مجلة الأصيل للبحوث الاقتصادية والإدارية
El - Acil Journal forEconomic and Administrative Research
ISSN: 2571-9866
EISSN: 2661-7854
Volume:10./ N°1./ ***April****,2026, PP121-136*

The impact of digital development on economic growth in Algeria An econometric study for the period (1990-2023)

أثر التنمية الرقمية على النمو الاقتصادي في الجزائر دراسة قياسية للفترة (1990-2023)

***Sebti Latifa**
University of Biskra
Latifa.sebti@univ-biskra.dz

El ghoul Islam Nacer Eddine
CRSTRA-Biskra
islammlili@yahoo.com

Received:*10/02/2026* ***Accepted:****16/04/2026* ***Published****: 30/04/2026*

Abstract :

This study aimed mainly at testing the impact of digital development on economic growth in Algeria during the period (1990 to 2023). To achieve this goal an econometric model was designed based on the economic theories and published scientific studies. The study data were obtained from the World Bank website. The results of the econometric analysis showed a significant positive impact between the digitalization and economic growth. The study recommended the need to pay attention to digitalizing all sectors in order to keep pace with the global trend and to increase the efficiency and effectiveness of business completion, especially since the Corona pandemic crisis which strongly proven the importance of digitalization.

Key words: Digital development, Internet, Technology, Economic growth.
JEL classification codes: L86, O33, O40

* ***Corresponding author***

1. Introduction.

The digital transformation of the past few decades has profoundly changed almost every aspect of life. Internet access and connectivity, the increasing number of people using mobile (smart phones) and social media, and other information and communication technology services have all impacted how individuals interact, communicate, learn, and work.

1.1. The problem statement

Following the COVID-19 pandemic, which affected the entire world, digitalization in general, and the digitalization of the economy in particular, has gained significant importance as a key driver of real economic growth. Digitalization also increases the efficiency of traditional factors of production such as capital and labor.

This study attempts to answer the following question:

-What is the impact of digital development on economic growth in Algeria during the period (1990-2023)?

This main question encompasses several sub-questions :

-What is the impact of gross fixed capital formation on economic growth in Algeria during the period (1990-2023)?

-What is the impact of the labor force on economic growth in Algeria during the period (1990-2023)?

-What is the impact of trade openness on economic growth in Algeria during the period (1990-2023)?

-What is the impact of digitalization on economic growth in Algeria during the period (1990-2023)?

-What is the impact of technology on economic growth in Algeria during the period (1990-2023)?

1.2. The study Objectives

The main objective of this study is to examine the impact of digital development on economic growth in Algeria during the period (1990-2023), in addition to the following sub-objectives:

-To study and analyze the evolution of economic growth in Algeria during the period (1990-2023)
-To study and analyze the evolution of digital development in Algeria during the period (1990-2023).

1.3. The study hypothesis

This study is based on testing the following hypotheses:

1-The gross fixed capital formation has no impact on economic growth in Algeria during the period (1990-2023)

2-The labor force has no impact on economic growth in Algeria during the period (1990-2023)

3- The trade openness has no impact on economic growth in Algeria during the period (1990-2023)

4-The digitalization has no impact on economic growth in Algeria during the period (1990-2023)

5-The technology has no impact on economic growth in Algeria during the period (1990-2023)

1.4. The study method

To achieve the study's objectives, a descriptive approach (method) will be used to present the theoretical framework of the study variables and analyze the related data. Econometric analysis will also be employed to test the impact of each of the independent variables (gross fixed capital formation, labor force, trade openness, digitalization, and technology) on the dependent variable (economic growth), represented by GDP per capita in Algeria during the period (1990-2023).

1.5. The literature review (the previous studies)

A large number of previous arabic and foreign studies were reviewed and arranged chronologically from oldest (2011) to newest (2024). The following is a presentation of the objectives and results reached by each study:

(Luu, 2011) tested the impact of digital transformation on the economic growth of the 8 provinces in Vietnam's Southern key economic region over the period (2009-2017). Using the Difference Generalized Method of Moments (DGMM) technique. The results were that a 1% rise in the readiness index for IT application and development is associated with a 0.84% increase in the gross regional domestic product. The growth can be linked to enhancements in the IT infrastructure indices and the IT application index in the key economic zones in the southern region.

(Hina, Sumaira, & Basit, 2024) tried to explore how digitization affects the economic growth of 87 developing countries emerging economies, by using a panel dataset covers the period from 2000 to 2023, a Panel Autoregressive Distributed Lag (ARDL) methodology

is utilized for the analysis. Research's results found that taxes have a detrimental impact on economic expansion. At the same time, variables such as DI, GFCF, LFPR, and M2 have a positive effect on the economic growth of emerging nations.

(Harshitta, Debi, & Byomabesh, 2024) aimed at investigating the dynamic relationship between digitalization, financial inclusion and economic growth from 2010 to 2020 for G20 nations. Using an ARDL approach. They revealed a positive correlation between digitalization and long-term economic growth. Conversely, the research findings indicate a negative relationship between them in the short run. Similarly, we spot an detrimental long-term association between financial inclusion, measured as the number of commercial bank branches, and economic growth.

(Neffati & Jbir, 2024) aimed at testing the impact of economic diversification and digitalization on economic growth in Saudi Arabia during the period 1990–2021. using the autoregressive distributed lag (ARDL) cointegration approach. The empirical results offer compelling evidence that economic diversification and digitization affected economic growth both directly and indirectly through their effects on non-oil GDP growth. The findings indicate that there was a long-run dynamic between economic growth, economic diversification, and digitalization. In the long run, digitalization contributed to the progress of non-oil economic growth and, therefore, sustainable economic growth. In addition, digitalization played an important role in the Kingdom's economic transition toward economic diversification. Indeed, our results proved that digitalization increases non-oil income and then reduces the supremacy of the oil sector in the economy, which promotes economic diversification.

The current study is similar to the studies presented above in that it addressed the variables of digital development and economic growth, but it differs from them in terms of the descriptive and quantitative presentation of the study variables, as well as in terms of the method adopted in the econometric analysis.

1.6. The study model

This section of the study focuses on testing the impact of each of the independent variables (gross fixed capital formation, labor force,

trade openness, digitalization, and technology) on the dependent variable (economic growth), represented by GDP per capita in Algeria during the period (1990-2023). Using an econometric model based on established macroeconomic theories, the results of this study have implications for the choices and effectiveness of macroeconomic policies. To test the study hypotheses and answer the study questions, the researchers relied on an econometric model constructed based on studies conducted by (Warrad, 2024). The study model is formulated as follows:

$$\text{Ln GDP per capita}_t = b_0 + b_1 \text{ Ln GFCF}_t + b_2 \text{ Ln LF}_t + b_3 \text{ Ln OP}_t + b_4 \text{ Ln DIG}_t + b_5 \text{ Ln TECH}_t + E_t$$

Where:

b_0: The constant.

b_1, b_2, b_3, b_4, b_5: Coefficients of the independent model variables

GDP per Capital: Real GDP per capita in US dollars*

*Real GDP per capita is calculated by dividing real GDP by the population. Economists rely on it, rather than the size of GDP itself, as a measure of economic growth because it is free from inflationary effects and takes population size into account, making it a reliable and accurate indicator of a country's economic growth and individual well-being (Cassells, Vidyattama, & Miranti, 2009)

$GFCF_t$: Gross fixed Capital Formation, measured in US dollars.

LF_t: Labor Force, measured in individuals (15-65 years old)

OP_t: Trade Openness, measured as a share of GDP.

DIG_t: Digitalization, measured by the number of people using the internet.

$TECH_t$: Technology, measured by the number of patents.

E_t: Error term

1.7. The study data

The researchers relied on secondary data, which was obtained through World Bank statistics, as well as through a review of books, articles, university theses, and reports related to the subject of the study. The aim of resorting to secondary sources in this study is to benefit from the results it reached and the prospects it highlighted, as

well as to get a general idea of the latest developments that have occurred and are occurring in the field of this study.

2. The differences between : digitization, digitalization and digital transformation

In 1945, John von Neumann presented a standardized script for writing and processing data instructions. This allowed machines to handle data and instructions in the same way, paving the way for the modern computer.

In 1947, three American researchers—John Bardeen, William Schockley and Walter Brattain—invented the transistor at Bell Labs. The concept of the microprocessor dates back to 1947, but Intel didn't market its 8080 model until 1974. This model was used in early computers such as the Altair 8800 from MITS and the Imsair 8080.

The synergy and cooperation between these components led to smaller and cheaper microprocessors over time. Furthermore, Steve Jobs's brilliant idea, later championed by Microsoft, to create accessible applications for everyone revolutionized computing. The evolution of digitization can be summarized as follows:

Fig 1. The evolution of digitalization

1970-1990	Era of main frames
1990-2020	Era of microcomputing
2020 till today	Era artificial intelligence

Source : Matoušková D, 2022, p 53

Digitization, digitalization, and digital transformation can be defined as follows (MATOUŠKOVÁ, 2022)

*Digitization refers to the technical process of converting, creating, storing, or processing data.

*Digitalization is a socio-technical phenomenon resulting from the use of digital technologies and their impact on societies, institutions, and individuals' lives.

*Digital transformation refers to technological innovation without neglecting the human element. In other words, digital transformation is the process of converting an object, tool, process, or profession into computer code to make it more efficient, while considering the

social and technical impact of adopting digital technologies on society, organizations, and individuals.

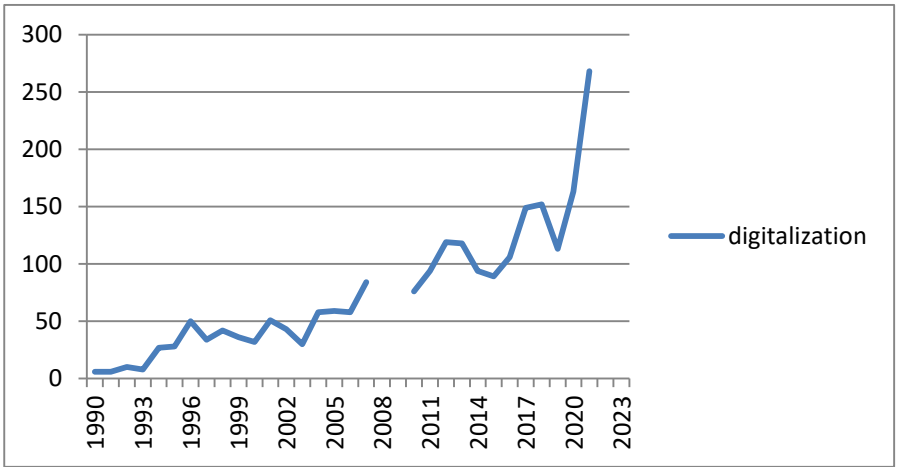
3. Analysis of the evolution of and economic growth in Algeria during the period (1990-2023)

In this section of the study, we analyze the evolution of digitalization (presented by the number of individuals using the internet) and economic growth (presented by per capita real GDP) in Algeria during the period (1990-2023).

3.1. Analysis of the evolution of digitalization in Algeria during the period (1990-2023)

In this section of the study, we analyze the evolution of digitalization (represented by the number of individuals using the internet) in Algeria during the period (1990-2023).

Fig 1. The evolution of digitalization



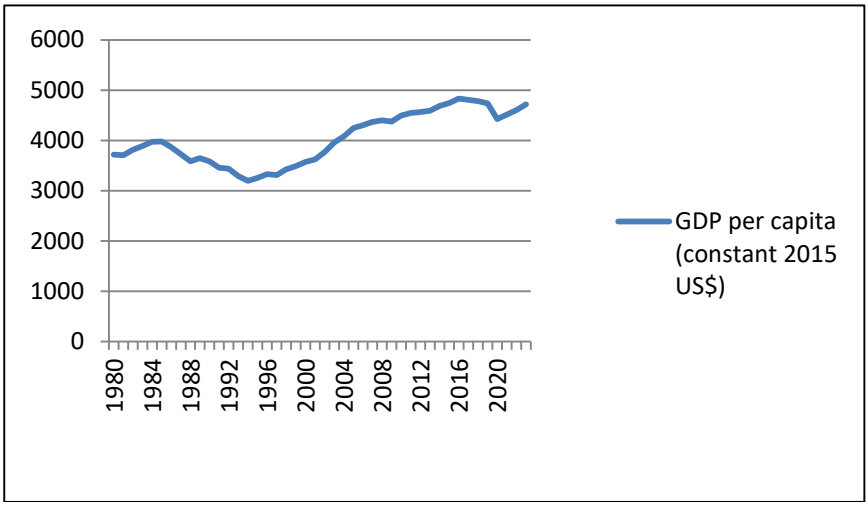
Source : World Bank Data, 2025

We can see from the figure above that the number of individuals who use the Internet has fluctuated slightly between rising and falling, but it has generally tended towards increasing throughout the study period because of the increased use of smart phones and digital services...etc.

3.1. Analysis of the evolution of economic growth in Algeria during the period (1990-2023)

In this section of the study, we analyze the evolution of economic growth (presented by per capita real GDP) in Algeria during the period (1990-2023).

Fig 1. The evolution of digitalization



Source : World Bank Data, 2025

We can see from the figure above that the per capita gross domestic product throughout the study period (1990-2023) has fluctuated between rising and falling, as it experienced a decline during the eighties, then generally trended towards rising from the nineties until the end of the study period because a lot of economic phenomena .

4. Econometric analysis

In this part of the study, we will estimate the relationship between the study variables (the impact of digital development on economic growth) using the appropriate econometric tests.

4.1. Selecting the optimal number of lags

It is necessary to determine the optimal number of lags to remove any sequential correlation between the residuals (Gujarati, 1995)To select the optimal number lags, many tests can be used, and the Akaike and Schwartz tests are the most common and used in studies. The results in Table 1 below show that the optimal number of lags is one (1).

Table 1. Optimal lag lengh selection test

n of	LogL	LR	FPE	AIC	SC

lags					
0	-174.0783	NA	127011.5	14.58986	14.63895
1	-140.1012	62.29142*	8137.816*	11.84177*	11.93994*
2	-139.7684	0.582449	8611.052	11.89736	12.04462
3	-139.7631	0.008786	9372.360	11.98026	12.17660
4	-139.5853	0.281484	10067.72	12.04878	12.29420
5	-138.8126	1.159085	10307.89	12.06772	12.36223

Source: Eviews.9 outputs

* represents the optimal number of lags.

AIC: represents the Akaike test value.

SC: represents the Schwartz test value.

4.2. The Stationarity test

Before conducting the necessary econometric tests to examine the impact of digital development on economic growth in Algeria during the period (1990-2023), it is essential to verify the stationarity of the data over time to avoid falling into the trap of spurious regression and thus obtaining incorrect estimates. spurious regression is initially indicated by a high value for the coefficient of determination (R^2) and a low value for the Durbin-Watson statistic (Granger & Newbold, 1974)

Several tests exist to determine the stationarity of variables. This study relies on the Augmented Dickey-Fuller test. The decision rule for this test is as follows: (The null hypothesis states that the variable in question has a unit root, i.e., it is not stationary). If the calculated value is greater than the critical value, we reject the null hypothesis, meaning the variable is stationary. Conversely, if the calculated value is less than the critical value, we accept the null hypothesis, meaning the variable is not stationary. A decision can also be made based on a comparison between the probability values. The significance level adopted in this study is 5%. The probability value corresponding to the variable is compared to this 5% significance level. If the probability value is less than 5%, the null hypothesis (that the variable is not stationary) is rejected, and the alternative hypothesis (that it is stationary) is accepted. Conversely, if the probability value is greater than 5%, the null hypothesis (that the variable is not stationary) is accepted, and the alternative hypothesis (that it is stationary) is rejected. Table 2 shows the results of the stationarity test for the study variables.

Table 2. stationarity test

	Cal. Value	Cri. value	Prob. value	Cal. Value	Cri. value	Prob. value	Decision
variables	Constant			constant and time trend			
GDP per capita	-0.182	-2.957	0.802	-1.781	-3.557	0.690	Not stationary at level
Δ(GDP per capita)	-4.003	-2.957	0.004	-3.934	-3.557	0.022	stationary at 1st diff
GFCF	-0.467	-2.963	0.884	-2.023	-3.568	0.565	Not stationary at level
Δ(GFCF)	-3.071	-2.963	0.039	-2.970	-3.568	0.156	stationary at 1st diff
DIG	5.110	-2.957	1.000	0.311	-3.557	0.997	Not stationary at level
Δ(DIG)	-1.215	-2.963	0.654	-5.669	-3.562	0.000	stationary at 1st diff
LF	-2.618	-2.96	0.100	1.830	-3.568	1.000	Not stationary at level
Δ(LF)	-5.460	-2.960	0.000	-4.434	-3.568	0.007	stationary at 1st diff
TECH	1.626	-2.991	0.999	-1.719	-2.971	0.410	Not stationary at level
Δ(TECH)	-4.829	-2.991	0.000	-3.612	-3.875	0.073	stationary at 1st diff

Source: Eviews.9 outputs

*cal.value is calculated value

*cri.value is critical value

*prob.value is probability value

Table.2 shows that the calculated values were lower than the critical values, and the probability value was greater than 5% for the following study variables: GDP per capita, constant gross capital formation (GFCF), digitalization (DIG), technology (TECH), labor force (LF), and trade openness (OP). Therefore, these variables are not stationary at the level I(0).

When considering the first difference for the aforementioned variables, we observed that their calculated values were greater than the critical values, and the probability value was less than 5%.

Therefore, all the variables of the study are stationary at the first difference I(1) Therefore, the most appropriate estimation method in this case is the vector error correction mechanism (VECM).

4.3. The Granger Causality Test

This test can determine the direction of causation between variables. It can be unidirectional, meaning one variable causes the other, or reciprocal, meaning each variable causes the other. It is also possible that there is no causal relationship between the variables. The causality test is based on the F-test, and the calculated F-value is determined using the following equation:

$$Fc = \frac{(RSSr - RSSur)/ q}{RSSur / (n-m)}$$

Where:
n: Number of observations.
q: Number of parameters constrained in the constrained regression.
m: Number of parameters in the unconstrained regression.
RSSur: Sum of squared residuals in the unconstrained regression.
RSSr: Sum of squared residuals in the constrained regression.

In this test, the calculated F-value is compared with the tabulated F-value at a specific significance level. If the calculated F-value is less than the tabulated F-value, we reject the null hypothesis that X does not cause Y, and accept the alternative hypothesis that X causes Y.

Table 3. The Granger Causality test

Causality direction	N	Cal. F	Prob Value	Result of causality
GDP per capita does not cause GFCF	34	14.109	0.000*	We reject H_0 (causes)
GFCF does not cause GDP per capita	34	2.123	0.156	We do not reject H_0 (does not cause)
GDP per capita does not cause DIG	34	6.859	0.013*	We reject H_0 (causes)
DIG does not cause GDP per capita	34	1.953	0.172	We do not reject H_0 (does not cause)
GDP per capita does not cause LF	34	0.246	0.623	We do not reject H_0 (does not cause)

LF does not cause GDP per capita	34	6.289	0.017*	We reject H_0 (causes)
GDP per capita does not cause OP	34	1.110	0.300	We do not reject H_0 (does not cause)
OP does not cause GDP per capita	34	3.022	0.092*	We reject H_0 (causes)
GDP per capita does not cause TECH	34	4.859	0.994	We do not reject H_0 (does not cause)
TECH does not cause GDP per capita	34	0.225	0.639	We do not reject H_0 (does not cause)

Source: Eviews.9 outputs

*If the probability ratio (Prob) is < 0.1 (10%), then we reject the null hypothesis, i.e., that one variable causes the other one.

The results of the causality test can be summarized as follows:
1. Real GDP per capita causes gross fixed capital formation (GFCF) (unidirectional causal relationship)
2. Real GDP per capita causes digitalization (DIG) (unidirectional causal relationship), when individuals' real income is increasing, they looking for digital services which means looking for facility, rapidity and more comfortable life.
3. Labor force (LF) causes real GDP per capita (unidirectional causal relationship)
4. Trade openness (OP) causes real GDP per capita (unidirectional causal relationship)

4.4. The cointegration test

Cointegration refers to the correlation or harmony between two or more time series. A cointegration relationship between variables statistically indicates a long-term equilibrium relationship between these variables. Table 4 presents the results of the Johansen cointegration test for the first model in the current study.

Table 4. the Johansen cointegration test

Supposed n of cointeg equation	Eigen value	Trace statistics	Critical value 0.05	Prob. value
*None	0.932120	186.1853	95.75366	0.0000
At most 1	0.860568	116.2451	69.81889	0.0000
At most 2	0.719514	65.02047	47.85613	0.0006
At most 3	0.521047	31.96845	29.79707	0.0277

At most 4	0.358363	12.82850	15.49471	0.1212
At most 5	0.048458	1.291446	3.841466	0.2558

Source: Eviews.9 outputs

Table 4 shows that the probability value for the assumed number of cointegration relationships (none) is significant (less than the significance level of 5%), which means rejecting the null hypothesis (no cointegration) and accepting the alternative hypothesis (long-term relationship) between the independent and dependent variables of the study.

The results of the Johansen cointegration test indicated a long-term relationship between the study variables. This relationship is determined using the Vector Error Correction Model (VECM), which helps establish causality in both the long and short run. The long-term causal relationship is established using the significancecritical value, the test is significant, indicating the lag value for a single error correction interval for the long-term relationship. The short-term causal relationship is determined using the significance test for the explanatory variables in the first difference. If the calculated t-value is greater than the critical value, the null hypothesis, which states that there is no short-term causal relationship, is rejected. The error correction model is based on estimating the following equations:

$$\Delta GDP\ per\ capita_t = \theta_0 + \sum_{i=1}^{n} \theta_i\, \Delta GDP\ per\ capita_{t-1} + \sum_{i=0}^{m} \theta_i\, \Delta X_{t-1} + \lambda_1 ECT_1 + U_t$$

$$\Delta X_t = \beta_0 + \sum_{i=1}^{m} \beta_i\, \Delta X_{t-1} + \sum_{i=0}^{n} \beta_i\, \Delta GDP\ per\ capita_{t-1} + \lambda_2 ECT_2 + V_t$$

The dependent variable (ΔGDP per capita$_t$): Real GDP per capita

The independent variables (ΔX_i): Gross fixed capital formation (GFCF), Digitalization (DIG), Technology (TECH), Labor Force (LF), and Trade Openness (OP)

ECT_1, ECT_2 Error correction: These represent the rate at which short-run imbalances are adjusted to reach long-run equilibrium. If they are significant, this indicates a long-run causal relationship. If both λ_1 and λ_2 are significant, this indicates a bidirectional causal relationship. If only one is significant, this indicates a unidirectional causal relationship. If θ_0 is significant using a t-test, the explanatory variables cause the dependent variable. If α_0 is significant using a t-test, the dependent variable causes the explanatory variables. Table 5 presents the results of the vector error correction model for the current study model.

Table 5. The Vector Error Correction Mechanism

Cointegration equations	Cointegration equation (1)
GDP per capita (-1)	1.000000
GFCF (-1)	3.94E-08
	(4.4E-09)
	[9.01298]
DIG (-1)	53.17264
	(6.09093)
	[8.72981]
LF (-1)	0.000245
	(5.9E-05)
	[4.17207]
TECH (-1)	18.23321
	(1.91262)
	[9.53310]
OP (-1)	-59.47177
	(5.88912)
	[-10.0986]
C	-1823.227
D((GDP per capita(-1))	
Cointegration equation (1)	0.062660
	(0.06043)
	[1.03692]

Source: Eviews.9 outputs

( ) Standard error

[ ] Calculated T

The error correction vector model can be formulated based on a single lag as follows:

GDP per capita	C	LF	DIG	GFCF	OP	TECH
	-1823.2	0.0002	53.172	3.94E-08	59.889-	18.233
		4.172	8.729	(9.013)	10.098-	9.533

-The calculated value of (t) was greater than the critical value for all the explanatory variables, namely the gross fixed capital formation variable (GFCF), the digitalization variable (DIG), the technology variable (TECH), the labor force variable (LF), and the trade openness variable (OP).

5.Conclusion:

This study primarily aimed to examine the impact of digital development on economic growth in Algeria during the period (1990-2023). It reached the following conclusions:

-The coefficients of the explanatory variables showed a sign consistent with economic theory, which means that there is an impact emanating from these variables towards the dependent variable in the long run. (Regarding the trade openness variable (OP), some studies have shown a positive impact on economic growth, while others have shown the opposite.)

*The coefficient of the gross fixed capital formation variable (GFCF) reached ($3.94*10^{-3}$), indicating that if it increases by one unit, economic growth increases by the same value.

*The coefficient of the digitalization variable (DIG) reached (53.172), indicating that if it increases by one unit, economic growth increases by the same value.

*The coefficient of the technology variable (TECH) reached (18.233), indicating that if it increases by one unit, economic growth increases by the same value.

*The coefficient of the labor force variable (LF) reached (0.00024), indicating that if it increases by one unit, economic growth increases by the same value.

*The coefficient of the trade openness variable (OP) reached (-59.889), indicating that if it decreases by one unit, economic growth decreases by the same value.

As for the relationship between The study variables in the short run show that the error correction coefficient for the economic growth variable is (0.0626), which is positive and statistically significant. This means that 6.26% of the imbalances are addressed in the subsequent period until full equilibrium is achieved in the long run.

In light of these findings, the study recommends prioritizing the digitization of all sectors to keep pace with global advancements and enhance the efficiency and effectiveness of operations, especially given the significant emphasis on this point demonstrated by the COVID-19 pandemic.

6. Bibliography List:

-Cassells Rebecca &Vidyattama Yogi & Miranti Riyana.(2009).The Impact Of A Sustainable Gender Wage Gap On The Australian Economy, Report to the Office for women, department of families, community services, housing and indigenous Affairs, University Of Canberra, Australia.

-Granger William John & Newbold P.(1974). Spurious Regressions In Econometrics, Journal Of Econometrics , (2) : 111-120.

-Gujarati, Damodar.(1995). Basic Econometrics. 4th Edition, MC Graw Hill, United State, New York.

-Harshita Jangid & Debi Prasad Bal & Byomakesh Debata. (2024). Digitalisation and economic growth in g-20 countries: a panel ARDL analysis, Journal of Technology Management Innovation, (1)4: 18-31.

-Hina Asma & Sumaira Batool & Basit Rehman.(2024). Impact of Digitalization on Economic Growth in Developing Countries: A Panel ARDL Analysis, Qlantic Journal of Social Sciences, 5(3), 11-23.

-Matoušková Dana.(2022).Digitalization and Its Impact on Business, Review of Business & Management' TMP, 18(2): 51-67.

-Mohamed Neffati & Rafik Jbir.(2024). The impact of digitalization and economic diversification on economic growth: evidence from Saudi Arabia, technological and economic development of economy, 30(5):1510-1532.

-Thien Binh Luu. (2024), The Effects of Digital Transformation on Economic Growth in the Provinces of Vietnam's Southern Key Economic Region, Pakistan journal of life social Sciences, 22(1): 6867-6877 .

-Warrad Taleb Awad.(2024). The Impact of Digital Development on Economic Growth: Empirical Evidence from Selected Arab Countries, Jordan Journal of Economic Sciences, 11(1): pp 16-23.