positive impact of both mobile and fixed phone subscriptions on foreign investment flows into Algeria, and the negative impact of the Internet subscription variable on foreign investment flows into Algeria in the short term.

In addition, the study expound, through the correction coefficient, the length of time that the foreign investment flows takes to return to moderate in the long term when any changes occur in digital transformation indicators. The study recommended accelerating the digital transformation process given its importance in all fields in our current era .

Key Words: Digital transformation; Foreign direct investment; Infrastructure; technology; Algeria.

JEL Classification : F21, O33, C22, O55.

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Introduction:

In light of the rapid pace of technological developments at the present time, in addition to other changes, including the expansion of the base of economic openness, countries have found themselves facing several challenges, especially those related to meeting the requirements of economic and social development, which has necessitated them to find innovative solutions that differ from the conventional solutions; in this context, we find that adopting digital transformation supported by technological developments as a new approach helps countries meet various development needs, considering the effects that digital transformation has on all fields, including its role in attracting foreign direct investment that contributes to supporting economic development.

In an effort to keep pace with contemporary international developments to support the business climate, Algeria has developed the telecommunications sector



by opening it to competition at the beginning of the current millennium, in addition to the current intensive efforts to adopt a national strategy for digital transformation, which will contribute to improving the business environment in order to attract foreign direct investment, considering it an important tributary to achieving comprehensive development.

Accordingly, this study came to examine the impact of digital transformation as a tool to attract foreign direct investment flows in Algeria and a mechanism to support the business environment in Algeria.

Problematic of the study: Based on the above, this study came to answer the main problem included in the following main question: What is the impact of digital transformation on foreign direct investment in Algeria?

Study hypotheses: This study is based on the following two hypotheses:

- There is a mutual integration relationship between digital transformation and foreign direct investment in Algeria.
- There is a positive impact of digital transformation on foreign direct investment in Algeria.

Study objectives:

The study aims to achieve a set of objectives, the most important of which are:

- Identify the indicators of digital transformation in Algeria.
- Identify the development of foreign direct investment in Algeria
- Determine the nature of the relationship between digital transformation and foreign direct investment in Algeria.
- Highlight the impact of digital transformation in attracting foreign direct investment flows in Algeria.

Importance of the study: The study derives its importance from the position of digital transformation in foreign direct investment in Algeria, given that improving the business environment is a tool for attracting foreign direct investment. Accordingly, the Algerian government has worked to upgrade the communications environment due to its important role at the present time in various fields, and this is evident through the efforts and developments that the communications sector has witnessed to support digital transformation.

The study methodology: The study used the descriptive and analytical method to describe the study variables represented by digital transformation and foreign direct investment in Algeria and to analyze its indicators and developments during the study period, and the standard method to try to build a model to measure the relationship between digital transformation and foreign direct investment in Algeria. During the period (1993-2022) using the Autoregressive Distributed Lag (ARDL) methodology using the EVIEWS12 program.



Previous studies: There are many applied studies that have addressed the topic of digital transformation and foreign direct investment. Below we review some of those studies:

- A study (Magdy , 2022) entitled “The Role of Digital Transformation in Supporting the Business Environment and Attracting Investments in Egypt in Light of Vision 2030”. This study examined the implications of applying digital transformation mechanisms on supporting the business environment and attracting more investments to Egypt during the period from 2006 to 2020 using the ARDL methodology. The study reached a number of results, the most important of which is that the success of digital transformation depends largely on developing the digital communications infrastructure, as for Egypt, it has good indicators for digital transformation, but it is still used in consumer aspects due to weak industrial production. The study also concluded that digital transformation has a positive role in attracting foreign direct investment.
- A study (Jodi & Douifi , 2024) entitled “The Impact of the Quality of Information and Communication Technology Infrastructure on Attracting Foreign Direct Investment during the Period 2007-2021” where this study aimed at the importance of technological infrastructure as one of the most important factors supporting the business environment in order to attract foreign direct investment, and to know the causal relationship between them, the study used cross-sectional time series data for a sample of Arab countries (Algeria, Egypt, Tunisia, Saudi Arabia, the Emirates, Qatar) for the period 2007-2021. The study reached a number of results, including that most of the Arab countries in the study sample have a very high percentage in the information and communication technology infrastructure development index, foreign investment flows to Arab countries also increased compared to the total flows to developing countries. The study concluded that there is no causal relationship in both directions, while there is an explanatory relationship in both directions.
- A study (Bouatli , 2023) entitled "The Role of Digital Government in Attracting and Stimulating Foreign Direct Investment in Arab Countries during the Period 2003-2020", where this study aimed to analyze and measure the role of digital government in attracting foreign direct investment in 17 Arab countries during the period 2003-2020, using panel models and the R program. The study concluded that the development of digital government has a positive impact on foreign direct investment flows in Arab countries. Accordingly, the study saw the need to expand the scope of digital coverage and facilitate procedures, especially those related to establishing companies and working to enhance the legal and legislative environment, in order to attract more foreign direct investment flows to Arab countries.
- A study (Belghno & Mawassim , 2024) entitled "Digital infrastructure and its role in attracting foreign direct investment to Algeria during the period 2019-2022", where this study, which was analytical, examined the relationship between the development of digital infrastructure and foreign direct investment in Algeria by



identifying the determinants of foreign direct investment in Algeria and highlighting the most important indicators of digital infrastructure. The study concluded that the weak level of digital infrastructure in Algeria was a major reason for the lack of foreign direct investment. Accordingly, the study recommends the necessity of strengthening and developing digital infrastructure, as it is currently considered one of the main determinants in attracting foreign direct investment.

- A study (Bardesi, 2024) entitled "The Impact of Digitalization on FDI Inflows in Saudi Arabia", which aimed to examine the impact of digital transformation on foreign direct investment flows in the Kingdom of Saudi Arabia, as it addressed the main digital and institutional determinants that influence foreign direct investment flows in Saudi Arabia and addressed this through a descriptive, analytical and quantitative study by conducting a multiple linear regression analysis using the least squares method on data from 1997 to 2022 using the SPSS program. The study concluded that the use of mobile phones, providing access to the Internet and supportive government policies contribute positively to attracting foreign direct investment flows to the Kingdom of Saudi Arabia.

- A study (Xuyang , 2024) entitled "Digital Transformation and Foreign Direct Investment of Enterprises: Evidence from Listed Companies in China", which examined the impact of digital transformation on foreign direct investment of Chinese companies listed on both the Shanghai and Shenzhen stock exchanges during the period 2011-2021. A two-way fixed effects model was used to test the impact of digital transformation on foreign direct investment of listed companies. The results of the study revealed that digital transformation significantly affects foreign investment of Chinese companies, especially those listed on the Shanghai and Shenzhen stock exchanges.

- A study (Le & Nguyen, 2022) entitled "Impacts of digitalization on foreign investments in the European region during the COVID-19 pandemic", where this study is considered among the first studies that attempted to investigate the relationship between digital transformation and foreign direct investment flows during the COVID-19 health crisis and the period before it from 2015 to 2019, as this study was conducted on data from 23 European countries using the Panel model, and the results revealed that during the period preceding the health crisis there was a non-linear relationship between digital transformation and foreign direct investment flows, during the health crisis, e-commerce activities played an important role in attracting foreign direct investment. Accordingly, the study concluded that it is necessary to digitize public services to overcome the repercussions of Covid-19, and that all countries should seek to enhance digital transformation to attract more foreign direct investment, especially in light of the current Fourth Industrial Revolution.

- A study (Joshua & Benjamin , 2019) entitled "Impact of Infrastructure on Foreign Direct Investment in Nigeria: An Autoregressive Distributed Lag (ARDL) Approach" This study aimed at the roles and impacts played by infrastructure in



attracting foreign direct investment flows in Nigeria during the period: 1981-2014, through a standard study using the ARDL model, where it relied on some components of infrastructure, namely: electricity production, number of agricultural tractors per 100 km² of arable land, fixed telephone subscriptions per 100 people, which are considered basic factors of production in the industrial, agricultural and services sectors respectively, in order to know their impact on attracting foreign direct investment flows in Nigeria. The results of the study showed that in the short term, the infrastructure variables used in the study do not play a significant role in attracting foreign direct investment flows in Nigeria, as well as in the long term, except for electricity production, which has a positive impact on attracting foreign direct investment flows in Nigeria.

Through the applied studies that we reviewed in this study and the studies that were reviewed, it was concluded that all developed and developing countries seek to attract foreign investments to them, considering that the latter is among the most important tools that enhance economic growth, especially in developing countries that suffer from a financing gap, unemployment and weak production. Most previous studies also recommended the need to provide an encouraging environment to attract foreign direct investment flows, especially at the present time in light of the Fourth Industrial Revolution, improving the digital environment or what is called digital transformation. Accordingly, this study came to highlight the impact of digital transformation in attracting foreign direct investment flows in Algeria.

I- Digital transformation and its reality in Algeria

The world is currently witnessing rapid and tremendous developments that have affected all aspects of life, as a result of countries, institutions and societies using digital technology in all aspects of their business and operations within the framework of the era of the Fourth Industrial Revolution. This is called digital transformation, which has become an issue that all countries are concerned with in order to be able to withstand crises and challenges. The Covid-19 health crisis is the greatest evidence of this. Algeria, like other countries, is striving to adopt digital transformation through the availability of political will and an appropriate legal and technical environment for it.

1- Digital transformation (concept and importance):

Digital transformation has several definitions, and despite their differences, they all share the necessity of using technology. These definitions include the following:

- Digital transformation: is the integration of digital technology into all aspects of business, which radically changes the way economic and social activities are organized. It is also a purposeful process of social change, rather than an unorganized process that must be planned and implemented intentionally (UNDP, 2022, p. 49).



- Digital transformation: use of digital data and technologies as well as interconnectedness that leads to changes in existing activities or new activities (OECD, 2021, p. 5).

From the above, it can be said that digital transformation is a process based on the use of digital technology in various fields and at all levels, through the use of modern technologies such as: artificial intelligence, cloud computing, the Internet of Things, big data analysis, and others.

2- The importance of digital transformation:

The importance of digital transformation is evident in all levels that adopt it, as it achieves many benefits for governments, companies, or individuals, which are represented in the following:

2-1- For companies: Digital transformation in our current era is an urgent necessity for companies. The benefits of digital transformation for companies include gaining competitive advantages by taking advantage of the latest modern technologies and responding proactively, improving customer experience by responding quickly to their requirements, which leads to increased satisfaction and loyalty, enhancing employee efficiency by using advanced technologies to reduce effort, time and error, and stimulating the spirit of innovation by accessing new technologies and data, and saving costs as the automation of manual processes contributes to, and reducing errors, improving resource allocation in achieving financial efficiency. And increasing productivity as digital technologies help accelerate and improve production processes and improve the quality of products and services provided, and enhancing readiness to face what is emerging in the market as the Corona pandemic emphasized the importance of preparedness and readiness at the level of digital transformation, as adopting digital transformation processes allows business continuity in times of crisis.

2-2- For community members: The importance of digital transformation lies in obtaining more appropriate, faster and more efficient services in responding to their needs and desires, in addition to reducing the cost that may be incurred by personal movement between government departments to access information and complete transactions (Akram , 2024, p. 236). Spreading awareness and developing digital skills for all segments of society.

2-3- For governments: Digital transformation plays a crucial role in improving services, facilitating operations in government institutions, and improving their performance. It also contributes to achieving economic and social development, as it leads to increased integration of the state's economy into the global economy, access to the global market and market sectors, and ease of making many decisions. It also contributes to improving the investment climate, which leads to attracting foreign investments, and also contributes to improving living standards and economic growth, and reflects a positive image of the general performance of the government in terms of achieving justice and fighting corruption (Akram , 2024, p. 236).



II- The reality of digital transformation in Algeria

There are many indicators that can be relied upon to know the reality of digital transformation in any country, such as the Network Readiness Index, the Global Innovation Index, the E-Government Development Index, and the Communications Infrastructure Index. etc. In this study, we will try to limit some of the determinants of the infrastructure, which are: the number of fixed and mobile phone subscriptions and the Internet.

The telecommunications sector is one of the sectors that Algeria attaches great importance to, as evidenced by its opening to competition since 2000 after the issuance of Law 03-2000 in August 2000, which allowed the introduction of the second generation (2G) in 2001, the third generation (3G) in 2013, and the fourth generation (4G) in 2016. The sector has been working on implementing many programs and projects in cooperation with its partners in order to promote integration into the information society and keep pace with the national economy by generalizing the integration of technology in various sectors through modernizing and developing the infrastructure to improve the flow of the Internet and access to it and increase the number of subscribers to fixed and mobile phones. The electronic communications market in Algeria currently includes five operators (Algeria Telecom Satellite, Optimum Telecom Algeria, Algeria Telecom Mobile, Algeria Telecom, National Telecom Algeria) (Authority, 2022, p. 7).

1- Development of mobile phone subscriptions in Algeria:

The number of mobile phone subscriptions in Algeria has witnessed developments in recent years, as shown in the following table:

Table 1: Development of mobile phone subscriptions according to technology in Algeria

	2018	2019	2020	2021	2022
GSM	10 811663	8 514105	6 783111	5 235558	4 260261
3G	17 422312	11 989154	9265682	7 272657	5 961291
4G	18 920289	24 922271	29506880	34 507542	38 797214
Total	47 154264	45425533	45555673	47 015757	49 018766

Source: Ministry of Post and Telecommunications, Report on the Development of Telecommunications Indicators for the First Half of 2023, Algeria, p. 11.

Table No. (01) shows that the number of mobile phone subscribers increased from 47.1542 million in 2018 to 49.0187 million in 2022, despite the decline recorded in 2019 and 2020 due to the Covid-19 crisis and the resulting border closures that resulted in a shortage of imports and an increase in the prices of mobile phones. The table also shows a decrease in second-generation and third-generation subscriptions, especially after the introduction of fourth-generation technology.



2- Development of fixed-line telephone subscriptions in Algeria:

Fixed-line telephone subscriptions were characterized by continuous increase, reaching 5,576,193 subscribers in 2022, an increase of 36% compared to 2017. It is also noted that residential subscriptions dominate at the expense of professional ones in fixed-line telephone subscriptions in Algeria, and the following table No. (02) illustrates this:

Table 2 : Development of fixed telephone subscriptions in Algeria

	2017	2018	2019	2020	2021	2022
Residential Subscriptions	3611735	3 711765	4 190162	4 347326	4 646659	5 126100
Professional Subscriptions	489247	452274	445055	438437	450400	450093
Total	4 100982	4 164039	4 635217	4 785763	5 097059	5576193

Source: Ministry of Post and Telecommunications, Report on the development of telecommunications indicators for the first half of 2023, Algeria, p. 06.

3- Development of Internet subscriptions in Algeria:

Distribution of Internet subscriptions according to fixed Internet network and mobile Internet.

Table 3: Development of fixed Internet and mobile phone subscriptions in Algeria

	2018	2019	2020	2021	2022
Subscriptions less than 10 MB	2199194	2385257	2576105	68577	10321
Subscriptions from 10-20 MB	861301	1191875	1205611	3621969	4204916
Subscriptions equal to or greater than 20 MB	2605	3324	7412	484826	490609
Total fixed internet subscriptions	3063100	3580456	3789128	4175372	4705846
Total mobile internet subscriptions	36342601	36911428	38772562	41780199	44757505

Source: Ministry of Post and Telecommunications, Report on the development of telecommunications indicators for the first half of 2023, Algeria, p. 06.

The table shows the continuous increase in the number of internet subscribers in Algeria, noting that most fixed internet subscriptions were in the 10 to 20 megabyte category, due to the speed of the flow and the appropriate pricing for subscribers. While mobile internet subscriptions have seen a continuous raise with the increase in fourth generation technology subscriptions (Telecommunications, 2023, p. 17).



It can be said that Algeria has prospects for digital transformation in Algeria, which are mainly due to the availability of political will for this endeavor, a set of legislations that govern and regulate it, human resources qualified to implement it, and financial resources to finance it. As for basic facilities, Algeria has achieved important achievements in this aspect, the most important of which are the following (ESCWA, 2021, p. 2):

- The fiber optic link between the capital Algiers and the farthest border point in the Algerian desert, specifically in the border state of Ain Guezzam, in addition to the maritime link between the state of Oran and the city of Valencia in Spain.
- The fourth generation mobile phone technology that was introduced in 2014, with the fifth generation technology and the Internet of Things to intervene in the future.
- Algeria owns a communications satellite ALComSat-1 that was launched in 2017.

We note here that Algeria intends, by 2025, to adopt the first national strategy for digital transformation, which aims to develop the digital sector in Algeria under the supervision of the High Commission for Digitization.

4- Analysis of the development of foreign direct investment flows into Algeria

Foreign direct investment is an important catalyst and tributary in driving the wheel of economic growth for all countries of the world, as it contributes to the flow of capital, transfer of technology, and the provision of job opportunities across borders. It also plays a fundamental role in enhancing productivity and encouraging innovation in host countries. According to the Balance of Payments and International Investment Position Manual, foreign direct investment is defined as “a category of cross-border investment that is linked to a resident of one economy who has control or a high degree of influence in the management of an enterprise resident in another economy” (IMF, 2009, p. 100), multinational companies are one of the controllers of it, and this is due to the capabilities they possess, and all countries seek to attract it, and this is due to its importance in financing economic development programs and projects, especially developing countries that suffer from imbalances and gaps, especially those related to the savings gap, the foreign exchange gap, the gap between revenues and public expenditures, in addition to the technological gap.

Algeria is among the developing countries that did not realize the importance of foreign direct investment until after the economic crisis it experienced after the collapse of oil prices in 1986 and its subsequent repercussions, especially its need to reform the economy under the supervision of international financial institutions (International Monetary Fund, World Bank), which forced it to change its economic and political approach, as Algeria sought to provide a favorable environment through a set of laws regulating investment, the latest of which was Law 22-18 on investment dated July 24, 2022. The following table shows the development of foreign direct investment flows into Algeria.



Table 4: Development of foreign direct investment flows into Algeria during the period (1993-2022).

Year	Foreign investment inflow to Algeria (million dollars)	Year	Foreign investment inflow to Algeria (million dollars)
1993	0.000	2008	2632.04
1994	0.001	2009	2754.11
1995	0.001	2010	2301.225
1996	27	2011	2580.62
1997	26	2012	1499.44
1998	606.6	2013	1696.86
1999	291.6	2014	1506.73
2000	280.1	2015	-584.53
2001	1113.10	2016	1636.29
2002	1064.96	2017	1232.34
2003	637.85	2018	1474.58
2004	884.74	2019	1381.83
2005	1145.61	2020	1139.72
2006	1888.45	2021	869.69
2007	1743.63	2022	254.73

Source : UNCTAD, United Nations Conference on Trade and Development, world investment reports, Online data source: <https://unctad.org/>

The table clearly shows the developments witnessed by foreign direct investment flows to Algeria during the study period (1994-2022), as the years from the beginning of the period until 1997 witnessed very small flows due to several factors, including the economic and security crisis that Algeria experienced during the first half of the nineties, but we note that starting from 1998, the volume of foreign direct investment flows to Algeria began to record a noticeable improvement, reaching \$606.6 million as a result of the improvement in the security situation in particular, the upward trend in the volume of foreign direct investment flows into Algeria continued during the first decade of the third millennium as a result of the improvement of the economic and financial conditions due to the rise in oil prices and the revival of development programs, in addition to the stability of the political situation that culminated in the National Reconciliation Law in 2005, where the year 2009 recorded the largest value of 2754.11 million dollars, and with the advent of the second decade of the third millennium, the flow of foreign direct investment into Algeria witnessed a decline, where the year 2010 recorded a value of 2301.22 million dollars, this period also witnessed fluctuations that reached the point where 2015 witnessed a negative flow estimated at \$884.53 million, due to the Algerian government purchasing the foreign investor's (Ben Lakhal , 2017, p. 129). Foreign direct investment flows to Algeria returned to a significant decline during the years 2021-2022, mainly due to the global health crisis Covid-19, which led to a decline in foreign direct investment activity in all countries of the world.



III- Measuring the effect of Digital Transformation on Attracting Foreign Direct Investment to Algeria.

1- Model specifications:

The study aims to estimate the impact of digital transformation on attracting foreign direct investment in Algeria, by measuring the impact of the explanatory variables represented by the most important infrastructure determinants in the short and long term on attracting foreign direct investment in Algeria, and based on what most theoretical and experimental studies have concluded that there is an impact of digital transformation indicators on attracting incoming foreign investment. The size of this impact varies from one country to another based on the availability of its attraction determinants, and through this study we try to test and estimate the impact of digital transformation on attracting foreign direct investment in Algeria.

Accordingly, to determine the appropriate form of the study model, we relied on three explanatory variables for the dependent variable represented by foreign investment flows into Algeria (FDI), which are: Internet subscriptions (INTE), mobile phone subscriptions (MOB), and fixed-line telephone subscriptions (FTEL). In our selection of the explanatory variables, we relied on the fact that they are considered among the most important infrastructures that support digital transformation and attract foreign direct investment, and given that most previous studies used them. Given the existence of structural changes, especially those related to the shock experienced by foreign direct investment flows in Algeria when 2015 recorded a negative value, a dummy variable was included that takes the value 0 before 2015 and the value 1 after it. In light of this, the basic model used in the study can be expressed as follows:

$$FDI = f(INTE, MOB, FTEL, DUMMY) \dots\dots\dots(01)$$

To study the long-term and short-term equilibrium relationship between the independent variables and the dependent variable, we use the autoregressive lag (ARDL) methodology. Accordingly, we write the long-term equilibrium relationship as follows:

$$FDI = \beta_0 + \beta_1(INTE)_{t-1} + \beta_2(MOB)_{t-1} + \beta_3(FTEL)_{t-1} + \beta_4(FDI)_{t-1} + \beta_5(DUMMY)_{t-1} + \varepsilon_t \dots\dots\dots(02)$$

Where: Fixed telephone subscriptions (per 100 people)

- β_0 : represents the constant term.
- FDI: Foreign direct investment, net inflows (% of GDP).
- INTE: Individuals using the Internet (% of population).
- MOB: Mobile cellular subscriptions (per 100 people).
- FTEL: Fixed telephone subscriptions (per 100 people).
- DUMMY: The dummy variable takes the value (0,1)
- $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$: long-run coefficients of human development for: FDI.
- ε_t : random error term.



For the short-term equilibrium relationship and the error correction model (ECM), they are formulated according to the following equation:

$$(FDI)_t = \beta_0 + \sum_{i=1}^n \beta_1 \Delta(INTE)_{t-1} + \sum_{i=1}^n \beta_2 \Delta(MOB)_{t-1} + \sum_{i=1}^n \beta_3 \Delta(FTEL)_{t-1} + \sum_{i=1}^n \beta_4 \Delta(FDI)_{t-1} + \sum_{i=1}^n \beta_5 \Delta(DUMMY)_{t-1} + \psi(ECT)_{t-1} + \xi_t \dots\dots\dots (3)$$

Where Δ refers to the first differences of the variables under study, n : refers to the length of the optimal slowdown period, and ξ_t is the white noise residuals, ψ : adjustment speed $(ECT)_{t-1}$: error correction term.

2- Data description: This study used annual data from 1993 to 2022. Data were obtained from the World Development Indicators (WDI) database of the World Bank.

3- Unit Root Test:

the Augmented Dickey–Fuller (ADF) test and Phillips-Perron (PP) test statistic were done at levels and differences to determine the degree of integration. The test results are summarized in Table (5) and (6) below.

Table 5: Unit root test results using (PP)

Variables		With Constant	With Constant & Trend	Without Constant & Trend	degree of integration
FDI	At level	-1.9714	-1.7595	-1.3021	I(1)
	At first difference	-6.4064***	-6.4970***	--6.5280***	
INTE	At level	3.9674	-0.1822	5.6664	I(1)
	At first difference	-2.8979***	-5.5605***	-1.3486	
MOB	At level	-0..7571	-1.4945	0.6949	I(1)
	At first difference	-2.6569***	-3.2426*	-2.6569***	
FTEL	At level	3.0318	-1.7311	3.0318	I(1)
	At first difference	-4.2609**	-5.2762***	-4.2609**	
*, **, *** indicate that the series is stationary at 1%, 5%, 10% significance level, respectively.					

Source: Eviews12 outputs

**Table 6: Unit root test results using (ADF)**

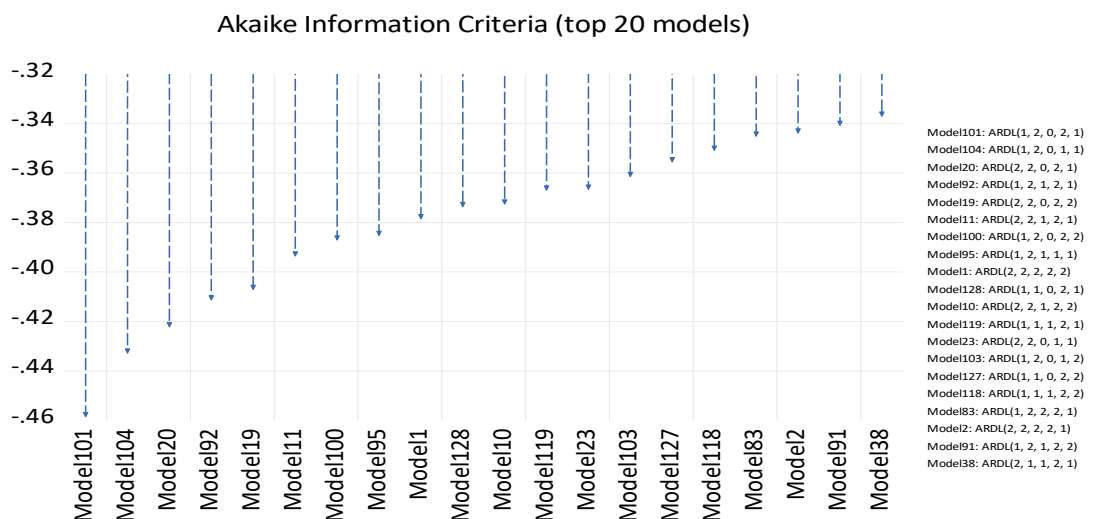
Variables		With Constant	With Constant & Trend	Without Constant & Trend	degree of integration
FDI	At level	-1.9607	-1.7328	-1.3390	I(1)
	At first difference	-6.4001***	-6.4669***	-6.5222***	
INTE	At level	4.5570	3.0879	7.2334	I(1)
	At first difference	-1.2969	-5.5605***	-0.3268	
MOB	At level	-1.3412	-2.6500	-0.1593	I(1)
	At first difference	-3.2752**	-3.2426*	-1.5212	
FTEL	At level	0.0716	-1.7311	2.7307	I(1)
	At first difference	-5.3214***	-5.2755***	-4.2056***	

*, **, *** indicate that the series is stationary at 1%, 5%, 10% significance level, respectively.

Source: EvIEWS12 outputs

From the results shown in Table (5) and (6), According to the results, it was found that all variables are integrated to the first degree(I1).. This allows the application of the Bounds test.

4- Lag selection and the optimal model: the optimal lag period was determined with two periods, as shown in Figure (01): the selection of lag lengths in the ARDL model was based on the Akaike Information Criterion (AIC). The selected ARDL model is ARDL(1, 2, 0, 2,1).

Fig.1 : Optimal lag periods according to the Akaik criterion for the (ARDL) model

Source: EvIEWS12 outputs



5- ARDL Bounds Test Approach to Cointegration

Table 7: Results of the Bounds Method Test

F Statistic	Critical values	significance level		
		1%	5%	10%
F=11.18663	I (0)	3.29	2.56	2.2
	I (1)	4.37	3.49	3.09

Source: Prepared by the researcher based on the outputs of the Eviews12 program

It is clear from Table (07) The calculated F-statistics 11.18663 is greater than upper critical bounds, indicating the presence of cointegration among the variables, which validates the presence of a long- run relationship between foreign investment flows into Algeria ; and Internet subscriptions, and mobile phone subscriptions, and fixed-line telephone subscriptions in Algeria during the period(1993-2022).

6- Estimating the long-term relationship: After we concluded that there is joint integration between the model variables, we will estimate the relationship in the long run, which is shown in the following table: After confirming the existence of joint integration between the variables under study and estimating, we can now estimate the long-term relationship equation. The estimation results are shown in Table (08):

Table 8: Results of long-term relationship estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FTEL	0.213135	0.084156	2.532607	0.0215
INTE	-0.057053	0.012801	-4.456777	0.0003
MOB	0.008897	0.002419	3.678159	0.0019
DUMMY	1.941506	0.532390	3.646778	0.0020
C	-0.848527	0.439609	-1.930186	0.0704
EC = FDI - (0.2131*FTEL -0.0571*INTE + 0.0089*MOB + 1.9415*DUMMY - 0.8485)				

The results of the long-term estimates in Table (08) show that fixed telephone subscriptions (FTEL).is a positive and significant impact on foreign direct investment flows in Algeria(FDI), as increasing the fixed telephone subscriptions by 1% leads to an increase in the percentage of foreign direct investment flows to the gross domestic product by 0.213% in the long run, . The estimation results also showed the positive impact and direct relationship between mobile cellular subscriptions and foreign direct investment flows in Algeria(FDI), as increasing mobile cellular subscriptions by 1% leads to an increase in FDI by 0.008% with statistical significance at the 1% level(Prob=0.0019). On the contrary, the results



showed in the long term the negative and significant impact of individuals using the Internet (% of population) on foreign direct investment flows in Algeria, as a 1% increase in internet subscriptions leads to a decrease in the ratio of foreign direct investment flows to GDP by 0.057%. As for the dummy variable, the results showed that it had a positive and significant effect, which indicates its importance in the reliability of the model in the long-term.

7- Estimating the short-term coefficients and the error correction model:

After confirming the existence of cointegration and estimating the long run relationship equation, we can now estimate the error correction model (ECM) for the foreign direct investment, net inflows and the independent variables to measure the short-term relationship and measure the speed of adjusting and correcting the error by rebalancing in the long term. The estimate results are shown in Table (09)

Table 9 : Results of estimating the short-term coefficients and the error correction model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FTEL)	-0.225113	0.053419	-4.214078	0.0006
D(FTEL(-1))	-0.144478	0.060384	-2.392667	0.0285
D(MOB)	0.020049	0.004507	4.448509	0.0004
D(MOB(-1))	0.009877	0.004968	1.988048	0.0632
D(DUMMY)	-0.238193	0.160722	-1.482017	0.1566
CointEq(-1)*	-0.699344	0.075038	-9.319917	0.0000

Source: Eviews12 outputs

The results of the short-term estimates of the Foreign direct investment, net inflows in Table (09) indicate that Mobile cellular subscriptions, when increased by 1%, lead to an increase in Foreign direct investment, net inflows by 0.02%, which indicates a positive but weak effect at a significance level of 1% on the Foreign direct investment, net inflows in the short term.

On the contrary, for the fixed telephone subscriptions, is a negative impact on the FDI flow indicator, as a 1% increase in the fixed telephone subscriptions leads to a 0.22% decrease in FDI flows to Algeria, indicating the existence of a significant inverse relationship at a statistical significance of 0.006%. The study also showed the insignificant negative impact of the dummy variable and the absence of any impact of the Internet variable on FDI flows to Algeria in the short run.

It is also clear from Table (09) that the error correction coefficient is negative(-0.6993) and statistically significant at a significance level of 1% (0.000), which



confirms the existence of a long-term relationship between the explanatory variables represented by the fixed telephone subscriptions and mobile cellular subscriptions and individuals using the Internet and the dummy variable and the dependent variable represented by the foreign direct investment, net inflows. It also indicates that 69.93% of the imbalances in the foreign direct investment in the previous year from its equilibrium values in the long term are corrected in the current year.

8- Diagnostic Tests:

8-1 Test LM (Brewsh-Godfry) : This test is used to detect the possibility of the existence of a serial autocorrelation between the errors in order to know the possibility of accepting the null hypothesis that there is no serial autocorrelation problem between the regression parameters. The following table shows the results of this test.

Table 10: Breusch-Godfrey Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:			
Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	1.496929	Prob. F(2,15)	0.2554
Obs*R-squared	4.658702	Prob. Chi-Square(2)	0.0974

Source: EvIEWS12 outputs

The table shows that the probability value = 0.2554 F(1.496929) which is greater than 5% and thus we accept the null hypothesis stating that there is no problem of serial autocorrelation between the errors.

8-2 Heteroskedasticity Test: Breusch-Pagan-Godfrey :

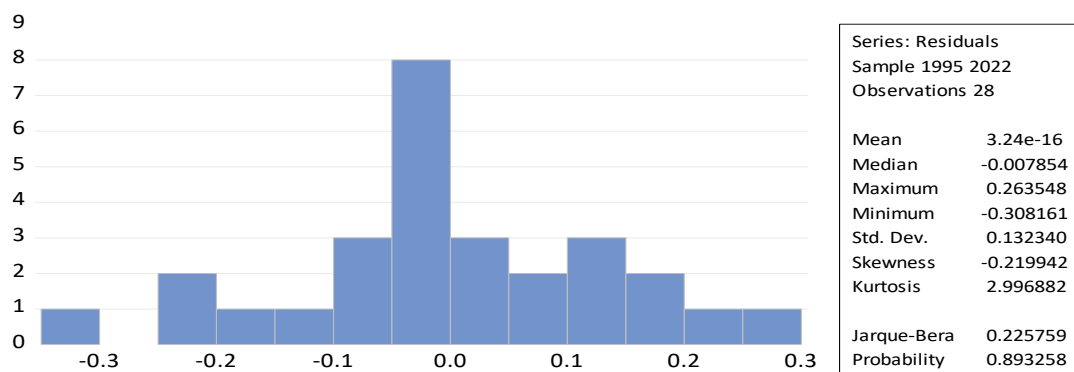
Table 11: Heteroskedasticity Test: Breusch-Pagan-Godfrey

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
Null hypothesis: Homoskedasticity			
F-statistic	2.153251	Prob. F(10,17)	0.0788
Obs*R-squared	15.64679	Prob. Chi-Square(10)	0.1102

Source: EvIEWS12 outputs

The table(11) shows the results of Breuch- Pagan that the calculated the probability value = 0.078 was greater than 5%, which means that the null hypothesis is accepted, indicate no significant evidence of heteroskedasticity.

8-3 Normality TEST : It is a test to verify the normal distribution of the residuals of the regression equation, which is what the test proved on the model, as shown in the following figure:

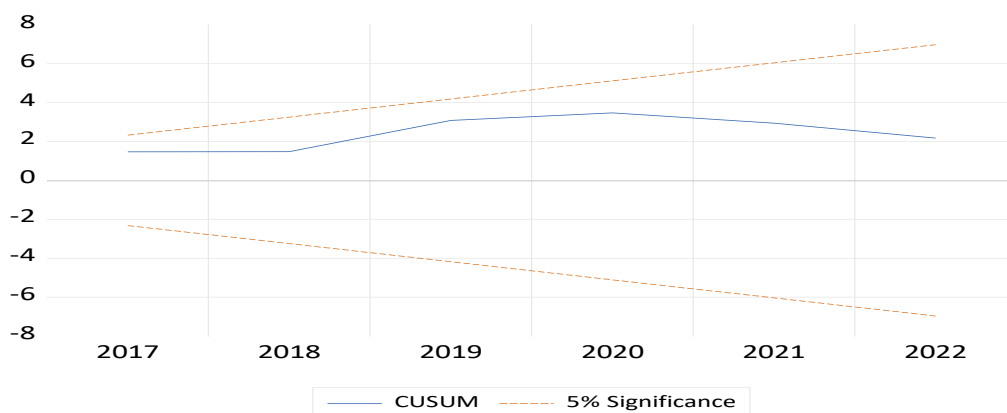
**Fig.2 : Normal Distribution of the Residuals of the Regression Equation**

Source: Eviews12 outputs

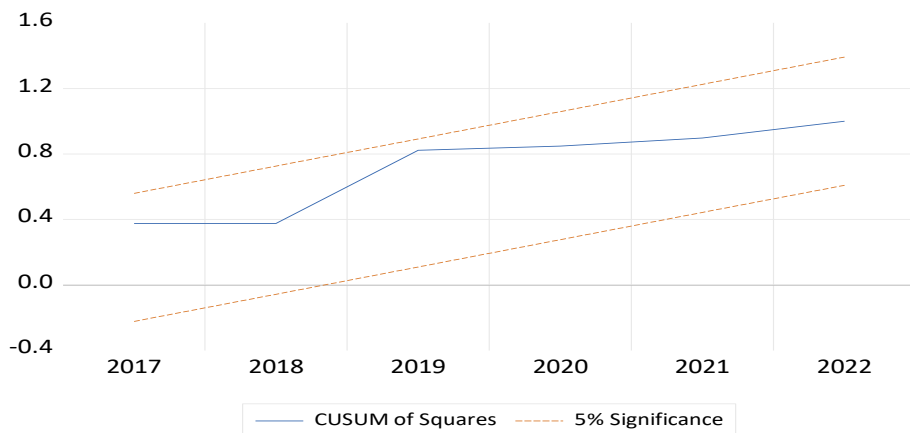
The figure(02) shows that the value of Jarque-Bera = 0.225 with a probability of 0.893 was greater than 5%, which means that the null hypothesis is accepted, This allows us to accept the null hypothesis that the residuals of the regression follow a normal distribution.

9- Stability Test:

The stability of Model is examined using the Cumulative and Cumulative Sum Squares condition of stability of the model is if the plots of the CUSUM and CUSUMSQ fall within the critical bounds at the significance level 5%, and this was proven in form the figures 3 and 4

Fig.3 : Plot of Cumulative of Recursive Residuals

Source: Eviews12 outputs

**Fig.4: Plot of Cumulative of Squares of Recursive Residuals**

Source: Eviews12 outputs

Conclusion:

This study investigated the impact of digital transformation on attracting foreign direct investment in Algeria during the period from 1993 to 2022 using the autoregressive methodology for lagging time gaps, as many theoretical and experimental studies have gone to the important role of digital transformation on attracting foreign direct investment, and this was proven in the case of Algeria through the following two hypotheses:

- There is a joint integration relationship between digital transformation and attracting foreign direct investment in Algeria.
- There is a positive impact of digital transformation indicators on foreign investment flows into Algeria, with the exception of the Internet.

The most important results reached by the study were the following:

- Through testing the limits of joint integration, the study found that there is joint integration between digital transformation and attracting foreign direct investment in Algeria, which proves the validity of the first hypothesis, and also allows us to measure the relationship between variables in the short and long term.
- The results of the study showed in the long term the positive impact of both mobile and fixed phone subscriptions on foreign investment flows into Algeria, and the negative impact of the Internet subscription variable on foreign investment flows into Algeria.
- The study also showed through the negative error correction coefficient the length of the period foreign investment flows to return to equilibrium in the long term when any changes occur in digital transformation indicators.



- The study clarified the efforts of the Algerian authorities to support digital transformation in all fields, gradually starting with providing a suitable infrastructure environment by increasing the connection to telephone and Internet lines equipped with high technologies, leading to the adoption of a national strategy for digital transformation.

The study concluded that Algeria faces several challenges in the digital transformation process, the most important of which is providing an advanced infrastructure for all communications, considering that it constitutes the basis of the issue of digital transformation, which has become a necessity in order to keep pace with the global trend of using information and communications technology in various fields, and thus its impact on economic and social development. In this context, we find that all countries seek to benefit from the digital transformation process, especially with regard to attracting foreign direct investment due to its importance in financing development projects in all their dimensions, especially economic ones. The study concluded that the digital transformation indicators have a weak impact on attracting foreign direct investment. Accordingly, the study recommends the need to accelerate the digital transformation process due to the inevitability and importance of adopting it.

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