Journal of Agriculture and Crops
ISSN(e): 2412-6381, ISSN(p): 2413-886X
Vol. 9, Issue. 4, pp: 540-552, 2023
URL: https://arpgweb.com/journal/journal/14
DOI: https://doi.org/10.32861/jac.94.540.552

Academic Research Publishing Group

Original Research **Open Access**

Economic and Developmental Returns of Information and Communications Technology in Saudi Arabia

Salah S. Abd El-Ghani (Corresponding Author)
Associate Professor of Economics - College of Business - Imam Mohammad Ibn Saud Islamic University (IMSIU)
Associate Professor of Agricultural Economics, Institute of Agricultural and Biological Research, National Research Centre, Giza, Egypt
Email: drsalahsaid@yahoo.com

Article History
Received: 20 July, 2023
Revised: 25 September, 2023
Accepted: 24 October, 2023
Published: 31 October, 2023

Abstract

Information and communications technology has become linked to the development of societies in our present era. It is considered one of the most important means of transferring developing societies to more advanced societies, and investments in the field of information and communications technology are increasing in the Kingdom of Saudi Arabia, and this in turn leads to many economic and development impacts that may be unspecified or unclear. Therefore, this study sheds light on the explanation of some of these effects. A standard model was used for the relationship between the dependent variable, which is the GDP of ICT, and the independent variables under study in Saudi Arabia for the period (1992:2022), and the standard model equation was estimated using the least squares method, and the autoregressive distributed lags (ARDL) model to verify the existence of a long-term equilibrium relationship between... The independent variables and the GDP of ICT and verifying this relationship with the error correction model (ECM), where it was found that there is a positive relationship at the level between the ICT revenue variable and employment and the GDP of ICT, while the relationship was negative between them in slow periods (1, 2, 3) and in terms of 1%. There is a negative relationship between the employment variable and the GDP of ICT in slow periods (2, 3) and with a significance of 1%. There is a positive relationship at the level between the employment variable and the GDP of ICT with a significance rate of 1%. Therefore, the study recommends the following: paying attention to qualifying and training workers in the field of information and communications technology, encouraging more investments in the field of information and communications technology, and working to find a kind of geographical balance in the distribution of projects based on information and communications technology. Facilitating licensing procedures for companies wishing to invest in the field of information and communications technology.

Keywords: Digital economy; Information technology; Communications; Sustainable development.

How to Cite: Salah S. Abd El-Ghani, 2023. "Economic and Developmental Returns of Information and Communications Technology in Saudi Arabia." *Journal of Agriculture and Crops*, vol. 9, pp. 540-552.

1. Introduction

There is no doubt that communications and information technology have become a major axis of development in its various fields, and a basic pillar in measuring the development and progress of nations. Modern communications have contributed to a major qualitative leap in the world, enabling societies to communicate and exchange information with ease and super-fast. With the tremendous technical progress and the low prices of devices and services, communications and information technology services became accessible to many peoples of the world, and these services extended to include remote areas, which contributed to the convergence of societies, and transformation of the world into a small village, in which the individual enjoys knowing what is going on around him in various parts of the world. [1]

In order to keep pace with the international race to win a share of the benefits of communications and information technology, many countries have sought to provide all kinds of support in this field, overcoming difficulties and facilitating possibilities to motivate society and its various institutions to adopt and develop technical options. Emphasis was placed on relying on technical knowledge and supporting the economy based on the fields of communications and information technology in its various axes. From this standpoint, the Kingdom, like other countries, has sought to develop appropriate plans for the short or long term; To develop communications and information technology, expand its spread and facilitate access to it in all regions of the Kingdom, in a way that meets the needs of economic, social, educational and health development, and other aspects of life, and encourages investment in these areas.

2. Research Importance

Investment in information and communication technology has a strategic and sustainable development role by increasing the rate of economic growth, reforming economic, commercial and financial mechanisms, providing more job opportunities and improving the standard of living. Specifically, investment in information technology and its various tools such as the Internet transforms and changes patterns of economic performance in finance, business, trade and investment from the traditional form to the rapid electronic form in order to improve competitive positions.

The Kingdom of Saudi Arabia also aims to transform into an information society and become a pioneer in the field of information and communication technology. The Kingdom aspires to achieve this through the implementation of a plan for information and communication technology in the Kingdom during the next twenty years, which aims to spread the use of information and communication technology in all possible places, in addition to promoting strong cooperation with developed countries in this field.

3. Research Problem

Investments in information and communication technology are increasing in the Kingdom of Saudi Arabia, and this in turn leads to many economic and developmental effects that may be undetermined or unclear. Therefore, this study sheds light on and clarifies some of these effects.

4. Research Aims

4.1. This Research Aims to Study and Identify the Following

- Providing a comprehensive view of information and communication technology, its characteristics and sections.
- Statement of the role played by investment in information and communication technology and its economic effects on sustainable development in the Kingdom of Saudi Arabia.

5. Research Hypotheses

5.1. The Research Relied on the following Hypotheses

- The information, knowledge, and technological economy has a positive role in the Kingdom of Saudi Arabia.
- The growth and diversity of opportunities offered by investment in information and communication technology.
- There are many economic effects resulting from increased investment in information and communication technology in the Kingdom of Saudi Arabia.
- There are many variables that affect the evolution of the GDP of the transport and communications sector in the Kingdom of Saudi Arabia.

6. Research Methodology

To reach the desired goals of this research, and to test the hypotheses that were adopted, several approaches were used. Regarding the theoretical aspect, we relied on the descriptive statistical approach, the historical approach through previous studies, describing the phenomenon and identifying the most important definitions related to it on the one hand and on the other hand. Spending on information and communications technology and its role in sustainable development. On the practical side, the analytical, statistical, inferential and economic approach was used, through the use of mathematical methods and necessary statistical measures such as averages, percentages, and general trend equations for the variables of the study, the gross domestic product of information and communications technology, and the value in billion dollars for the period (1992:2022), the model equation was estimated using the least squares method, and a set of tests were applied, namely: clarifying the autoregressive distributed lags (ARDL) model, where each method has its conditions and application steps, all of which aim to verify the existence of a long-term balanced relationship between the variables. Independent and GDP of ICT and verify this relationship through the error correction model (ECM), to analyze, interpret and study the relationship between the most important economic and social variables associated with the role of ICT in increasing GDP.

This is based on the following econometric model after taking the first difference for all variables, which shows that (the gross domestic product of the transport and communications sector at current prices), which is the dependent variable, represents a function of several independent variables, namely (spending on information and communications technology, total revenues, total licenses for companies, employment for economic activity).

$$GDP.ICT(\textit{the gross domestic product of the transport and communications sector at current prices}) = f(\text{Spending on information and communications technology}, \text{Total revenues}, \text{Total licenses for companies}, \text{Employment for economic activity})$$

Estimation Equation:

==========

*DGDPICT = C(1)*DSPENDING + C(2)*DREVENUES + C(3)*DEMPLOYMENT + C(4)*DLICENSES + C(5)*Ut*

***DGDPICT** = (Dependent variable) the gross domestic product of the transport and communications sector at current prices.*

The independent variables were as follows:

****DSPENDING** =Spending on information and communications technology.*

***DREVENUES** =Total revenues.*
***DEMPLOYMENT** =Employment for economic activity.*
***DLICENSES** =Total licenses for companies.*
***Ut** =random error.*

7. Data Sources

The research depends on published and unpublished secondary data from annual reports and statistics issued by bodies and companies, masters' degrees and doctoral theses, scientific journals and periodicals and the website of the Saudi Ministry of Communications and Information Technology in the Kingdom of Saudi Arabia.

8. The Role of Communications and Information Technology in Development

Communication and information technology is one of the important and vital fields in achieving the goals and objectives of development, and it directly and indirectly touches all the various fields and axes of development. Its importance lies prominently in two main axes:

8.1. The First Axis

Is the role played by the communications and information technology sector as one of the important sources of increasing domestic income in most developed countries. As well as developing countries.

The communications and information technology industry includes complex production processes characterized by high economic added value, and labor with high technical capabilities, and is linked to large-scale commercial and service operations, including equipment, software, and others, which makes communications and information technology a sector of vital importance in almost all countries. It is even more important in countries where the development process depends directly on the ability to communicate. This sector has gained double importance as a result of the steady growth of the Internet and societal applications using the Internet, such as applications for e-government transactions, e-commerce, e-education, e-health...etc.

8.2. The Second Axis

Refers to the positive effects of progress in communications and information technology in other economic sectors.

Communications and information technology contribute to providing the means to support activities that benefit from targeted information, including improving the conditions of communities and reducing poverty. For example, communications and information technology make health care more comprehensive and provide it to wider sectors through telemedicine. It also increases the effectiveness of education and directs it to more segments, through e-learning and distance education. Having reliable information systems is essential for the effective management and operation of the public and private sectors; these systems cover many vital areas, such as internal government information, citizen services, trade, banking, and international relations, which highlights the importance of ensuring the security of information, data, and networks for the success of the information society.

In addition to these themes, communications and information technology, especially in the past few years, have become important factors in social communication, information and knowledge exchange, dissemination of the principles of dialogue, and hearing another opinion, and it has become a global media platform that does not depend on borders or monopolistic institutions.

The national plan for communications and information technology has taken into account these rapid developments through the development of infrastructure, improving the level of services and facilitating access to them, training and rehabilitation, and building individuals in the various educational stages, to adapt to these variables with a balanced efficiency, and in a manner that contributes to creating a serious environment to deal with the developments Modern access to an informational and digital society. Through its various projects emanating from its general objectives, and in a way that contributes to supporting the important role of communications and information technology in managing the wheel of development; To achieve the ambitious national aspirations in the successive development plans.

9. Previous Studies

In a study by Al-Shahri and Ajlan [2] on “Modern Office Techniques and Supportive Administrative Functions in Governmental Agencies”, the researcher addressed the problematic emanating from the impact of modern communication technology on office work in government agencies, from the point of view of employees and their approval of these technologies, about productivity To improve communication methods and work environment, the researcher chose an intended sample to test his hypotheses, which are the candidates for training in the office management programs at the Institute of Management. He followed the descriptive approach. He also used a questionnaire consisting of twenty-nine questions distributed on **two axes**:

9.1. The First Axis

Dealt with socio-demographic information, while **the second axis** dealt with the problem of the impact of communication technology (telex, fax, telephone, computer, and internet) on office work. This study has concluded

that modern communication technology has positive effects on the level of performance and the quality of communication, according to the employees' views always.

The study of Belkidom [3], under the title "The Impact of Modern Information and Communication Technology (NTIC) on the Strategic Management of Economic Institutions", it was highlighted the extent to which the economic enterprise achieves competitive advantage mainly linked to strategic management in light of the widespread growth applications of information and communication technology in achieving competitive advantage, organizational development, achieving total quality and engineering strategic alliances under the problem of "the impact of modern information and communication technology on the strategic management of economic institutions." It aims to enrich the field of knowledge and support researchers and those interested in carrying out new studies on such topics. The study reached several results, the most important of which are: The process of modernization and administrative development requires enhancing the process of absorbing information and communication technology and making it available for use by all members of the organization to achieve distinction in performance, from By adopting a strategic management method that reflects the strategies of transition towards a knowledge economy, as well as establishing departments for strategic intelligence, total quality management, research, and development and giving them more freedom for creativity and development.

In a study by Huang [4] entitled "An Empirical study of the Relationship between investment in information technology and corporate performance: the resource-based perspective". This study empirically tested the correlation between investments in information technology and corporate performance, the results indicate that companies with a high level of infrastructure in Information Technology and a high level of human resources for technology has a strong positive relationship with intangible capabilities for information technology, but not with corporate performance. In addition to the intangible capabilities of information technology, it is positively and strongly linked with the performance of companies. Through this study, the partnership between investment in information technology and future information technology capabilities was tested. The results showed that investment in information technology began to show results that indicate the possibility of a positive contribution to the establishment of Information technology infrastructure, however, the different measures of investment in information technology do not show any positive relationship with human resources for information technology and intangible capabilities of information technology, but intangible capabilities of information technology is one of the most important factors affecting the performance of business and human resources for information technology.

This study also examined the impact of investment in information technology and several variables on the volatility of future revenues, and then reached through the study that investment in information technology strongly increases the volatility of future revenues, and that four compatible and intermediate factors affect the volatility of revenues: Focus on industry, sales growth, diversification, leverage), it should be noted that when the main impact of spending on information technology is revenue volatility and this effect is positive and strong, it does not mean that all other mediating factors enter into this effect and the results indicate that there are Factors that fall under the so-called positive relationship between risk and return can appear and lead to the opposite of results or lead to making the results more balanced.

In the study Shin [5] entitled: "The impact of information technology on financial performance, the importance of strategic choice." The researcher believes that information and communication technology does not automatically improve the company's profits, but it is an essential tool for that. The researcher also believes that information and communication technology alone is not sufficient to improve the profits of companies, so it must be linked with other factors such as business strategies, and the researcher stated that companies can maximize the returns achieved from investment in information technology by linking them with business strategies because information technology improves goals This study empirically tests the impact of information technology on financial performance as measured by net profit, return on assets and return on equity, with a focus on linking information technology with business strategies such as vertical lack of integration, diversification, and others. Through empirical analysis, it was found that information technology and lack of integration Verticality and diversification improve financial performance as measured by net profit, but do not improve corporate performance, such as return on equity and return on assets.

The study of Shadly [6] entitled "The impact of the use of information and communication technology on the performance of small and medium enterprises - a case study of small and medium enterprises in the state of Algeria". Which dealt with assessing the intensity and methods of using information and communication technology, with a focus on Internet-related technologies used by Algerian small and medium enterprises under the problem of "Can information and communication technology contribute to raising the performance of small and medium enterprises in light of the current conditions and Algeria's orientation towards building an information society A set of hypotheses have been developed to encompass all aspects of the study and to identify the extent to which the performance of institutions is affected by this technology using a set of indicators.

In a study by Harizi [7] on "The Role of Modern Communication Technologies in Achieving the Goals of the Sustainable Human Development Strategy in Algeria." In the first chapter, the researcher dealt with the nature of information technology and networks, and in the second chapter, sustainable human development and the impact of the use of networks in the development of human resources. In the institution, it was touched on in the third chapter of the field study. The conclusion he reached is that the modern technology of communications in Algeria Telecom through the intranet seeks to facilitate the delivery, transmission, and preservation of information in the fastest time and at the lowest cost, and the impact of the Internet on human resource development by improving the workflow in the institution and indirectly participating in decision-making.

In the study Al-Alami [8] on the role of investment in information and communication technology in achieving sustainable development, a comparative study between Malaysia, Tunisia, and Algeria. She also clarified that the economic impact of investing in information and communication technology can be in terms of external influences and indirect effects due to its use and application in various sectors of the economy, greater than its direct contribution to the gross domestic product. As a sector of production. Therefore, the information and communication technology sector has a developmental role at all levels, especially in promoting sustainable development.

In a study by Al-Sabti and Khalid [9] entitled "The Future of the Information Technology Industry in the Gulf Cooperation Council Countries", the Ninth Gulf Industrialists Conference, September 28-29, 2003 Muscat. The researcher concluded that the growing role played by the industry of information and communication technology for the economies of countries and their contribution to the gross domestic product and the provision of great job opportunities and that there are main requirements for a strong information industry linked to different roles, and there are requirements that need more support by the Gulf Cooperation Council and proposes a general framework for the development of information industry in the Gulf countries.

In the study Al-Shalhoub and Salah [10] entitled “Investment in Information Technology in the Gulf Countries,” the researcher concluded that investment in information technology is important for the Gulf countries, and the reason for this is a set of factors that make it important to take care of this based on the economic capabilities and needs of these Countries. The Gulf States are more convinced than ever of the importance of diversifying their economic resources.

9.2. Indicators of the General Trend of some Variables Related to Investment in information and Communication Technology in Saudi Arabia

This part deals with the study of general trend indicators for some variables related to investment in information and communication technology in the Kingdom of Saudi Arabia during a time series for the period (1992-2022), and the following is an estimate of the general trend equations for these variables.

10. Results and Discussion

10.1. The Evolution of the GDP of the Transport and Communications Sector at Current Prices in Billion Dollars during the Period (1992-2022):

The data contained in Table No.(1) indicate that the value of the GDP of the transport and communications sector at current prices in Billion dollar during the period (1992-2022) took an increase, with a minimum of about 3.8 Billion dollar in 1992, and a maximum of about 64.5 Billion dollar in 2022, and the average for this period amounted to about 24.9 Billion dollar, according to an estimation of the general time trend equation for the evolution of the value of the GDP of the transport and communications sector at current prices in Billion dollar during the aforementioned period, as evidenced by equation No.(1) in Table No.(2) that the value of the GDP of the transport and communications sector at current prices in Billion dollar took a general, increasing and statistically significant trend estimated at about 2.1 Billion dollar annually, representing about 8.4% of the annual average value of the gross domestic product of the transport and communications sector at current prices in Billion dollar during the same period. The coefficient of determination indicates that about 92% of the change in the GDP value of the transport and communications sector at current prices in Billion dollars during this period is due to factors that are reflected in the time variable.

10.2. The Evolution of Spending on Information and Communication Technology (Billion Dollars) during the Period (1992-2022):

The data in Table No. (1) indicate that spending on information and communication technology (Billion dollars) during the period (1992-2022) took an increased, with a minimum of about 3.5 Billion dollars in 1992, and a maximum of about 45.8 Billion dollars in 2022, and the average for this period amounted to about 18.6 Billion dollars, and by estimating the equation of the general time trend of the development of spending on information and communication technology (Billion dollar) during the aforementioned period, and as shown by equation No. (2) in Table No. (2) that The amount of spending on information and communication technology has taken an increasing general and statistically significant trend, estimated at 1.5 Billion dollars annually, representing about 7.9% of the annual average spending on information and communication technology during the same period. The coefficient of determination indicates that about 93% of the change in spending on information and communication technology during this period is due to factors that are reflected in the time variable.

Table-1. shows a time series of the evolution of some variables related to information and communication technology in the Kingdom of Saudi Arabia during the period (1992-2022)

years	Gross Domestic Product of the Transport and Communications Sector at Current Prices (Billion dollar)	Spending on Information and Communication Technology (Billion dollar)	Total revenue (Billion dollar)	Employment for economic activity (transportation, storage, communications) thousand employees	Total licenses for companies
1992	3.8	3.5	6.6	62	50
1993	3.9	3.9	6.8	68	70
1994	4.7	4.3	7	75	72
1995	5.6	5.5	7.2	79	81
1996	6.1	5.5	7.4	83	85
1997	6.8	5.5	7.6	86	90
1998	7.4	5.9	7.8	89	91
1999	8	6.3	8	95	100
2000	8.4	6.7	8.2	95	113
2001	8.7	7.1	8.4	98	116
2002	10	7.5	8.6	101	119
2003	10.2	7.7	8.8	105	122
2004	11.1	9.1	9	112	150
2005	11.6	9.6	9.1	125	180
2006	13.3	12.8	10.1	127	223
2007	16.3	16	11.5	132	294
2008	20.7	18.7	13.1	146	290
2009	23.7	19.5	14	172	298
2010	27	20	16.2	197	313
2011	30.7	22	17.5	231	230
2012	33.1	25.1	18.9	273	292
2013	35.8	27.4	19	336	309
2014	39.3	29.3	20.2	395	327
2015	42.5	31.4	21.4	424	340
2016	45.6	33.4	22.6	454	353
2017	48.7	35.5	23.8	483	366
2018	51.9	37.6	25	513	379
2019	55	39.6	26.2	543	392
2020	58.2	41.7	27.4	572	405
2021	61.3	43.7	28.6	602	418
2022	64.5	45.8	29.8	631	431

Source: Communications and Information Technology Commission website Reports for different years, Kingdom of Saudi Arabia. (http://www.citc.gov.sa/ar/MediaCenter/Annualreport/Pages/default.aspx)

10.3. Evolution of the Value of Total Revenues in Billion Dollars during the Period (1992-2022)

The data in Table No. (1) indicate that the value of total revenues in Billion dollars during the period (1992-2022) continued to increase, reaching a minimum of about 6.6 Billion dollars in 1992, and a maximum of about 29.8 Billion dollars in 2022. The average for this period amounted to about 14.7 Billion dollars, and by estimating the equation of the general time trend of the development of total revenues in Billion dollars during the aforementioned period, as it is clear from equation No. (3) in Table No. (2) that the value of total revenues in Billion dollar took a general trend. Increasing and statistically significant, estimated at 0.8 Billion dollars annually, representing about 5.4% of the annual average value of total revenues in Billion dollars during the same period. The coefficient of determination indicates that about 92% of the change in the value of total revenues in Billion dollars during this period is due to the factors reflected by the time variable.

10.4. The Development of Employment for Economic Activity (Transportation, Storage, and Communications Thousand Employees) during the Period (1992-2022):

The data in Table No.(1) indicate that the total employment for economic activity (transportation, storage, communications thousand employees) during the period (1992-2022) took an increase, with a minimum of about 62 thousand employees for the year 1992, and a maximum of about 631 thousand employees for the year 2022, and the average for this period was about 242 thousand employees, and by estimating the equation of the general time trend of the development of total employment for economic activity (transportation, storage, communications thousand employees) during the aforementioned period, and as it becomes clear from equation No.(4) in Table No.(2) that the total employment Economic activity (transportation, storage, communications) has taken an increasing general and statistically significant trend, estimated at about 19.3 thousand employees annually, representing about 8% of the annual average of total employment for economic activity (transportation, storage, communications thousand

employees) during the same period. The coefficient of determination indicates that about 85% of the change in the total employment of economic activity (transportation, storage, communications thousand employees) during this period is due to factors that are reflected in the time variable.

10.5. The Evolution of the total Licenses for Companies during the Period (1992-2022):

The data contained in Table No. (1) indicates that the total licenses for companies during the period (1992-2022) fluctuated between increase and decrease, with a minimum of about 50 licenses in 1992, and a maximum of about 431 licenses in 2022. The average of this period amounted to about 229 licenses, and by estimating the equation of the general time trend of the development of the total licenses for companies during the aforementioned period, as it becomes clear from equation No. (5) in Table No. (2) that the total licenses for companies took an increasing general and statistically significant trend estimated at 13.6 Annual licensing represents about 5.9% of the annual average of total corporate licenses during the same period. The coefficient of determination indicates that about 95% of the change in the total licenses of companies during this period is due to factors that are reflected in the time variable.

Table-2. Shows the general time trend equations for the development of some variables related to investment in information and communication technology in the Kingdom of Saudi Arabia during the period (1992-2022):

Item	Equation number	The equation	Rate of change for the average	R^2	Prob.
Gross Domestic Product of the Transport and Communications Sector at Current Prices (Million Riyal)	**1**	$\hat{y} = -8.6+2.1\ x$ $(18.0)^{**}$	***8.4***	***0.92***	***0.000***
Spending on Information and Communication Technology (Billion Riyal)	**2**	$\hat{y} = -4.7+1.5x$ $(20.2)^{**}$	***7.9***	***0.93***	***0.000***
Total revenue (Billion Riyal)	**3**	$\hat{y} = 1.7+0.8\ x$ $(17.8)^{**}$	***5.4***	***0.92***	***0.000***
Employment for economic activity (transportation, storage, communications thousand employees)	**4**	$\hat{y} = -67.1+19.3\ x$ $(12.9)^{**}$	***8.0***	***0.85***	***0.000***
Total licenses for companies	**5**	$\hat{y} = 11.8+13.6\ x$ $(23.6)^{**}$	***5.9***	***0.95***	***0.000***

Source: collected and calculated from Tables No. (1,3). $\hat{y}$= the estimated value of the area in the year (i), Xi = variable time, (i)= 1, 2, 3,...,n). (**) Indicates a significant regression model or when the level of significance (0.01). R2 = R Square.

11. The Econometric Model and Estimation Results

Statistical characteristics and data sources for research variables:

The research relied on (the official website of the Saudi General Authority for Statistics, Communications, Space & Technology Commission) to obtain the time series of the research variables for the period from (1992-2022). The econometric model variables are as follows:

The following table no. (3) shows the statistical characteristics of the model variables, where the average values of the variables (real GDP for ICT, spending, and revenues) amounted to about ($24.96 billion, $18.95 billion, $14.70 billion) respectively, and the values also amounted to The averages of the variables (employment, and permits for companies) were (242 thousand employees, 229 permits), respectively, while the highest values for the same variables, respectively, were (64.5, 45.8, 29.8) in billion dollars (631 thousand employees, 431 permits for companies), while the lowest was Values for the variables (3.8, 3.5, 6.6) are in billion dollars, respectively (62.0 thousand employees, 50.0 company permits). The values of the Jarque-Bera test for all variables indicate that they follow a probability distribution.

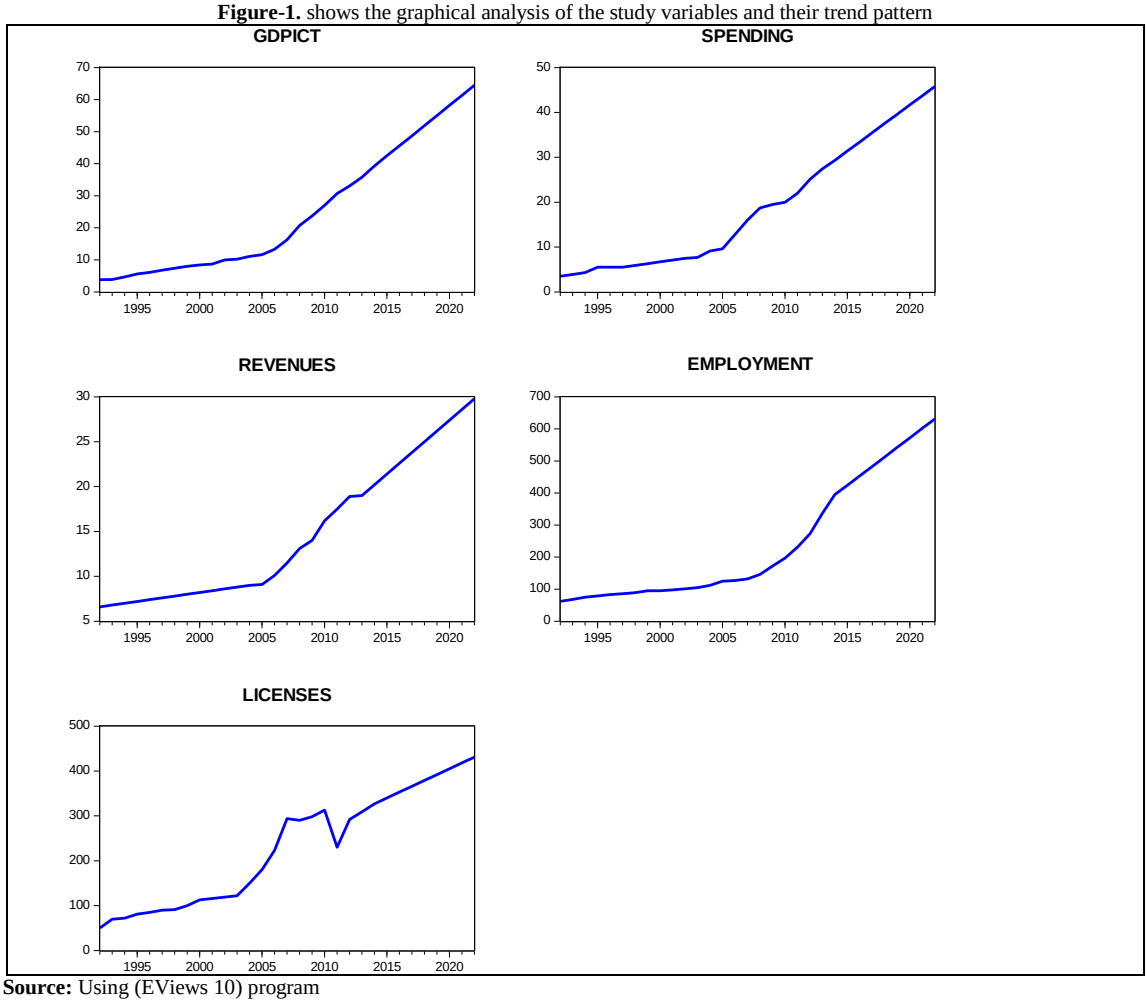
Table-3. shows the statistical characteristics of the model variables.

	GDPICT	SPENDING	REVENUES	EMPLOYMENT	LICENSES
Mean	24.96452	18.95484	14.70323	242.0645	229.0000
Median	16.30000	16.00000	11.50000	132.0000	230.0000
Maximum	64.50000	45.80000	29.80000	631.0000	431.0000
Minimum	3.800000	3.500000	6.600000	62.00000	50.00000
Std. Dev.	19.90009	13.93090	7.701623	190.4519	126.6020
Skewness	0.625252	0.535279	0.588537	0.825252	0.060767
Kurtosis	1.945497	1.853498	1.874573	2.106951	1.470638
Jarque-Bera	3.456160	3.178225	3.425613	4.548867	3.040218
Probability	0.177625	0.204107	0.180359	0.102855	0.218688
Sum	773.9000	587.6000	455.8000	7504.000	7099.000
Sum Sq. Dev.	11880.41	5822.097	1779.450	1088158.	480842.0
Observations	31	31	31	31	31

Source: Using (EViews 10) program

Figure No. (1) Shows that all variables take a general increasing trend.

Figure-1. shows the graphical analysis of the study variables and their trend pattern



Source: Using (EViews 10) program

12. Testing the Significance of the Model Parameters using Multiple Linear Regression using the Least Squares Method after Taking the First difference for All Variables

It is clear from the results in Table (4) that there is a positive relationship between the independent variables and the dependent variable, as all parameters of the variables are significant at the level of significance (1%), except for the total licenses of companies, which had an inverse relationship with the dependent variable. The value of Adjusted R-squared was (0.90) and the model was significant at the level of (1%).

Table-4. Significance of model parameters using multiple linear regression using the least squares method (Method: Least Squares):

Dependent Variable: DGDPICT				
Method: Least Squares				
Date: 09/13/23 Time: 00:33				
Sample (adjusted): 1993 2022				
Included observations: 30 after adjustments				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
DEPENDING	0.372740	0.116202	3.207691	0.0036
DREVENUES	1.282875	0.179781	7.135781	0.0000
DEMPLOYMENT	0.021738	0.005674	3.830915	0.0008
DLICENSES	-0.011084	0.003511	-3.157073	0.0041
C	0.234161	0.143579	1.630887	0.1154
R-squared	0.914749	Mean dependent var		2.023333
Adjusted R-squared	0.901109	S.D. dependent var		1.347714
S.E. of regression	0.423815	Akaike info criterion		1.271970
Sum squared resid	4.490468	Schwarz criterion		1.505503
Log-likelihood	-14.07955	Hannan-Quinn criter.		1.346679
F-statistic	67.06316	Durbin-Watson stat		1.733328
Prob(F-statistic)	0.000000			

Source: Using (EViews 10) program

From the previous table No. (4), it is possible to deduce and write the multiple linear regression equation that explains the relationship between the dependent variable (real GDP) and the independent variables after taking the first difference for all variables as follows:

Estimation Equation:

==========

*DGDPICT = C(1)*DSPENDING + C(2)*DREVENUES + C(3)*DEMPLOYMENT + C(4)*DLICENSES + C(5)*Ut*

Substituted Coefficients:

==========

*DGDPICT = 0.372740057381*DSPENDING + 1.28287523035*DREVENUES + 0.0217375048876*DEMPLOYMENT - 0.0110841614495*DLICENSES + 0.234160515327*

13. ARDL Model for Cointegration or Simultaneous Integration between Variables

After conducting stability tests of the chains through the Phillips-Perron test and ensuring their compatibility with the ARDL model to test the optimal deceleration periods and thus determine the optimal model equation (Model Selection Criteria).

It is clear that the optimal model that was chosen is ARDL (4, 4, 4), and the numbers in parentheses express that the dependent variable (GDP) has four lag periods, as well as the independent variables, each of which has four lag periods, and the value of the criterion indicates (Durbin-Watson stat = 2.078815) However, all model variables follow a probability distribution, and the significance of the model is evident through the value of the F-statistic, which is equal to (41.7) at a significance level of (1%).

Before adopting this model to estimate the short- and long-term effects of the independent variables on the dependent variable, the quality of this model must be verified through the following model examination tests:

13.1. Bounds Test

It is clear from the data in Table (5) and through the value of (Bounds Test), which amounted to (5.54) and its comparison with the values of the upper and lower limits of test I(0), and the values of I(1), which were greater than all the values of the upper and lower limits at the ratios (10%, 5%, 2.5%, 1%), which proves the existence of cointegration or a long-term equilibrium relationship between the study variables, which confirms the quality of the model in estimation.

Table-5. shows the results of the Bounds Test:

F-Bounds Test		**Null Hypothesis: No levels of relationship**		
Test Statistic	**Value**	**Signif.**	**I(0)**	**I(1)**
			Asymptotic: n=1000	
F-statistic	5.543367	10%	2.63	3.35
k	2	5%	3.1	3.87
		2.5%	3.55	4.38
		1%	4.13	5

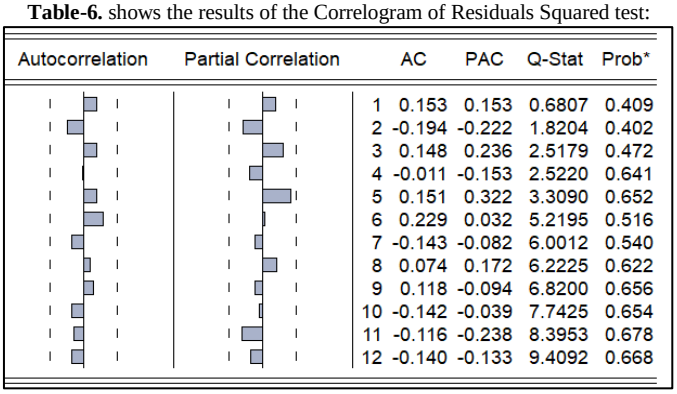
Source: Using (EViews 10) program

13.2. Residual Diagnostic Tests

13.2.1. Correlogram of Residuals Squared

It is clear from Table (6) that the residuals are within the confidence ranges or limits, meaning that the model is good at estimating.

Table-6. shows the results of the Correlogram of Residuals Squared test:



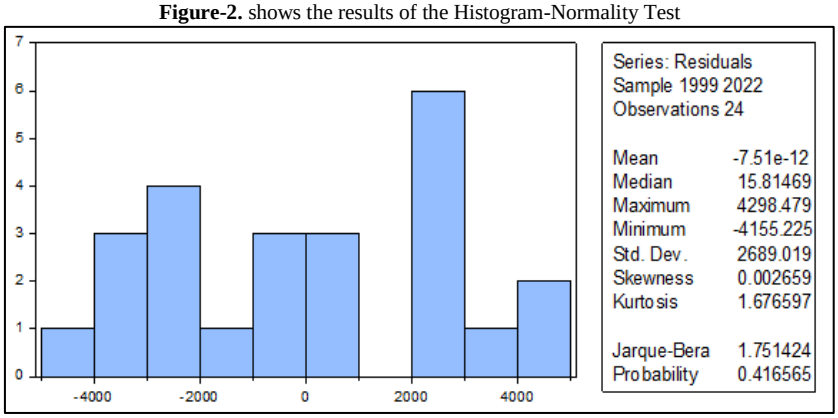
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
		1	0.153	0.153	0.6807	0.409
		2	-0.194	-0.222	1.8204	0.402
		3	0.148	0.236	2.5179	0.472
		4	-0.011	-0.153	2.5220	0.641
		5	0.151	0.322	3.3090	0.652
		6	0.229	0.032	5.2195	0.516
		7	-0.143	-0.082	6.0012	0.540
		8	0.074	0.172	6.2225	0.622
		9	0.118	-0.094	6.8200	0.656
		10	-0.142	-0.039	7.7425	0.654
		11	-0.116	-0.238	8.3953	0.678
		12	-0.140	-0.133	9.4092	0.668

Source: Using (EViews 10) program

13.2.2. Histogram-Normality Test

It is clear from the data in Figure (2) and through the value of the Jarque-Bera scale that the residuals follow a normal distribution, as the level of significance is equal to 0.417, which is greater than the level of (0.05).

Figure-2. shows the results of the Histogram-Normality Test



Source: Using (EViews 10) program

Table-7. Results of model tests

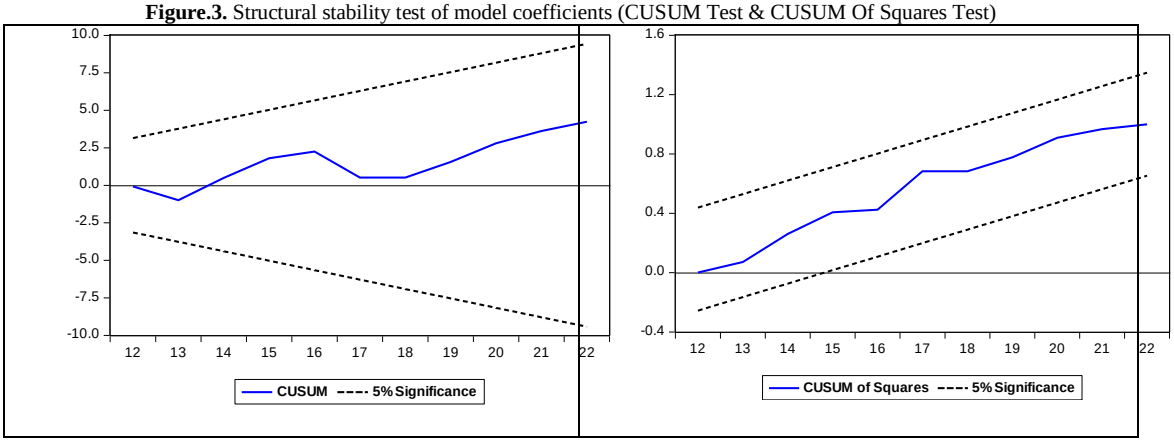
	Test name	**Prob. F-statistic**
1	Breusch-Godfrey Serial Correlation LM Test	0.369
2	Heteroskedasticity Test: ARCH	0.454
3	Jaque-bera (Histogram-Normality Test)	0.826
4	Ramsey RESET Test	0.828

Source: Using (EViews 10) program

Based on the results of Table (7), we note that the probability value for all tests is greater than 0.05%. This indicates that the model is free of the two standard problems: autocorrelation between errors, and variation in the variance of errors. We note that the errors follow a normal distribution.

The following is a test of the structural stability of the model parameters. To determine the extent of the stability of the estimated parameters in the long term, a test (CUSUM Test & CUSUM Of Squares Test) was conducted. It is clear from Chart (3) that the estimated parameters are stable at a 5% significance level for both tests. This indicates that there is agreement between the long-term model parameters and the short-term model parameters.

Figure.3. Structural stability test of model coefficients (CUSUM Test & CUSUM Of Squares Test)



Source: Using (EViews 10) program

14. Error Correction Model (ECM)

After ensuring that the variables in the model are integrated that the residuals are stationary and that the model is free from the two standard problems: autocorrelation between errors, and the difference in the variance of the errors as they follow a normal distribution, therefore comes the use of the error correction model to test the long-term equilibrium and report the short-term dynamics. Which allows for the representation of the short-term relationship and the long-term relationship. From the results of the model it was found that the error correction factor has a negative sign and is significant at (1%), as it shows the convergence of the equilibrium from the short run to the equilibrium in the long run, and the percentage of the correction factor expresses the speed of adjustment or correction of errors in In the short term, towards returning to equilibrium, in the long term, where it takes less than a year to correct errors and about 6 months towards their equilibrium value, meaning that the adjustment process takes place quickly, this shows that the model has the good predictive ability.

Table (8) shows the relationship between the independent variables and the dependent variable in the short term, where the following is noted:

- There is a positive relationship at the level between the ICT revenue variable and employment and the ICT GDP, while the relationship was negative between them at slow periods (1, 2, 3) with a significance of 1%.
- There is a negative relationship between the employment variable and the ICT GDP at slow periods (2, 3) with significance of 1%.
- There is a positive relationship at the level between the employment variable and the ICT GDP with a significance of 1%.

Table-8. Variables and parameters of the short-run model

ECM Regression				
Case 2: Restricted Constant and No Trend				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(DGDPICT(-1))	1.364757	0.319374	4.273232	0.0013
D(DGDPICT(-2))	1.349260	0.219132	6.157283	0.0001
D(DGDPICT(-3))	0.585891	0.151967	3.855393	0.0027
D(DREVENUES)	1.487331	0.164604	9.035810	0.0000
D(DREVENUES(-1))	-1.767323	0.630158	-2.804573	0.0171
D(DREVENUES(-2))	-2.728117	0.398187	-6.851351	0.0000
D(DREVENUES(-3))	-1.883090	0.297464	-6.330490	0.0001
D(DEMPLOYMENT)	0.036885	0.015398	2.395478	0.0355
D(DEMPLOYMENT(-1))	0.001056	0.012898	0.081852	0.9362
D(DEMPLOYMENT(-2))	-0.076057	0.010685	-7.118363	0.0000
D(DEMPLOYMENT(-3))	-0.020752	0.008041	-2.580861	0.0256
CointEq(-1)*	-2.502192	0.471016	-5.312323	0.0002

Source: Using (EViews 10) program

The long-run equation for the relationship between the independent variables and the dependent variable can be clarified as follows: -

EC = DGDPICT - (1.9186*DREVENUES + 0.0213*DEMPLOYMENT + 0.1466)

It is clear from the previous equation and Table (9) that there is a positive relationship in the long run between the independent variables, which are (ICT revenues, and employment) and the dependent variable, which is (ICT GDP), with a significance of 1%.

Table-9. Variables and parameters of the long-run model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DREVENUES	1.918622	0.201983	9.498940	0.0000
DEMPLOYMENT	0.021329	0.006793	3.140023	0.0094
C	0.146618	0.041771	3.510008	0.0049

Source: Using (EViews 10) program

Recommendations

- Attention to the rehabilitation and training of workers in information and communication technology.
- Encouraging more investments in information and communication technology.
- Work to find a kind of geographical balance in the distribution of projects based on information and communication technology.
- Facilitating licensing procedures for companies wishing to invest in the field of information and communications technology

References

[1] The website of the Saudi Ministry of Communications and Information Technology. Available: https://www.mcit.gov.sa/ar/documents

[2] Al-Shahri and Ajlan, b. M., 1999. *Modern office techniques and administrative assistant functions in government agencies*. Center for Administrative Research and Studies, Saudi Arabia.

[3] Belkidom, S., 2013. *The impact of modern information and communication technology (ntic) on the strategic management of economic institutions," a thesis submitted for obtaining a ph.D*. Management Sciences, Constantine University.

[4] Huang, S.-M., 2006. "An empirical study of relationship between it investment and firm performance: A resource-based perspective." *European Journal of Operational Research*, vol. 173, pp. 984-999.

[5] Shin, 2001. "The impact of information technology on financial performance: The Important of strategic choice." *European Journal of Information System*, vol. 10, pp. 227-236.

[6] Shadly, S., 2008. *The impact of the use of information and communication technology on the performance of small and medium enterprises - a case study of small and medium enterprises in the state of Algeria*. University of Ouargla: A Research Submitted to Obtain a Master's Degree, in Management Sciences.

[7] Harizi, F., 2011. *The role of modern communication technologies in achieving the objectives of the sustainable human development strategy in algeria, master's thesis*. Algeria: Specialization in Strategic Business Administration and Sustainable Development, Faculty of Economics, Business and Management Sciences.

[8] Al-Alami, H., 2013. *The role of investment in information and communication technology in achieving sustainable development, a comparative study between Malaysia, Tunisia and Algeria, Master's thesis*. Specializing in International Economics and Sustainable Development, Faculty of Economics, Commercial Sciences and Management Sciences.

[9] Al-Sabti and Khalid, b. A., 2003. "The future of the information technology industry in the gulf cooperation council countries." In *the Ninth Gulf Industrialists Conference, Muscat.*

[10] Al-Shalhoub and Salah, b. F., 2012. *Investment in information technology in the gulf countries*. Saudi Arabia: King Fahd University of Petroleum and Minerals.

العوائد الاقتصادية والتنموية لتكنولوجيا المعلومات والاتصالات في السعودية*

د. صلاح سعيد عبدالغني [1]، [2]

(1) أستاذ الاقتصاد المشارك– كلية الأعمال ، جامعة الإمام محمد بن سعود الإسلامية (IMSIU)
(2) أستاذ الاقتصاد الزراعي المساعد، معهد البحوث الزراعية والبيولوجية، المركز القومي للبحوث، الجيزة، مصر.

* البريد الإلكتروني للمؤلف: drsalahsaid@yahoo.com

*"يعرب المؤلف عن تقديره لوكالة البحث والابتكار بوزارة التعليم في المملكة العربية السعودية لتمويل هذا البحث من خلال رقم المشروع IFP-IMSIU-2023060. ويقدر المؤلفون أيضًا عمادة البحث العلمي في جامعة الإمام محمد بن سعود الإسلامية (IMSIU) لدعم هذا المشروع والإشراف عليه.

المستخلص: أصبحت تكنولوجيا المعلومات والاتصالات مرتبطة بتطور المجتمعات في عصرنا الحاضر. وتعتبر من أهم وسائل نقل المجتمعات النامية إلى مجتمعات أكثر تقدماً، وتتزايد الاستثمارات في مجال تكنولوجيا المعلومات والاتصالات في المملكة العربية السعودية، وهذا بدوره يؤدي إلى العديد من الآثار الاقتصادية والتنموية التي قد تكون غير محددة أو غير واضحة. ولذلك فإن هذه الدراسة تلقي الضوء على توضيح بعض هذه التأثيرات. حيث تم استخدام نموذج قياسي للعلاقة بين المتغير التابع وهو الناتج المحلي الإجمالي لتكنولوجيا المعلومات والاتصالات والمتغيرات المستقلة قيد الدراسة في المملكة العربية السعودية للفترة (1992:2022)، وتم تقدير معادلة النموذج القياسي باستخدام طريقة المربعات الصغرى ، ونموذج الانحدار الذاتي الموزع للمتباطئات (ARDL) للتحقق من وجود علاقة توازنيه طويلة المدى بين المتغيرات المستقلة والناتج المحلي الإجمالي لتكنولوجيا المعلومات والاتصالات والتحقق من هذه العلاقة من خلال نموذج تصحيح الخطأ (ECM) حيث وجد أن هناك علاقة طردية عند المستوى بين متغير إيرادات تكنولوجيا المعلومات والاتصالات العمالة والناتج المحلي الإجمالي لتكنولوجيا المعلومات والاتصالات، في حين كانت العلاقة عكسية بينهما في لفترات الإبطاء (1، 2، 3) وبدلالة معنوية عند 1%. كما توجد علاقة عكسية بين متغير العمالة والناتج المحلي الإجمالي لتكنولوجيا المعلومات والاتصالات لفترات الإبطاء (2، 3) وبدلالة معنوية عند 1%. توجد علاقة طردية عند المستوى بين متغير العمالة والناتج المحلي الإجمالي لتكنولوجيا المعلومات والاتصالات بدلالة معنوية عند 1%. لذا توصي الدراسة بما يلي: الاهتمام بتأهيل وتدريب العاملين في مجال تكنولوجيا المعلومات والاتصالات، وتشجيع المزيد من الاستثمارات في مجال تكنولوجيا المعلومات والاتصالات، والعمل على إيجاد نوع من التوازن الجغرافي في توزيع المشاريع على أساس تكنولوجيا المعلومات والاتصالات. تسهيل إجراءات التراخيص للشركات الراغبة في الاستثمار في مجال تكنولوجيا المعلومات والاتصالات.

الكلمات المفتاحية: (الاقتصاد الرقمي، تكنولوجيا المعلومات، الاتصالات، التنمية المستدامة)