Boosting Jordan's Economic Growth through Digital Economy Expansion: Quantitative Analysis and Policy Implications

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Abstract: - This study aims to understand the influence of the critical drivers of the digital economy on Jordan's economic growth using a cointegration model between the periods from 2005 to 2022. The essential drivers include the number of fixed-line users, mobile phone subscribers, Internet users, fixed-line purchasers, and mobile subscribers. The model was estimated using the Vector Error Correction Model (VECM), revealing a unique and consistent integrating relationship between variables. This indicates that the digital economy helps Jordan grow faster and creates job opportunities, which also helps improve the quality of many sectors. The study suggested that the business environment can be improved by enhancing trust and increasing transparency. The government should focus on the digital economy as a sector that works to increase growth rates in Jordan. It must also work to develop infrastructure, which requires more investment in this area, and there is a need to enhance investments in the Jordanian digital economy and enhance the effectiveness of the industry to enhance the country's Gross Domestic Product.

Key-Words: - Cointegration, Digital Economy, Economic Growth, Gross Domestic Product, Fixed-line subscribers, Internet subscribers, Mobile phone subscribers, Public Sector and Vector Error Correction Model.

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1 Introduction

The financial system is highly instrumental in diverse socio-economic issues facing societies, particularly economic growth. The Jordanian economy, which can be classified as a developing one, has an emerging vibrant digital economy. The digital economy (conceptualized in more detail below) influences the growth of the economy through its impact on the efficiency of production inputs and outputs. This is exemplified by the increase in the utilization of production factors, the improvement in the allocation of these factors, and the overall boost in factor productivity arising from technological advancements and their implications, particularly for developing countries. The main driving forces behind economic growth attributable to the digital economy include that it enables countries to become part of the global market system, fosters the development of capital and employment opportunities, and reduces transaction expenses. In developed countries, the digital economy predominantly influences the nature of economic progress by expediting and expanding businesses and promoting sustainable national development and macroeconomic stability, which generally improve public living standards.

The development of digital infrastructure, technological advancement, and regional economic growth are all made possible by the digital economy, which depends on digital platforms,

intelligence, and environmental factors, [1]. As a result, regions with a growing digital economy and a robust infrastructure will benefit from comparative advantages and first-engine benefits. These advantages include high levels of industry concentration in the digital sphere, technological application, the development of digital ecosystems, and more, [2]. The first engine offers several benefits, such as enhanced digital infrastructure and human capital building, propelling the economy's superior development. In 2016, Jordanian public sector actors were directed to create an action plan to ensure the renewed advancement of information technology and Jordan's status as a regional hub for regional sectors. This was done within the framework of the "Rich2025" digital vision, which is a translation of the High Royal Initiative, aiming to create a digital economy that allows business sectors and individuals to increase efficiency to ensure growth, [3], [4].

This study aims to investigate how Jordan's economy has grown thanks to the digital economy in the years since the initiation of such efforts in 2016. Given Jordan's endeavor to keep abreast of the new economic transformations related to the digital economy, especially in ICT, by keeping pace with the significant expansion of ICT for use in various economic activities, this study explores the role of the digital economy through ICT in Jordan's economic growth. The importance of the study lies in the significance of the digital economy as one of the modern topics in giving comprehensive concepts and pictures to keep pace with the developments of the times, in addition to the growing interest at the level of economies of states and international organizations in the facilities made for the implementation of these projects, as it serves the future strategies of global economies and works to increase economic growth rates in Jordan, [5]. The study seeks to understand how the digital economy affects Jordan's economic growth by examining the effects of each of the critical drivers of the digital economy, such as the number of fixed-line purchasers, mobile subscribers, and Internet users.

2 Literature Review

To develop a thorough assessment index system, recent research has utilized the model of the Global Trade Analysis Project to assess the impact of COVID-19 on digital trade patterns and industries. Using a regression model to empirically examine how the digital economy affected the economic expansion of nations where the COVID-19 epidemic spread, [6] demonstrated that, despite a glaring geographical disparity in the growth of those nations' digital economies, the digital economy significantly boosted their rates of economic expansion, as attested by other studies, [5], [7].

The primary impact mechanism promotes labor restructuring, full employment, and upgrading industrial structure. Furthermore, COVID-19 has increased demand for digital industries and has had a significantly bigger effect on demand than supply. During the pandemic, the digital sectors in Estonia, Latvia, and Armenia all demonstrated tremendous development potential. In contrast, the digital sectors in the Philippines, Egypt, Turkey, and Ukraine suffered due to COVID-19. In the post-COVID-19 age, development methods are suggested to improve the catalytic effect of the digital economy on industry, employment, and commerce, as well as to bridge the pre-existing "digital divide" in countries that are excluded from it, [8].

[9], aimed to examine how digital trade affects Algeria's economic expansion, employing a shared integration border test to evaluate the sustained equilibrium among four principal factors: digital trade, GDP per capita, real GDP, and openness of trade. These factors were presented as annual data. The results affirmed a lasting connection among these variables, signifying a positive relationship between digital trade and Algeria's economic growth. To gauge the impact of the digital economy on Algeria's economic expansion from 2000 to 2019, their conventional study utilized the VECM.

This model aimed to identify the count of Internet and mobile subscribers. Utilizing a historical and descriptive curriculum to present the research subject's facts, the study also employed an inductive extrapolation approach through presentation and analysis, relying on economic measurement, which combines statistics as an inductive approach and mathematics as a deductive approach (extrapolation of results) to form statistical data processing. The impact of fixed-line subscribers and the total number of phone subscribers on GDP revealed a single, long-term relationship between the digital economy and economic growth, with the aim of the digital economy intervening to accelerate economic growth rates.

[10], investigated how the digital economy affects Turkey's economic performance using a descriptive approach, with general variables for various concepts related to the digital economy and its role in economic performance; and a statistical quantitative analytical approach (to analyze the findings). As the value of the determination factor showed that the adopted variables reflecting the

digital economy accounted for 92% of the rise in GDP growth rate, the research concluded that the digital economy in Turkey had a favorable impact on GDP growth.

[11], used a conventional economic model for empirical examination, utilizing a dataset comprising panel data from 30 cities in China from 2015 to 2019 to validate the intermediary role of technological advancement in connecting the digital economy with attaining high-quality economic development. The assessment of China's digital economic progress within the 30 cities was based on a "digital economic development index", considering digital infrastructure, industry, and integration as its three key dimensions. The outcomes revealed that China's digital infrastructure has been noticeably expanding, with the digital economy experiencing annual growth at varying rates. However, the progress of the digital sector within the nation as a whole has been relatively less rapid.

Earlier work by [12] found that the efficiency of regional collective factors in China was associated with substantial improvement thanks to digital industry, infrastructure, and integration; their corresponding effect factors were 0.3458, 0.0773, and 0.2452, respectively, while the intermediate impact of technological advancement was 0.1527, according to the results of the mechanism for transitioning from the digital economy to high-quality economic development. Technological progress has intermediate impacts of 1.70%, 9.25%, 28.89%, and 21.22% in all regions, respectively. Regarding spatial distribution, it is evident that the digital economy is advancing significantly faster in the eastern region than in other non-eastern areas. Additionally, its growth contributes to enhanced worker productivity at a higher marginal rate in the eastern region.

3 Theoretical Framework

3.1 Concept of Digital Economy

In the context of ongoing global changes, advancements in science and technology are ushering in a substantial transformation across various domains. This revolution in technology and science has greatly enhanced the global economy, enabling it to operate with unprecedented speed and efficiency. Consequently, this progress has given rise to novel concepts, including economic globalization. Economic globalization has effectively shrunk the world into a closely connected global community, [13]. The tremendous advances in technology and the world's accelerated and significant development in communications and information have led to new patterns of human economic, social, and scientific life, with increasing economic dependence on technological platforms and processes, encompassing consumerism, industrial production, and supply chains, [14]. This has brought about fundamental changes in the means and methods of implementing economic activities, which has led to the emergence of a new type of economy, the digital economy.

In terms of the conceptualization of the "digital economy", a very early study by [15] analyzed the evolution of the phenomenon and how it had influenced Russian society's market structure. The notion of the "digital economy" was structured, and its attributes were validated to identify the fundamental elements of the digital economy. The study found that information has a defined role in the digital economy as a unique type of economic commodity, and Russia's digital economy was found to offer both advantages and disadvantages, as well as discernible difficulties and trends. The study noted that government support was essential in establishing institutions needed to foment and drive the digital economy, noting contemporary development tendencies.

At the current juncture, the digital economy reflects a future vision of the world in which economic information is a fundamental pillar of the economy. Therefore, the transition towards the digital economy has become a compulsory but not optionally oriented path, as the digital paradigm has made profound changes in regulating the global economy, redefining value chains, and pushing the trend towards achieving tasks in the least time and with the least effort possible, [4]. Many concepts can clarify what a digital economy is, since it can be defined as the practice of modern economic systems to manage knowledge products through storage, dissemination, and recovery tools, thus creating unique specificity for digital products, [16].

3.2 Elements of the Digital Economy

The digital economy has several interconnected elements, which interact with each other to create the desired effectiveness. Digital products consist of most digital goods such as electronic software, digital magazines, and digital books, as well as various digital services such as booking tickets and government services. Digital consumers are any individuals entering the global information network who are considered potential customers consuming the services and digital goods on the network. Digital sellers display and sell their products

through the Global Information Network, in terms of e-commerce promotion, publicity, advertising, and sales. Digital institutions are responsible for grassroots structures, i.e., for providing electronic software, communications networks, and investment bodies. Digital laws and legislation govern the digital economy, regulating international trade of an unprecedented scale and volume, [17].

3.3 Properties of the Digital Economy

The digital economy has several distinguishing properties, as described below.

Accessibility of information sources: The success of the digital economy is based on the ability of institutions and individuals to rely upon and participate in information networks and various websites. This requires providing an infrastructure environment and lowering the cost-of-service fees, financial resources, training skills, education, and the availability of equipment and devices, [16].

Market structure and competition: In the digital economy, ICT affects a country's economic competitiveness and, thus, its growth. The degree of application of digital economy indicators will vary at the domestic and international levels. There must be an interaction between the digital economy and the various sectors of the country's latent or conventional economy, such as manufacturing, training, education, financial, banking, and investment services, [9].

Providing information and decision-making: Concerning the use of practical information and its use in political and economic decision-making, the digital economy can provide the optimal essential and vital information and the management of trade in an influential and efficient manner.

Providing electronic information: Information has become a force in contemporary societies in the era of the digital revolution. The information-based economic orientation emphasizes information and intellectual wealth as primary and fundamental drivers of the economy. It includes e-mail, the web, video information, hard disk or flexible information, spoken information, telephone calls, dialogues, and printed information such as reports and faxes, [16].

3.4 The Digital Economy in Jordan

In the late 1990s, the Jordanian government had already prioritized ICT as an essential strategic sector. Jordan already had very high levels of Internet penetration by the early 2000s, and ICT services were then estimated to contribute about 12% of GDP, [18]. More recently, the "REACH 2025" initiative, started in 2016, aimed to surge the income of the economy sectors by 25-30%, in addition to creating 130,000 to 150,000 jobs and between 5,000 and 7,000 new companies by 2025, [3], [4]. The stated objective of this initiative was to reinvigorate the country's digital transformation, in particular by focusing on the competitive advantage of the technology sector in communications and information, and its integration into global value chains. The ICT sector plays an absolutely essential role in the national development planning of Jordan.

In 2019, the Jordanian government established the Ministry of Digital Economy and Leadership (formerly the Ministry of Information and Communications Technology) to support the Kingdom's digital efforts and give it broad responsibilities, especially regarding entrepreneurship, digital skills, finance, and infrastructure. The fastest-growing sector of the economy in Jordan is the ICT sector, encompassing 928 companies by 2016, 98% of which are micro-, small, and medium-sized companies. However, despite encouraging figures and proportions representing the digital economy, and Jordan being a regional leader in this area, there are significant challenges to be faced, most notably: lack of an adequate trade and regulatory environment, lack of complementary infrastructure, high costs, and lack of commensurate skills for digital sector employment.

Aside from the digital economy, economic growth per se is a phenomenon that represents a sustained per capita increase in national output, [19].

3.5 The Relationship Between Digital Economy and GDP

The digital economy has a strong relationship with all macroeconomic variables, including the most critical indicator of economic growth per se. This relationship is reflected in the fact that ICT embodied in the digital economy is a fundamental basis for revitalizing the national economy; in the last decade, it has become the first in terms of its contribution to international trade. Wealth is positively exploited in electronic industries and digital services, and the digital economy is the critical backbone of modern-day economic development. It can be the primary catalyst for economic growth, supported by commensurate infrastructure and the concentration of research centers, the renovation of ICT, and the creation of new products. By contributing to reducing distances and times, digital globalization has transformed the entire world into a single world to engage in new types of trade and marketing among economic dealers and large corporations through modern

technologies and advanced networks such as the Internet.

With the proliferation of distance teaching centers, digital libraries and electronic administrations, and other very advanced technology, virtual networks are becoming a pivotal alternative to human beings, providing integral spaces in dimensions and objectives for financial transactions and commercial exchanges are taking place as soon as the computer button is pressed, Financial liquidity in that virtual space is estimated to be worth billions of dollars, according to experts' reports in that area. Trading and buying stocks and bonds have become available to the world; once there was a web-based face-to-face credit card, they invested in cryptocurrencies by buying and selling them in what is known as forex markets. The emergence of modern digital projects contributes to revitalizing countries' economies by diversifying industrial products in electronics and supporting innovation in virtual eradication and artificial intelligence. This increases the motivation of domestic and foreign investors to create digital projects with high returns. The digital economy is represented by trade, [9].

3.6 Research Hypotheses

Based on the reviewed literature, the authors identified variables indicating positive correlations between fixed-line infrastructure and economic growth, examining the role of communication in enhancing productivity and business efficiency, [20], [21]. Jordan's fixed-line infrastructure, while being overshadowed by mobile and Internet penetration, still plays a role in business and government sectors. The hypotheses derived from previous literature and tested by this study are as follows:

- There is a statistically significant relationship between the number of fixed-line subscribers and economic growth rates in Jordan.
- There is a statistically significant relationship between the number of mobile phone subscribers and economic growth rates in Jordan.
- There is a statistically significant relationship between the number of Internet subscribers and economic growth rates in Jordan.

4 Materials and Methods

The quantitative method of analysis was used based on standard analysis, by measuring the impact of the digital economy on economic growth rates in Jordan, during 2022-2005 through co-integration using the short-term and long-term VECM, through Eviews. Secondary data guarantees validity and reliability, which are essential for the empirical design of this study. This is especially true when the secondary data originate from reputable institutions such as the World Bank and IMF, [22].

Quantitative analysis was used based on standard analysis by measuring the impact of the digital economy on economic growth rates in Jordan during 2022-2005 through co-integration using the short-term and long-term VECM, [23], [24] through Eviews 10. In the article, the economic growth rate was chosen as the dependent variable, and the number of fixed-line subscribers, mobile subscribers, and Internet subscribers was considered the independent variable. An Augmented Dickey-Fuller test (ADF) indicates that for a time series sample, the null hypothesis on the unit root is present. Trends, stationarity, or non-stationarity of the data affect the ADF alternative, [18]. The VECM consists of a cointegrated VAR model of the order p-1 and an error correction derived from the cointegrating relationship, [15].

The dataset's stationarity is checked using the ADF test along with the Johansen cointegration test, which is required prior to VECM analysis being conducted to count the number of cointegrating vectors between the variables. The short-term dynamics and cointegrating vectors are then added to the VECM. The model incorporates variables that represent the digital sector in addition to conventional economic growth indicators. Because the study uses secondary data, the main ethical concerns include identifying the data's sources and ensuring that it is handled responsibly while upholding intellectual property rights, [25].

The function of growth can be relied upon, as it represents the relationship between the digital economy and economic growth, and indicates the level of growth expected to be obtained if one of the variables of the digital economy is used. One of the most important forms of production function in the macroeconomic analysis is the function of Cup Douglas, which takes the possibility of substitution between two elements of production, labor, and capital. The higher the digital economy, the higher the economic growth rates. There is a significant correlation between the digital economy and Jordan's economic growth rates and employment, with high growth rates indicating the Jordanian economy's need for additional labor.

To measure the impact of the digital economy on economic growth rates in Jordan, the following relationship was assumed:

$$\ln GR_t = \ln A + \beta \ln FLTS_t + MS_t + SBAT_t + e_t$$

Where GR is the economic growth rate, A is fixed, FLTS is the number of fixed-line subscribers, MS is the number of mobile subscribers [12], SBAT is the number of Internet subscribers, and e_t is the residual variable. This study applied root, unit root, Johansen, trace, maximum eigenvalues, Granger causality, and VECM tests, as presented below.

5 Results

5.1 Root Test

It is clear from Figure 1 that the VECM model achieves the stability requirement because all points are inside the circle.

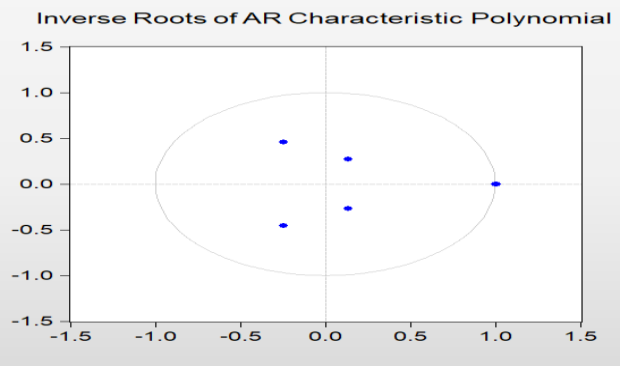

Fig. 1: Root test
Source: Prepared by Authors

5.2 Unit Root Test

It is essential to analyze time series to avoid correlation, and the integration tests employed the Augmented Dickey-Fuller test (ADF) for the unit root. The results in Table 1 show that the dependent variable (GR) is integrated t I at the first level, I(1); all the independent variables are stationary at the first difference, I(1). As a result, the co-integration test procedure can be adapted to estimate our model, [26].

Table 1. Unit Root Test

Variables	Probability	Unit Root Test
GR	0.010	I(1)
FLTS	0.060	I(1)
MS	0.015	I(1)
SAT	0.044	I(1)

Source: Authors using E-views

5.3 Johansen Test

This test aims to check for a long-term relationship between variables, and all variables must be stationary to the same degree. This test is suitable for small samples and large samples, as well as for relationships containing more than two variables. It determines if there is more than one integration vector; this test is based on estimating the vector autoregressive model.

5.4 Trace Test

This explains whether there is a co-integration between the variables. Table 2 shows that the calculated value of all variables was more significant than the value at the level of 5% (i.e., a typical integration relationship between the variables). We conclude that there are four co-integrations between the study variables according to the trace test.

Table 2. Unrestricted Cointegration Rank (Trace) Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.963670	92.49510	47.85613	0.0000
At most 1 *	0.651011	39.45318	29.79707	0.0029
At most 2 *	0.596090	22.60973	15.49471	0.0036
At most 3 *	0.397427	8.104742	3.841466	0.0044

Trace test indicates 4 cointegrating eqn(s) at the 0.05 level
* Denotes rejection of the hypothesis at the 0.05 level
Source: Authors using E-views

5.5 Maximum Eigenvalues Test

Table 3 indicates that there is one long-term relationship between the variables, and since the results of the two tests will be different, our decision is based on the test in which there is the lowest number of relationships (i.e., there is one co-integration relationship between the study variables).

Table 3. Maximum Eigen Values Test

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.963670	53.04192	27.58434	0.0000
At most 1	0.651011	16.84345	21.13162	0.1795
At most 2 *	0.596090	14.50499	14.26460	0.0458
At most 3 *	0.397427	8.104742	3.841466	0.0044

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* Denotes rejection of the hypothesis at the 0.05 level.
Source: Authors using Eviews

5.6 Granger Causality Test

This test examines the existence of a causality relationship between two variables. It depends mainly on the test (F-statistic) where the variable X is said to affect Y. If the slowing of the X variable

has higher predictive power than the predictive power of the Y variable. Table 4 shows that the FLTS variable exerts Granger causality in the GR variable, while the reverse relationship from the GR variant to the FLST variable does not drive, thus it can be concluded that there is a one-way causal link from the FLST variable to the GR variable. As for the MS variant to the GR variable, there is no causal link between them in both cases. There is no causal link between the SBAT variant and GR, or vice versa. The MS variant causes the FLST variable, and there is no causation for the reverse relationship going from the FLST variable to the MS variable. As for the SBAT to MS variable, there is no causal link between them in both cases.

Table 4. Granger Causality Test

Pairwise Granger Causality Tests
Sample: 2005 2022
Lags: 1

Null Hypothesis	Obs	F-Statistic	Prob.
FLTS does not Granger cause GR	17	6.86851	0.0201
GR does not Granger cause FLTS		3.20450	0.0951
MS does not Granger cause GR	17	2.39552	0.1440
GR does not Granger cause MS		0.28670	0.6007
SBAT does not Granger cause GR	17	2.12052	0.1674
GR does not Granger cause SBAT		0.65871	0.4306
MS does not Granger cause FLTS	17	10.0673	0.0068
FLTS does not Granger cause MS		0.56604	0.4643
SBAT does not Granger cause FLTS	17	4.29591	0.0571
FLTS does not Granger cause SBAT		1.94062	0.1853
SBAT does not Granger cause MS	17	0.14118	0.7127
MS does not Granger cause SBAT		0.79970	0.3863

Source: Authors using E-views

5.7 Vector Error Correction Model

Table 5 represents the error correction model coefficient (CointEq1), which is negative and significant (at a significance level of 5%), meaning that 0.054545 short-term errors are automatically corrected over time to reach long-term balance. The value of the regression coefficient of economic growth during the first period is negative (-0.14), indicating the negative impact of long-term economic growth. The regression coefficient value in the number of fixed-line subscribers was positive (19.3), showing the positive effects of fixed-line subscribers on economic growth in Jordan. The cellphone regression coefficient during the first period is negative (-1.06), due to the negative impact on economic growth. The decline factor in the number of Internet subscribers in Jordan was positive (1.89), indicating the positive effects of the Internet subscriber variable on economic growth in Jordan. This explains that the digital economy positively and effectively impacts economic growth rates in Jordan, especially in the long term. The digital economy contributes to the improvement of many businesses, the reduction of time and effort costs, and progress in the quality of sectors, especially the most vital sectors.

Table 5. Vector Error Correction Model

Sample (adjusted): 2007 2022

Cointegrating Eq	CointEq1
GR(-1)	1.000000
FLTS(-1)	-0.753793 (5.92595) [-0.12720]
MS(-1)	-18.25234 (1.57824) [-11.5650]
SBAT(-1)	12.79569 (1.34729) [9.49734]
C	101.9145

Error Correction	D(GR)	D(FLTS)	D(MS)	D(SBAT)
CointEq1	-0.054645 (0.14795) [-0.36934]	0.012182 (0.00235) [5.18918]	-0.001148 (0.01006) [-0.11419]	-0.003648 (0.01346) [-0.27112]
D(GR(-1))	-0.146710 (0.31614) [-0.46407]	-0.021847 (0.00502) [-4.35531]	0.021433 (0.02149) [0.99742]	-0.012904 (0.02875) [-0.44878]
D(FLTS(-1))	19.35295 (13.8209) [1.40027]	-0.083106 (0.21930) [-0.37897]	0.503145 (0.93945) [0.53558]	-1.229267 (1.25706) [-0.97789]
D(MS(-1))	-1.062176 (3.89364) [-0.27280]	0.097405 (0.06178) [1.57663]	0.235284 (0.26466) [0.88900]	0.134614 (0.35414) [0.38011]
D(SBAT(-1))	1.894124 (3.99364) [0.47429]	-0.124466 (0.06337) [-1.96419]	0.704706 (0.27146) [2.59599]	-0.113767 (0.36323) [-0.31320]
C	-0.086910 (0.71087) [-0.12226]	-0.018816 (0.01128) [-1.66820]	-0.069630 (0.04832) [-1.44101]	0.132250 (0.06466) [2.04543]

Source: Authors using E-views

6 Conclusion

In the long run, according to the Johansen test, one co-integration relationship exists between the variables, including the impact of the digital economy and economic growth through fixed and mobile subscribers and internet subscribers on GDP. There is a positive relationship between the variables and the economic growth rates in Jordan. In other words, expanding the digital economy increased economic growth rates in Jordan and helped provide new jobs. According to the study, there is a one-way causality between the number of fixed-line subscribers and economic growth. This reveals that there is a positive effect on the economic impact of the digital economy in Jordan. At a significance level of 5%, the error correction model coefficient, CointEq1, is negative and significant, -0.054545. Through time, therefore, 0.054545 short-run errors tend to long-run equilibrium. This implies that economic growth is pushing the expansion of Jordan's digital economy.

The findings thus attest that the digital economy positively and effectively impacts economic growth rates in Jordan, especially in the long term, and contributes to the improvement of many businesses, with reductions in time and effort costs, and the improvement of the quality of sectors, especially the

most vital ones. The government must consider the digital economy as a sector that accelerates Jordan's financial development rates, [20], [21]. The digital economy has become increasingly widespread in recent years, which has positively impacted the increase in the GDP in Jordan. This has opened the way for IT investors to create competition and develop the sector. Building infrastructure requires more investment in developing the digital economy's infrastructure to improve the business environment and enhance confidence and transparency, [27].

There is a need to increase investment in the digital economy in Jordan and enhance the efficiency of the digital sector to save effort and time and stimulate the national economy. The ICT sector and the Internet are at the heart of the economy; Jordan must develop this sector and increase its industries. It is enhancing its competitiveness through the adoption of appropriate methodologies and strategies, [28], [29]. To be able to fully and effectively establish the digital economy, these conclusions and policy recommendations highlight how promoting a digital economy helps various sectors and larger economic objectives for Jordan's development.

References:

[1] Li, R., Rao, J., & Wan, L. (2022). The digital economy, enterprise digital transformation, and enterprise innovation. *Managerial and Decision Economics*, 43(7), 2875–2886. https://doi.org/10.1002/mde.3569.

[2] Bertani, F., Ponta, L., Raberto, M., Teglio, A., & Cincotti, S. (2021). The complexity of the intangible digital economy: An agent-based model. *Journal of Business Research, Elsevier, 129*, 527–540. https://doi.org/10.1016/j.jbusres.2020.03.041.

[3] Ministry of Information and Communications Technology and ICT Association of Jordan. (2016). *Reach 2025: From vision to action*, [Online]. https://jordankmportal.com/resources/reach2025-dot-vision-and-action-paper-long-version-final-07-dot-11-dot-2016-1 (Accessed Date: June 12, 2024).

[4] Information and Communications Technology Association in Jordan. (2017). *ICT and ITES industry statistics and yearbook 2016*, [Online]. https://intaj.net/wp-content/uploads/2017/12/ICT-ITES-INDUSTRY-STATISTICS-AND-YEARBOOK-2016.pdf (Accessed Date: May 16, 2024).

[5] Saleem, T. A. A., Abbas, N. A., Al-Sawaie, K. M., & Jubran, A. H. M. (2021). The impact of digital trade on Jordan's economic growth. In *2021 22nd International Arab Conference on Information Technology* (pp. 1–8). New York, NY: IEEE. https://doi.org/10.1109/ACIT53391.2021.9677278.

[6] Zhang, J., Zhao, W., Cheng, B., Li, A., Wang, Y., Yang, N., & Tian, Y. (2022). The impact of digital economy on the economic growth and the development strategies in the post-COVID-19 era: Evidence from countries along the "Belt and Road." *Frontiers in Public Health, 10*, Article 856142. https://doi.org/10.3389/fpubh.2022.856142.

[7] Jordan Telecommunications Regulatory Authority (2024), *Strategic Plan for the years 2021-2024*, [Online]. https://trc.gov.jo/EchoBusV3.0/SystemAssets/PDF/AR/Tender/11318605-817d-4455-bacb-d588115b3797_doc00425420220913063710.pdf (Accessed Date: August 28, 2024).

[8] Shanafa, J. (2018). *Impact of the stock market on economic growth, Amman Stock Market case study* [Unpublished doctoral dissertation]. Farhat Abbas Setif University.

[9] Buelaqa, A., & Kabir, M. (2021). Measuring the impact of the digital economy on Algeria's economic growth: A standard study for 2000/19. *Economic Studies, 15*(2), 153–168, [Online]. https://www.asjp.cerist.dz/index.php/en/article/161211 (Accessed Date: May 16, 2024).

[10] Al-Khatib, R. J. (2021). The impact of the digital economy on Turkey's economic performance as a model for the period 1990–2018. *Middle East Journal of Humanities and Culture, 1*(5), 11–24. https://doi.org/10.56961/mejhss.v1i5.213,

[11] Zhou, Z., Liu, W., Cheng, P., & Li, Z. (2022). The impact of the digital economy on enterprise sustainable development and its spatial-temporal evolution: An empirical analysis based on urban panel data in China, *Journal of Sustainability, 14*(19), Article

11948. https://doi.org/10.3390/su141911948, Last Accessed on 10 March 2024

[12] Shao, B. B., & Lin, W. T. (2016). Assessing output performance of information technology service industries: Productivity, innovation, and catch-up. *International Journal of Production Economics, 172*, 43–53. https://doi.org/10.1016/j.ijpe.2015.10.026.

[13] Zhu, Y., & Jin, S. (2023). How does the digital transformation of banks improve efficiency and environmental, social, and governance performance? *Systems*, *11*(7), Article 328. https://doi.org/10.3390/systems11070328.

[14] Wang, J., Wang, K., Dong, K., & Shahbaz, M. (2022). How does the digital economy accelerate global energy justice? Mechanism discussion and empirical test. *Energy Economics, 114*, Article 106315. https://doi.org/10.1016/j.eneco.2022.106315.

[15] Luetkepohl, H. (2004). Vector autoregressive and vector error correction models. In H. Luetkepohl & M. Kraetzig (Eds.), *Applied time series econometrics* (pp. 86–158). New York, NY: Cambridge University Press.

[16] Mohammad, H. Z. (2019). Digital economy (advantages, challenges, applications). *The Spirit of Laws, 85*(85), 2–46.

[17] Nikityuk, L. G., Tkachuk, L. T., & Korotkova, G. K. (2020). The role of the digital economy in developing the market model of Russian society. *Advances in Economics, Business and Management Research*, 128, 379–387. http://dx.doi.org/10.2991/aebmr.k.200312.056

[18] Dolado, J. J., Gonzalo, J., & Mayoral, L. (2002). A fractional Dickey–Fuller test for unit roots. *Econometrica*, *70*(5), 1963–2006. http://dx.doi.org/10.1111/1468-0262.00359.

[19] Ranta, V., Aarikka-Stenroos, L., & Väisänen, J. M. (2021). Digital technologies catalyze business model innovation for circular economy: Multiple case study. *Resources, Conservation and Recycling, 164*, Article 105155. https://doi.org/10.1016/j.resconrec.2020.105155.

[20] Narayana, M.R. (2011). Telecommunications services and economic growth: Evidence from India. *Telecommunications Policy*, *35*(2), 115-127, https://doi.org/10.1016/j.telpol.2010.12.001.

[21] Waverman, L., Meschi, M., & Fuss, M. (2005). The impact of telecoms on economic growth in developing countries. *The Vodafone Policy Paper Series*, *2*, 10–23, [Online]. https://www.researchgate.net/publication/265758950_The_Impact_of_Telecoms_on_Economic_Growth_in_Developing_Countries (Accessed Date: May 8, 2024).

[22] Siddiqui, B. (2019). Using secondary data in education research. *Social Research Update*, 68, [Online]. https://sru.soc.surrey.ac.uk/SRU68.pdf (Accessed Date: July 27, 2024).

[23] Engle, R. F., & Granger, C. W. J. (1987). Co-integration and error correction: Representation, estimation, and testing. *Econometrica*, *55*(2), 251–276, [Online]. https://www.jstor.org/stable/1913236 (Accessed Date: February 12, 2024).

[24] Johansen, S. (1991). Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models. *Econometrica*, *59*(6), 1551–1580, [Online]. https://www.jstor.org/stable/2938278, (Accessed Date: March 18, 2024).

[25] Miller, T., Mauthner, M., Birch, M., & Jessop, J. (2012). *Ethics in qualitative research* (2nd ed.). London: Sage Publications.

[26] Srivastava, D. (2020). A comparative study of entrepreneurial environment of BRICS nations. *Zeichen Journal, 6*(7), 1–10, [Online]. https://ssrn.com/abstract=3734416 (Accessed Date: March 20, 2024).

[27] Gruber, H., & Koutroumpis, P. (2011). Mobile telecommunications and the impact on economic development. *Economic Policy*, *26*(67), 387–426. https://doi.org/10.1111/j.1468-0327.2011.00266.x.

[28] Czernich, N., Falck, O., Kretschmer, T., & Woessmann, L. (2011). Broadband infrastructure and economic growth. *Economic Journal*, *121*(552), 505–532. https://doi.org/10.1111/j.1468-0297.2011.02420.x.

[29] Koutroumpis, P. (2009). The economic impact of broadband on growth: A simultaneous approach. *Telecommunications Policy*, *33*(9), 471–485. https://doi.org/10.1016/j.telpol.2009.07.004.

Contribution of Individual Authors to the Creation of a Scientific Article (Ghostwriting Policy)

- Saleh Yahya AL Freijat played a pivotal role in the conceptualization and design of the study. He was instrumental in defining the research objectives, formulating the hypothesis, and establishing the framework for the quantitative analysis. Dr. Saleh's expertise in economic theory and digital economy provided the foundational basis for the study's direction.
- Nedal K.A. Almaaitah was primarily responsible for the data collection and statistical analysis. He designed the survey instruments and methodologies for data gathering, ensuring the reliability and validity of the data. Dr. Almaaitah applied advanced statistical techniques using E-views to analyze the data, interpret the results, and derive meaningful insights.
- Hussien A. K. Al-trawneh provided his expertise in policy analysis and implications. He evaluated the economic policies related to the digital economy and assessed their potential impact on Jordan's economic growth. Dr. Al-trawneh developed policy recommendations based on the study's findings, aiming to enhance the effectiveness of digital economy initiatives.
- Ohoud A.H Khasawneh focused on the literature review and theoretical framework of the study. She conducted a comprehensive review of existing literature on the digital economy and its impact on economic growth, providing a solid theoretical foundation for the research. Dr. Khasawneh identified key concepts and variables relevant to the study, which guided the research design and analysis.

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Conflict of Interest

The authors have no conflicts of interest to declare.

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