

IMPACT OF INFORMATION AND COMMUNICATION TECHNOLOGY ON ECONOMIC GROWTH: A CASE STUDY OF ARAB COUNTRIES DURING THE YEAR 2022

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ABSTRACT:

This study aimed at measuring the impact of ICT on economic growth in the Arab States through an econometric study that included disaggregated data for 17 Arab countries during 2022, based on the independent variables of: Percentage of Intranet subscribers, percentage of mobile phone subscribers per 100 persons, Percentage of subscribers of fixed phones per 100 persons, in addition to economic growth expressed in the average per capita GDP as a dependent variable, Based on the statistical analysis technique of cluster analysis, the Arab States were classified into three groups according to the ICT index and the Gulf States were at the forefront and the method of analysing the gradual decline, which concluded that the variable percentage of subscribers to fixed phones had the only impact on Arab countries' economic growth.

Keywords: ICT, economic growth, cluster analysis.

Introduction:

The world has witnessed significant and rapid changes in recent years due to advancements in information and communication technology (ICT), which have directly influenced human life, especially economic, social, and cultural aspects. ICT has become a driving force for economic growth in countries, allowing the world to progress and adapt to new environments. This has posed a growth challenge for Arab countries.

ICT has opened up avenues and possibilities for these countries to improve their economic situations, enhance growth rates, and reduce disparities between advanced countries and developing Arab nations. Additionally, it has increased openness to the economies of these countries and reduced economic disruptions, enabling them to integrate into the global communication network by liberalizing their economies and adopting modern ICT. This research paper aims to address the following research problem:

- **What is the extent of the impact of ICT on economic growth in Arab countries?**

To answer the research problem, we have formulated the following hypothesis:

- **There is disparity in the adoption of ICT among Arab countries?**

Therefore, we divided the study into the following axes:

- **First Axis:** Theoretical Foundations of Information and Communication Technology.
- **Second Axis:** Theoretical Foundations of Economic Growth.
- **Third Axis:** Previous Studies.
- **Fourth Axis:** Practical Aspect.

First Axis: Theoretical Foundations of Information and Communication Technology.

The term "Information and Communication Technology" is a relatively modern concept that focuses on integrating modern technology into various fields, including the economy. Before delving into the concept of ICT, some related concepts will be explained.

1. Concept of Technology:

The term "technology" clearly refers to "modern techniques," but it is simpler and more precise than that. It is one of the most commonly used terms in our current era, yet as its usage becomes more common, it becomes increasingly ambiguous and confusing. The subject of technology still raises many questions regarding its precise definition by economists, leading to multiple perspectives and differing concepts about it. Some of these include:

- a. It refers to tools or means used for practical scientific purposes that humans employ to enhance their capabilities and meet their needs arising within their social and historical contexts. (Guerin & Hibbal, 2005, p. 5)
- b. It is a process or set of processes that, through clear scientific research methods, allow for the improvement of basic techniques and the application of practical knowledge to develop industrial production. (Dussauge & Ramanantsoa, 1994, p. 19)

2. Concept of Information:

Most scholars agree that information is:

- a. Processed data that has been given meaning for its future or current users, adding real or perceived value for current or future decision-making processes. (Ismail, 2005, p. 22)
- b. A set of organized data related to a specific subject, comprising facts, concepts, opinions, conclusions, and beliefs that constitute tangible experience and knowledge of perceived value in current or expected use. Information is obtained through processing data via tabulation, classification, analysis, and organization in a manner tailored to serve a specific purpose. (Fadel & Al-Zughb, 2004, p. 24)

3. Concept of Communication:

Several definitions of communication exist, including:

- a. One of the pillars of guidance, involving the flow of information, instructions, guidance, orders, and decisions from an individual or group to individuals or groups, with the aim of informing, influencing, or effecting change towards predefined goals. (Al-Alag, 2014, p. 7)
- b. The process through which a specific message is sent from a sender to a targeted receiver using multiple methods and through specific communication channels. (Ben Al-Habib, 2018, p. 561)

4. Concept of Information and Communication Technology and Its Components:

a. Concept of Information and Communication Technology (ICT):

The term ICT is a relatively modern concept that focuses on integrating modern technology into various fields, including the economy, to enhance communication processes by coordinating between its various core sectors. ICT has been defined in several ways, including:

The Organisation for Economic Co-operation and Development (OECD) broadly defined ICT as a new technical-economic model that affects the management and monitoring of production and service systems. It relies on a set of profound discoveries in the fields of computing, electronics,

software engineering, remote monitoring systems, and telecommunications, allowing for broader information dissemination. (Paquin, 1990, p. 17)

It is also defined as the methodical and organized application of other sciences and knowledge within a specific practical framework to achieve practical solutions. ICT is intended as the integration of three elements: remote communication, informatics, and microelectronics. (Alaoui & Lamara, 2007, p. 2)

Furthermore, it is referred to as all technologies that facilitate the real-time transfer of data digitally, serving as a tool for transferring knowledge centers and accessing a wide range of experiences. It represents a tool for mutual communication.

b. Components of Information and Communication Technology:

Information and Communication Technology consists of five components, including: (Iaudan & Iaudan, 2005, p. 65)

- **Information Hardware:** Physical equipment for processing.
- **Software Technology:** Includes designing computer programs and various applications such as databases and communication information.
- **Storage Technology:** Involves physical carriers for data storage, such as hard drives, and software for data organization.
- **Communication Technology:** Comprises equipment, physical media, and software that connect various hardware components and transfer data from one place to another.
- **Networks:** Link individuals and computers to exchange data or resources.

Second Axis: Theoretical Foundations of Economic Growth.

Economic growth is one of the most important economic indicators and the goal of any economic policy. Therefore, we will discuss some of the theoretical foundations of economic growth.

a. Definition of Economic Growth:

The concept of economic growth varies according to different perspectives. Some of the most prominent definitions include:

a. It is the economy's ability to produce (gross domestic product) over time. (Salvatore & Diulio, 2001, p. 288)

b. It achieves an increase in the average individual's income or real national income over time. (Slim & Abdelwahab, 2014, pp. 79-80)

c. It is one of the main economic goals that states attempt to achieve to develop their economies and achieve a higher level of welfare for their societies. This growth is measured by the rates of increase in the national income resulting from the increase in society's production capacities. (Al-Eissi & Suleiman, 2006, p. 43)

b. Characteristics of Economic Growth:

Based on the previous definitions, economic growth is characterized by three attributes: (Al-Eissi & Suleiman, 2006)

- ✓ It is a continuous process over a relatively long period.
- ✓ It involves changes in specific economic quantities.
- ✓ It occurs over time, making it dynamic in nature due to its two characteristics of change and time.

c. Types of Economic Growth:

Economists distinguish between three types of economic growth: (Harbi, 2013, pp. 134-135)

a. Spontaneous Growth:

Refers to growth that occurs automatically without following any economic plan and without state intervention, stemming from self-initiated efforts by the private sector or non-capitalistic economic institutions.

b. Transient Growth:

Characterized by volatility and instability due to external factors that create it, followed by the cessation of growth. This type is particularly evident in developing and oil-rich Arab countries, where investments rise with increasing oil prices and decline with their fall.

c. Planned Growth:

Results from comprehensive planning of society's resources and requirements, referred to as comprehensive national planning for all sectors. The government plays a central role in this type of growth, prevalent in socialist countries, relying on collective ownership of the means of production. The importance of economic and social justice in the country arises here, and the success of this model depends on the planners' capabilities, the realism of the plans drawn, the effectiveness of implementation, monitoring, and participation by the popular masses at all levels.

4. Elements of Economic Growth:

There are several elements whose rational combination contributes to achieving economic growth, primarily:

a. Labor:

It represents the effort exerted by individuals to produce goods and services to satisfy their needs. Its volume can be measured by the number of workers or the number of mental work hours. The composition of labor, such as age, gender, and education, should not be overlooked, as it significantly affects the productivity of labor, represented by the output produced per worker or work hour. Therefore, improving the composition of labor, such as education, can lead to increased productivity. (Zakari, 2014, pp. 42-43)

b. Capital Accumulation:

It includes both physical and human capital, serving as essential elements for economic growth. Capital accumulation indicates the level and degree of technical equipment under specific conditions. It helps achieve technological progress and expands production through various investments. (Haddashi, 2014, p. 56)

d. Technological Progress:

It refers to technological changes in production methods or the nature of produced goods, allowing for: (Zakari, 2014, p. 43)

- ✓ Increased production with the same input quantity or maintaining the same production level with fewer inputs.
- ✓ Solving bottlenecks that limit production.
- ✓ Producing new goods of better quality.

Technological progress is a qualitative reality that requires significant and appropriate estimation in production transactions because it calls for improving economic performance.

Third Axis: Previous Studies

1. Al-Haj's study (2012) is a standard study on the impact of information and communication technologies on economic growth, focusing on Algeria (1995-2009). The researcher attempted to answer the question: "What is the impact of information and communication technology on economic growth in Algeria?" The study concluded, both theoretically and empirically, that while the reform of the wired and wireless communications sector in 2000 did not have a positive impact on density, it did have a general effect on economic growth. Additionally, investment in information and communication technologies contributes significantly to economic growth. (Al-Haj)

2. Chorbagi's study (2010) aimed to measure the impact of information and communication technologies on economic growth in 17 Arab countries from 2000 to 2009. The study found a significant and positive effect of information and communication technologies on economic growth. This means that increased use of the internet, landline, and mobile phones led to economic growth. (Chorbagi, 2011)

3. Mohammad Ali Moradi, Meysam Kebryaee's study (2010) aimed to study the relationship between investment in information and communication technology and economic growth in 48 member countries selected from the Organization of Islamic Cooperation during the period 1995-2005. The study concluded that there is a significant and positive direct impact of information and communication technology on GDP, especially for oil-producing countries. The results confirmed that information and communication technology has become an important contributor to economic growth in the Organization of Islamic Cooperation. (MORADI & KEBRYAEE, 2009)

4. Mohammad Salahuddin's study (2014) investigated the relationship between internet usage, economic growth, financial development, and trade openness in 11 countries in South Africa from 1990 to 2012. The study found a positive long-term relationship between internet usage and economic growth in the region. Additionally, it suggested that internet usage not only affects economic growth during the study period (1990-2012) but will also have an increasing impact on economic growth in the region in the future (2013-2034). (Mohammad & Jeff, 2016)

5. Taha Ben Al-Habib's study (2018), titled "The Impact of Information and Communication Technology on Economic Growth in Developing Countries: A Standard Study during the Period 2005-2015," aimed to measure the impact of information and communication technology on economic growth in developing countries. The study included 50 developing countries over the period 2005-2015 and used panel data models, focusing on independent variables such as the internet, mobile phones, inflation rate, population growth rate, and trade openness, with GDP growth as the dependent variable.

The static analysis of the panel models showed that the model of individual fixed effects is suitable, indicating the presence of fixed individual differences among developing countries in the impact of information and communication technology on economic growth. The dynamic analysis revealed a significant negative long-term effect of the internet index, indicating an inverse relationship between internet usage and economic growth, while the mobile phone variable had a non-significant negative impact on economic growth in developing countries. (Ben Al-Habib, 2018)

Fourth Axis: Practical Aspect.

In this axis, we will study the extent of the impact of information and communication technology (ICT) on economic growth in Arab countries during the year 2022. A sample of 17 Arab countries out of 22 was taken based on the availability of the required statistical data for the study.

We will begin by conducting a descriptive study of the study variables and performing cluster analysis to understand the distribution of Arab countries according to ICT indicators. Then, we will identify the indicator that has an impact on growth in Arab countries using stepwise regression analysis.

1. Descriptive Study:

Through descriptive analysis of the variables, primarily ICT indicators obtained from the International Telecommunication Union website and expressed by three indicators:

- ✓ Internet subscribers' percentage in the country, represented by the symbol (INT);
- ✓ Percentage of fixed-line telephone ownership per 100 people in the country, represented by the symbol (FIX);
- ✓ Percentage of mobile phone ownership per 100 people in the country, represented by the symbol (MOB).

In addition to the economic growth variable expressed by the average per capita GDP in US dollars in the country, symbolized as (GDPP), obtained from the World Bank database. Through Table (01) below, it is evident that during the year 2022, the per capita GDP had a minimum value of \$434.88, and Somalia had the lowest level of GDP due to its deteriorating security situation.

On the other hand, Qatar witnessed the highest level of GDP ownership, reaching \$63,782.51, attributed to its abundant oil resources. Regarding the internet penetration rate, the United Arab Emirates, Saudi Arabia, Qatar, and Bahrain had the highest percentage at 100%, while Yemen ranked last in internet ownership.

As for the mobile phone usage variable, the United Arab Emirates led with a percentage of 212.2%, while Djibouti ranked lowest. Concerning the fixed-line telephone variable, the UAE had the highest coverage rate with 24.2% per 100 people, while Sudan witnessed a low level compared to other Arab countries in fixed-line telephone ownership.

Overall, we find that ICT indicators in Arab countries showed dispersion, indicating differences between countries. The highest homogeneity was found in the fixed-line telephone variable, with a rate of 7%, while internet and mobile phone had rates of 27.46% and 52.9%, respectively.

Table (01): Descriptive Statistics of Study Variables.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
GDPP	17	434.88	63782.51	13993.0848	17813.22160
FIX	17	.30	24.20	10.7176	7.44482
INT	17	17.70	100.00	76.5941	27.46490
MOB	17	47.50	212.20	120.5118	52.91989
Valid N (listwise)	17				

Source: Prepared by researchers based on SPSS26 software.

Through Table (02) below, it is evident that there is a strong correlation between the average per capita GDP and all ICT indicators in Arab countries during the year 2022, with a correlation coefficient exceeding 0.58, indicating a strong, negative, and significant relationship

. Additionally, a strong, negative, and significant relationship was found between ICT indicators themselves. The correlation between fixed-line and mobile phone was 0.88, between fixed-line and internet was 0.75, and between mobile phone and internet was 0.739.

Table (02): Correlation Matrix between Study Variables.

Correlations					
		GDPP	FIX	INT	MOB
GDPP	Pearson Correlation	1	0.733 **	0.587 *	0.682 **
	Sig. (2-tailed)		0.001	0.013	0.003
	N	17	17	17	17
FIX	Pearson Correlation	0.733 **	1	0.750 **	0.880 **
	Sig. (2-tailed)	0.001		0.001	0.000
	N	17	17	17	17
INT	Pearson Correlation	0.587 *	0.750 **	1	0.739 **
	Sig. (2-tailed)	0.013	0.001		0.001
	N	17	17	17	17
MOB	Pearson Correlation	0.682 **	0.880 **	0.739 **	1
	Sig. (2-tailed)	0.003	0.000	0.001	
	N	17	17	17	17
**. Correlation is significant at the 0.01 level (2-tailed).					
*. Correlation is significant at the 0.05 level (2-tailed).					

Source: Prepared by researchers based on SPSS26 software.

2. Classification of Arab Countries According to ICT Indicators:

Using cluster analysis, which classifies a group of individuals or variables according to common characteristics, Arab countries were distributed according to the three variables of the ICT index during the year 2022.

From Table (03), which presents a classification range from 2 to 5 clusters of Arab countries classified according to the ICT index, we find three main groups of Arab countries based on the dendrogram tree diagram shown in Figure (01) below:

- **Group 1:** Countries with high percentages in all three variables comprising the ICT index, indicating strong infrastructure and extensive communication networks. These countries are labeled as Group 3 in the table below and include Kuwait, Qatar, the United Arab Emirates, and despite its political conditions, Libya. These are primarily Gulf Arab countries.
- **Group 2:** Arab countries with moderate percentages of the ICT index, labeled as Group 2 in the table below, include Bahrain, Saudi Arabia, Morocco, Oman, and Tunisia.

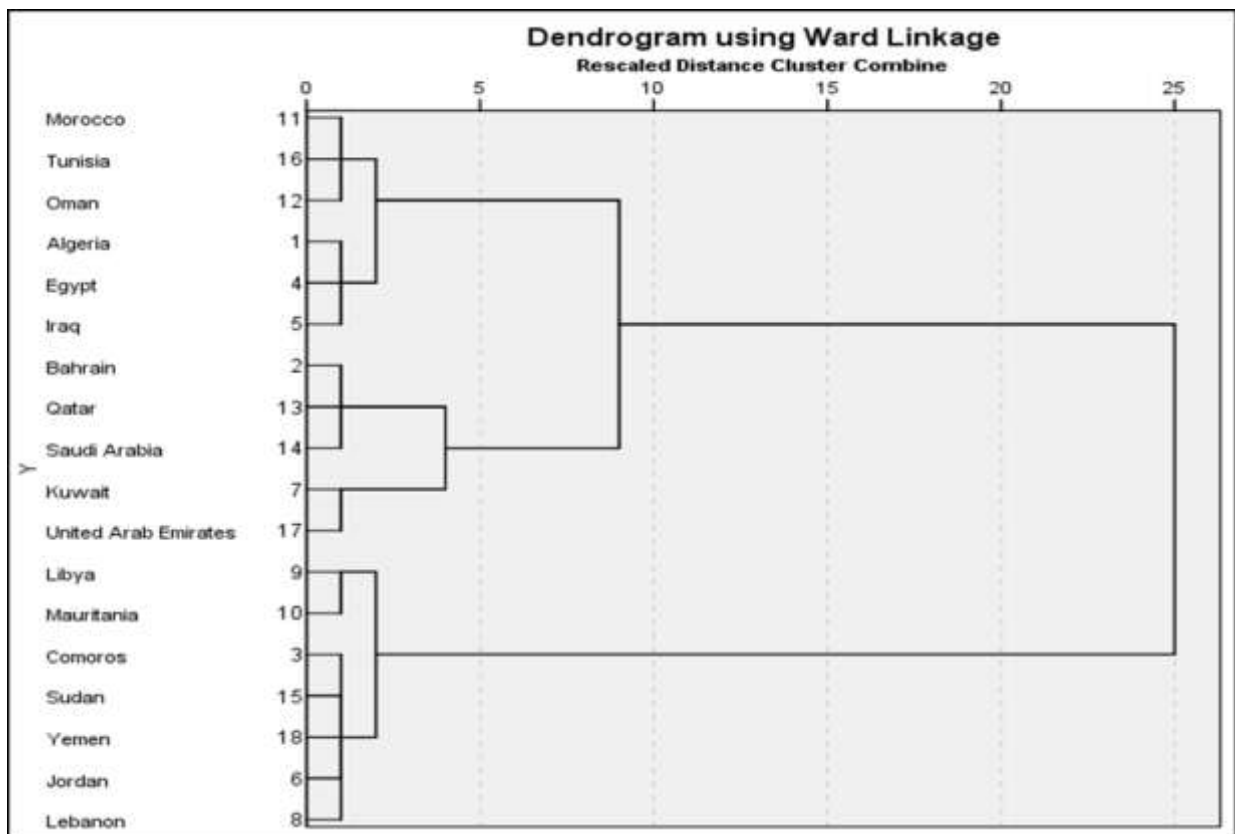
- **Group 3:** Ranked third in terms of ICT ownership, including Algeria, Djibouti, Egypt, Iraq, and Jordan.
- **Group 4:** Comprising Somalia, Sudan, and Yemen, characterized by security challenges and a lack of robust communication networks, placing them at the bottom of the Arab ICT index ranking.

Table (03): Classification of Arab Countries According to the ICT Index in 2022.

Cluster Membership				
Case	5 Clusters	4 Clusters	3 Clusters	2 Clusters
1:Algeria	1	1	1	1
2:Bahrain	2	2	2	2
3:Djibouti	3	1	1	1
4:Egypt, Arab Rep.	1	1	1	1
5:Iraq	1	1	1	1
6:Jordan	3	1	1	1
7:Kuwait	4	3	3	2
8:Libya	4	3	3	2
9:Morocco	2	2	2	2
10:Oman	2	2	2	2
11:Qatar	4	3	3	2
12:Saudi Arabia	2	2	2	2
13:Somalia	5	4	1	1
14:Sudan	5	4	1	1
15:Tunisia	2	2	2	2
16:United Arab Emirates	4	3	3	2
17:Yemen, Rep.	5	4	1	1

Source: Compiled by researchers using SPSS26 software.

Figure (01): Dendrogram Tree Diagram for the Classification of Arab Countries According to the ICT Index in 2022.



Source: Compiled by researchers using SPSS26 software.

3. Regression Analysis:

To identify which ICT variables had an impact on economic growth in Arab countries during 2022, stepwise regression analysis was utilized as it directly determines the variable and the estimated model is free from measurement problems. The proposed model for estimation can be formulated as follows:

$$GDPP = B_0 + B_1INT + B_2MOB + B_3FIX + \epsilon_t$$

After estimating the model using SPSS software, the following outputs were obtained:

From Table (04) below, representing the partial significance of the estimated parameters in the model, it is evident that there is one significant model containing the mobile phone variable alone, while the mobile phone usage and internet access variables were excluded from the model due to their lack of significance.

From the model, it is inferred that the fixed-line telephone variable alone had an impact on economic growth in Arab countries compared to other ICT variables.

Table (04): Significance of Estimated Parameters.

Coefficients ^a								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-4792.724	5435.039		-.882	.3920		
	FIX	1752.792	420.534	.733	4.168	.0010	1.000	1.000

a. Dependent Variable: GDPP

Source: Compiled by researchers using SPSS26 software.

From Table (05) below, showing the overall significance of the estimated model through the analysis of variance (ANOVA), the Fisher value was 17.372, significant at the 5% level, indicating overall model significance. Therefore, the model is significant as a whole.

Table (05): Overall Significance of the Model.

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2724512906.33 2	1	2724512906.33 2	17.372	0.001 ^b
	Residual	2352460913.76 1	15	156830727.584		
	Total	5076973820.09 3	16			
a. Dependent Variable: GDPP						
b. Predictors: (Constant), FIX						

Source: Compiled by researchers using SPSS26 software.

From Table (06) below, showing the interpretative power, the correlation coefficient value was 0.733 between the dependent variable and the independent variable, indicating a strong, negative relationship between economic growth represented by per capita GDP and the fixed-line telephone variable in Arab countries.

Moreover, the determination coefficient value was 0.537, implying that the fixed-line telephone usage variable contributes to explaining economic growth by 53.7%, indicating the presence of other factors or variables contributing to economic growth in Arab countries.

Table (06): Interpretive Capability

Model Summary ^b					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.733 ^{a0}	.5370	0.506	12523.20756	2.270
a. Predictors: (Constant), FIX					
b. Dependent Variable: GDPP					

Source: Compiled by researchers using SPSS26 software.

From Table (07) below, it is evident that both the variables of mobile phone usage and internet access were excluded from the estimated model using stepwise regression analysis, as they were not statistically significant, indicating that they had no impact on economic growth in Arab countries.

Table (07): Excluded Variables from the Model

Excluded Variables ^a								
Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics		
						Tolerance	VIF	Minimum Tolerance
1	INT	.086 ^b	.314	.758	.084	.437	2.289	.437
	MOB	.167 ^b	.437	.669	.116	.225	4.446	.225
a. Dependent Variable: GDPP								
b. Predictors in the Model: (Constant), FIX								

Source: Compiled by researchers using SPSS26 software.

Conclusion and Recommendations:

Information and Communication Technology (ICT) is one of the most important fields that has gained significant importance due to prevailing economic conditions and the intense competition in the global economy.

ICT is now associated with the development of societies in our present age, as it directly contributes to building a new society based on electronic information services directly related to production, communication, and education services. In this context, Arab countries are striving to integrate ICT into various sectors, especially the economy, in an attempt to keep pace with the information revolution and bridge the digital gap between them and advanced countries.

Through studying whether ICT has an impact on economic growth in these countries, the following results were obtained:

- ✓ There is variation among Arab countries in their level of ownership of ICT indicators, with Gulf Arab countries, especially Kuwait, Saudi Arabia, Qatar, and the United Arab Emirates, leading in ownership levels of the most prominent ICT variables, as indicated by cluster analysis in the study.
- ✓ Somalia, Sudan, and Yemen ranked at the bottom compared to other Arab countries in terms of ownership levels of the ICT index, attributed to weak infrastructure and deteriorating security conditions in some of them, especially in 2022.
- ✓ Qatar had the highest average per capita GDP, attributed to its status as an oil-rich country, in addition to its relatively small population. Conversely, Yemen ranked at the bottom of the Arab ranking in terms of per capita GDP.
- ✓ Descriptive analysis revealed a strong and negative correlation between ICT variables and economic growth represented by per capita GDP in Arab countries during 2022.
- ✓ Among the three variables representing ICT, fixed-line telephone subscribership was found to be the variable that had an impact on economic growth, with an explanatory power exceeding 53.7%, indicating that fixed-line telephone ownership is very important in influencing economic growth, as its significant availability leads to increased technological advancement and thus economic growth in the country.

Therefore, it is recommended that Arab countries significantly increase their focus on ICT by expanding and intensifying communication networks, improving infrastructure, and relying on modern methods in production, management, marketing, research, and development to catch up with advanced countries and achieve economic growth.

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