Analyzing the Influence of Information and Communication Technologies (ICT) on the Per Capita GDP of Iraq from 2004 to 2021

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Abstract

The study aims to identify the theoretical literature for all the variables of the study (ICT, GDP) as well as to identify the practical side of the impact of ICT on the per capita GDP in Iraq for the period (2004-2021). The study was based on the hypothesis that ICT impacts per capita GDP in Iraq. The problem of the study was to answer the question: does ICT contribute to per capita GDP? The study concluded that an increase in the rate of internet users per 100 people by one unit would increase. Increasing the landline telephone rate per 100 people by one unit will increase GDP per capita. In addition, increasing the mobile phone rate per 100 people by one unit will increase GDP per capita. The study recommended adopting rational policies to ensure the application of the results of the development of information technology to the policies adopted by governments in the manner and quality of Use and put at the service of development.

Keywords: *ICT, GDP, Internet Users, Landline telephone, Mobile Phone*

1. Introduction

The world is undergoing a technological revolution in information and communication, leading to significant changes in human life's economic, social, and cultural aspects. Information and communication technology have become a crucial driver of economic growth in countries, including Iraq, which faces growth challenges. Information and communication technology advancements allow Iraq to improve its economic situation, increase growth rates, reduce disparity with developed countries, and open up its economy. This will reduce the economic turmoil caused by a lack of diversification and dependence on a rental economy. Iraq can integrate into global communication by adopting modern information technology and liberalising its economy. This study aims to determine the impact of ICT on per capita GDP in Iraq between 2004 and 2021.

- **Research Problem**

The problem of the study arises in the following question: does ICT contribute to per capita GDP

- **The Importance of Study**

The study is important because it focuses on the impact of ICT on per capita GDP. GDP is a crucial macroeconomic variable, and increasing the production of goods and services is a primary goal of economic policies. A rise in output means a balance between supply and demand, reducing high inflationary waves. Additionally, it enables the increase of exports, rebalancing the balance of payments and stopping the outflow of hard currency.

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- **Study objectives**

This study has two main objectives.

Firstly, to comprehensively understand the theoretical literature surrounding ICT and GDP study variables. Secondly, to investigate and analyse the practical impact of ICT on per capita GDP in Iraq.

- **Study Hypothesis**

This study operates under the assumption that the use of ICT affects the per capita GDP in Iraq.

- **The concept of information and Communication Technology**

In the 21st century, information and communication technologies have grown significantly. These technologies have been around for over 40 years and have expanded to help businesses rely on network work and the Internet. Information technology refers to obtaining and transmitting information, saving time, money, and effort in all fields. It can help with obtaining new information or storing and transferring it. (Abdawi, 2016: 16) Enterprises build their competitive advantage on the concept of information technology. Information technology refers to technical, scientific, and applied knowledge that enables the efficient provision of means and equipment. This efficiency improves performance and achieves an organization's quantitative and qualitative goals. (Shehadeh, 2012: 54). Information technology is often associated with management information systems as a modern approach to managing and processing data using accounting systems. This concept is closely tied to the devices and tools utilized to generate knowledge. (Kharboush and Hamouda, 2017: 34). As a researcher, it is evident that information technology is closely linked to the devices and tools utilized to create new knowledge and enhance existing knowledge. Therefore, users of this technology must handle it efficiently and with expertise. Information technology encompasses tools, processes, methodologies, and equipment to gather, process, and store information. It is also a tool that enables information to be stored and processed within a system, encompassing everything related to computers, networks, software, and databases.

- Elements of the Use of Information and Communication Technologies

The elements of using information technology are summarized as follows (Salam, 2021: 11-12):

1-The accuracy of the information used: it is that percentage that expresses the information that is produced over some time, as this information is a future predICTion, and it also gives an exact pICTure of reality, as this information is inaccurate and serves to mislead decision-making processes, and the degree of accuracy in this information varies depending on the time range that expresses this information. 2- The suitability of the programs used: here, computers represent the irreplaceable part, so enterprises rely on systems and programs to perform their work greatly, and these systems have effective indicators to achieve many of the benefits that enterprises want to achieve with accuracy, efficiency and high speed, and this makes it imperative for enterprises to choose programs that help them perform their work in the best way. 3- Users 'knowledge of computer systems and software: this is one of the requirements that is considered a prerequisite for its ability to face the obstacles that the facility may go through, so users must have full knowledge of modern technological methods and sufficient ability to use modern technological systems, in addition to users' self-development and informing them of technological developments (swalem, 2015: 67).

- The Concept of Gross Domestic Product

Gross Domestic Product (GDP) is a crucial metric and indicator in macroeconomics. Its definition states that it is the market value of the final goods and services produced within a country in one year (Samuelson and Nordhaus, 2006: 419). Another definition of GDP is the total value of goods and services produced and sold within a country's borders over a specific period of time, such as three months or a year. (Callen, 2020:46).

The GDP (Gross Domestic Product) is a way to measure a country's economic situation during a specific period of time. When the state's production capacity increases, it indicates an improvement in economic conditions. This improvement leads to an increase in job creation, higher incomes for individuals and businesses, and increased consumption among individuals, resulting in higher levels of well-being. As production increases, so does income, which leads to greater savings and investments, ultimately leading to even more production. This cycle of increasing production, income, welfare, and economic growth progresses continuously. (Magdy, 2021: 7-8). Based on this concept, GDP allows us to gauge the results of different economic endeavours that occur within a country in a year. These include agricultural, industrial, and service-related activities at various levels. By analyzing changes in GDP over time, we can monitor the economy's trends. Increases in the production of final goods and services are reflected in the form of ratios, while a shrinkage in GDP is indicated by a drop in employment rates, high unemployment, and reduced profits, which is referred to as a recession or depression. (guarantor, 2022: 112-113).

- The Importance of Gross Domestic Product
GDP is comparable to a satellite in space that can, scanning the weather throughout an entire continent, allows policymakers and central banks to determine whether the economy is shrinking or expanding, whether it requires a boost or not, and if there are concerns on the horizon, such as recession or high inflation (Crivelli, .et al,2016: 16). The calculation of GDP involves the computation of national income and products. Policymakers, economists, and businessmen analyze the effects of monetary and fiscal policy variables and economic shocks, such as increased taxes, spending plans, and rising oil prices on the economy (Islam & Nazara, 2016:57).

Per Capita Gross Domestic Product;
In economic theory, the average per capita real GDP is a fundamental indicator for measuring economic growth and progress. This indicator is calculated by dividing the GDP by the total population. The following equation, as stated by al-Issawi (2019: 30), illustrates this concept: Average.

GDP per capita = gross domestic product/population
To calculate the average real GDP per capita, we need to compare the per capita share of goods and services in one country with other countries. Even though the use of average per capita GDP as a basic indicator of economic growth has received criticism, we will use it in this study because no other reliable quantitative measures are available as model measurement measures. It remains the most widely accepted indicator for many countries, economic systems, and economists. (al-Mohammadi, 2016: 67).

Analysis of ICT Infrastructure Indicators in Iraq
The ICT infrastructure indicators can be analyzed in order to form a clear vision of the activity of the knowledge economy structure in Iraq. We will discuss the ICT infrastructure indicators in Iraq and investigate their reality and agencies:

Table (1) ICT infrastructure indicators in Iraq for the period (2004-2021)

Year	landline telephone per 100 people	Growth Rate	Mobile phone per 100 people	Growth Rate	Internet users per 100 people	Growth Rate
2004	4.6	-	2.2	-	0.6	-
2005	3.9	(-15.2)	5.7	161.0	0.9	50.0
2006	4.1	5.1	34.1	498.4	0.9	0.0

2007	4.4	7.3	50.2	47.5	1.0	11.1
2008	4.7	6.8	61.4	22.3	1.9	90.0
2009	3.6	(-23.4)	69.4	13.0	3.7	94.7
2010	3.6	0.0	78.2	12.7	4.5	21.6
2011	5.1	41.7	83.1	6.2	5.6	24.4
2012	5.5	7.8	87.0	4.7	5.0	(-10.7)
2013	5.6	1.8	97.6	12.2	7.1	42.0
2014	5.6	0.0	99.6	2.0	9.2	29.6
2015	5.6	0.0	90.6	(-9.0)	13.2	43.5
2016	5.5	(-1.8)	92.4	1.9	17.2	30.3
2017	5.5	0.0	101.4	9.8	21.2	23.3
2018	7.6	38.2	102.3	0.9	49.4	133.0
2019	7.6	0.0	102.8	0.4	56.2	13.8
2020	7.6	0.0	103.2	0.4	69.3	23.3
2021	7.6	0.0	104.1	1.34	74.8	7.94

Source: World Bank data, available on the website: http://www.albankaldawli.org

landline telephone index (per 100 people)
The data in Table 1 show that the landline telephone index's performance has remained the same from 2004 to 2020, despite the low Iraqi economy. Since 2004, the number of landline telephone users has been going down at a rate of 4.6% per 100 people. Since then, low growth rates have shown that this indicator has stayed the same or gone backwards due to bad infrastructure and the destruction of the telecom industry.
It is important to remember that the National Telecommunications and Postal Company (ITPC), a Ministry of Transport and Communications division, manages the **line-fixed** network. This may help explain why there has been less innovation and bureaucracy performance in this area than with the mobile phone.

The power of the mobile phone index (per 100 people)
The indicator for mobile phone subscriptions that allow access to the switched telephone network (PSTN) via cellular technology applies to all mobile subscriptions that offer voice communication. Looking at Table 1, we can see that mobile phone usage has made significant progress in the Iraqi economy. The mobile phone subscription index (per 100 people) has hit new heights, peaking in 2021 at 104.1 (per 100 people), with a growth rate of 1.3 compared to 2004 when the rate was 2.2 (per 100 people). Despite the unstable security events in Iraq during this period, the mobile phone usage index has continued to grow, exceeding 100% since 2017 at a rate of 101.4 (per 100 people). However, growth rates for this indicator have slowed down since 2021. This is due to the Iraqi market becoming saturated with the service, insufficient public services, and low individual pensions. These factors have led to lower annual growth rates for this indicator.

- **Number of internet subscribers (per 100 people)**
Table 1 indicates a significant increase in internet usage in the Iraqi economy over the past four years, with a current rate of 21.2% per 100 people and an annual growth rate of 23.2% in 2017. This growth suggests the potential for a shift towards the digital environment and a reduction in technological disparities through investment in the ICT sector, which is a key driver of economic growth. The data also reveals a gradual rise in internet service subscriptions, except for a slight decrease in 2012. However, subsequent years have seen positive growth, reaching 74.8 subscriptions per 100 people in 2021. It's important to note the significant role of the telecommunications sector in the Iraqi economy and its impact on information and communication technology. This sector has developed significantly since the ban was lifted in 2003, which

had previously caused long-standing challenges for individuals.

- **Analysis of the average GDP per capita in Iraq**

The per capita income index is a key human development indicator that reflects the well-being of individuals and society and the country's economic progress. It takes into account the population size and output, as presented in Table(2).

Table (2) GDP per capita at current prices in Iraq for the period (2004-2021) (million Iraqi dinars)

Year	Population (thousand people)	Gross domestic product	Average GDP per capita	Rate of change % ratio
2004	27139	53235358	1.9	-
2005	27963	73533599	2.6	36.84
2006	28810	95587955	3.3	26.92
2007	29682	111455813	3.7	12.12
2008	30895	157026026	5.1	37.84
2009	31664	130643200	4.1	(-19.61)
2010	32481	162064565	4.9	19.51
2011	33330	217327107	6.5	32.65
2012	34392	254225490	7.4	13.85
2013	35423	273587529	7.7	4.05
2014	36005	266420384	7.3	(-5.19)
2015	35213	194680972	5.6	(-23.29)
2016	36169	196924142	5.6	0.00
2017	37140	221665709	6.1	8.93
2018	38124	268918874	7.1	16.39
2019	39127	276157868	7.1	0.00
2020	40248	219768798	5.5	(-22.54)
2021	41190	301439534	7.3	32.73

Source: Ministry of Planning, Central Organization for Statistics and Information Technology, Statistical Collection for the Period (2004-2021).

When referring to Table (2), it is noted that there is a development in the average per capita output for the year 2005 compared to 2004, as the average per capita GDP at current prices reached (1.9) million Iraqi dinars in 2004, increased in 2005 to (2.6) million Iraqi dinars with an annual growth rate (36.84%), and this increase was coupled with the changes in oil prices during the period (2004-2007) along with the interest of countries in improving the pension level of citizens by increasing the salaries of employees in the state and expanding the social insurance system (prabhi, 2011: 29), and in 2009 oil revenues decreased due to the global financial crisis that occurred at the end of 2008, and this, in turn, was reflected in the low growth rate of GDP, which led to a decrease in its average per capita share (Arab League, 2011: 203), reaching (4.1) million Iraqi dinars in 2009 compared to 2008, reaching (5.1) million Iraqi dinars with a negative annual growth rate of (19.61%), then the gross domestic product increased along with the per capita GDP, as the gross domestic product reached (162064565) million Iraqi dinars as a result of the improvement in oil prices, which was accompanied by an increase in oil revenues in 2010, as well as the per capita it continued to rise until it reached (4.9) million Iraqi dinars in 2013 at an annual rate of (4.04%), after which the gross domestic product

as well as the per capita output decreased to reach in 2015 to (194680972) The reason is due to the decline in oil prices, which reflected on oil revenues, which negatively affected the value of gross domestic product and its average per capita, and then continued to rise until it reached 7.7 million Iraqi dinars in 2021 at an annual rate of 32.73%.

3- Measuring the impact of ICT on per capita GDP in Iraq
- Characterization of model variables

Within the framework of our description of the model, we find that the standard model refers to a set of relationships that are illustrated by mathematical formulas called equations, which explain the behavior of this relationship, and that the economic model is a simplified image that expresses the economic activity of a particular country or a particular sector during a certain period of time, so the standard model is the model that is used to estimate the coefficients of the economic model and test its hypotheses, and then use the estimated values of the model variables for the purpose of forecasting, and we have found that the linear function gives the best unbiased linear estimate that can express the studied relationships between the variables, and The Ordinary Least Squares method has been used Square through the use of the regression method It is a statistical tool that builds a statistical model to estimate the relationship between one quantitative variable, which is the dependent variable, and another quantitative variable or several variables, called independent variables, and this results in a statistical equation that shows the relationship between the variables, as well as using the interview programme to extract the results, and the results are accepted or rejected according to their agreement with economic theories and passing the first-class tests of (F,T) and standard tests (second-class tests), and it takes the following formula (Naama, 2015: 146):

Yi = B0 + B1 Xi + Ui
Since the:
Yi is the dependent variable.
Xi is an independent variable.
Ui = random error
B0 = parameters (a constant value that expresses the value of Y when the value of X is equal to 0)
B1 is the slope of the straight line illustrating the relationship.

The formulation of an economic model requires determining the following:
1.   Independent   variables   and   dependent   variables
2. The semantic formula used

With regard to the variables used here, the following variables have been adopted:
Independent variables are represented by ICT indicators (landline telephone rate per 100 people, mobile phone rate per 100 people, internet user rate per 100 people). The dependent variable is represented by a variable (GDP per capita), expressed in millions of dinars.View and analyse the results of the standard model. The standard of the models was made in linear form, as follows:
- The first model represents the result of the fixed-line telephone rate per 100 people in GDP per capita. The second model represents the impact of the mobile phone rate per 100 people on GDP per capita.
- The third model represents the rate of internet users per 100 people in GDP per capita. The first model: following the landline telephone rate per 100 people in GDP per capita The standard analysis of the impact of the landline telephone rate per 100 people (LL) on GDP per capita was carried out by the following equation:

GDP = f (LL)
GDP = c + ßll

Table (3) results of estimating the landline telephone rate per 100 people in GDP per capita for the period (2004-2021)

Dependent Variable: GDP Method: Least Squares OLS				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LL	0.857464	0.240458	3.565955	0.0026
C	0.834765	1.344120	0.621050	0.5433
R-squared	0.442820	Mean dependent var		5.488889
Adjusted R-squared	0.407996	S.D. dependent var		1.771636
S.E. of regression	1.363128	Akaike info criterion		3.561880
Sum squared resid	29.72988	Schwarz criterion		3.660810
likelihood-Log	-30.05692	Hannan-Quinn criteria.		3.575521
F-statistic	12.71604	Durbin-Watson stat		0.475699
Prob(F-statistic)	0.002578			

Source: Prepared by the researcher based on the outputs of the EViews7 program.

The estimated model passed the statistical tests, represented by the (t) test, if the estimated parameter passed this test, as the calculated value of (t) was (2.12), which is greater than the tabular value, which means rejecting the hypothesis of nothingness, that is, its value is not equal to zero but is equal to its estimated values, and that these estimated parameters are statistically significant at the (5%) level (4.49), which is also larger than its Tabular counterpart and at a significant level (5%), which means the statistical significance of the model as a whole. The determination coefficient gave a value of (0.21); that is, (21%) of the change in GDP per capita is attributed to the rate of internet users per 100 people and the changes occurring in it, and this is shown by the value of the positive parameter of the independent variable with the dependent variable, which is a direct relationship, as an increase in the rate of internet users per 100 people by one unit will lead to an increase in GDP per capita by (0.03). The final equation of the estimated relationship between the rate of internet users per 100 people and GDP per capita can be formulated as follows:

GDP = 4.859897 + 0.033134 * INT

2. Conclusions

- Information and communication technologies are new, highly efficient methods that lead to the interconnection of computers and communication networks (the Internet) to process and communicate information electronically.

- The standard analysis results indicate that an increase in the rate of internet users per 100 people by one unit will increase GDP per capita.

- From the results on the practical side, it turned out that increasing the landline telephone rate per 100 people by one unit will lead to an increase in per capita GDP.
  According to the results of the standard analysis, it turned out that increasing the mobile phone rate per 100 people by one unit would lead to an increase in per capita GDP.

Recommendations:

1) The research shows that the average per capita income from GDP has increased, which has helped to improve many people's living standards. However, this increase in average income has also led to higher levels of income inequality. To address this issue, a progressive taxation system that targets the wealthy can help reduce inequality and increase overall social welfare programs. Additionally, investing in initiatives that can help boost the average per capita income can contribute to human development goals.
2) Governments should adopt logical policies to ensure that the benefits of Information Technology development are effectively and responsibly integrated into their policies and utilized for progress.
3) Using the incredible advancements in techniques, supplies, and worker training in the West is important. Delaying progress can result in economic and social stagnation.
4) Increasing technological assimilation by integrating technological skills within the educational curricula and enhancing the students ' and workforce's ability to innovate.

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