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The impact of ICT capital growth on economic growth: the case of Egypt*

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Abstract

Capital investments in information and communication technology (ICT) have been a major contributor to the growth of several developed countries. In an attempt to boost their economies, some emerging and developing countries have been following a similar path, in which they heavily invest in the sector of ICT. However, due to other factors, ICT capital growth may not always produce the desired economic outcome. The purpose of this study is to estimate the impact of capital growth in ICT on economic growth in one developing country, Egypt, which has been heavily investing in the sector of ICT. The study analyses time series data covering the period from 1999 to 2019 using an error correction model. The findings demonstrate that there is no long-term positive association between ICT capital growth and economic growth in Egypt. While the development of ICT provides the potential for Egypt to achieve sustained economic growth, the significance and size of these impacts are currently negligible. The study concludes that in order to benefit from capital investments in ICT, policymakers should enact high-quality investment policies and improve the overall quality of the surrounding environment, such as the regulatory and institutional environments, in addition to controlling inflation and government consumption.

Key words: *economic growth, ICT, capital growth, digital economy*

JEL classification: *O47, O33, E22, O14*

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1. Introduction

ICT refers to the collection of tools required for the treatment of information, most notably computers and software, as well as other technical provisions necessary for the management and storage of information in technological formats that enable information to be distributed, exchanged, searched for, and retrieved (Antonelli, 2003; Gollac et al., 2000). According to the OECD, the ICT sector is divided into three sub-sectors: information technology, telecommunications, and electronics. Today, digital technology permeates all sectors of the global economy, playing a critical role in many countries economic growth. The digital economy and ICT contribute directly to GDP growth in developed economies and have made a direct and significant contribution to job creation and productivity over the last decades (Pilat, 2004; Spiezia, 2013; Sawng et al., 2021). However, the debate over which countries are more likely to benefit from ICT investments continues. Some studies stress the importance of infrastructure and expertise in transforming ICT investments into real economic growth, thus leading them to believe that developed nations are more likely to benefit from these investments, while other studies oppose this. According to the World Bank report on digitization in the MENA region (Cusolito et al., 2022), despite the low adoption of digital technologies in many countries across the region, digitalizing the economy has the potential to increase GDP per capita by about 46% over the next 30 years. This study focuses on the most populous country in the MENA region, Egypt, which came first in the MENA region in the number of deals in startups in the ICT sector and second in the volume of foreign investments in startups in the ICT sector in 2020. According to the Egyptian Ministry of Communications and Information Technology (MCIT), the ICT sector in Egypt grew by 16.1% in 2022 and around 15.2% in 2020, which is considered the country's fastest-growing sector in 2022. Egypt has been heavily investing in the ICT sector; total investments in this sector in 2021 have reached $3 billion. It is hoped that these high levels of investment are going to directly impact the country's level of economic growth. As part of its ICT 2030 strategy, the Egyptian government is carrying out many investments, infrastructure modernization training, and capacity-building initiatives, in addition to digital reforms in the sectors of health, education, and government services. According to the strategy, these efforts are made to increase the ICT sector's contribution to the growth of the Egyptian economy. This paper investigates whether or not there is a short-term or long-term impact on economic growth due to the growth of the ICT capital in Egypt. Finding a positive association between the growth in the ICT capital in Egypt and its growth in GDP would serve as supporting evidence that Egypt has been on the right track over the past 20 years and that the efforts, initiations, and strategies drafted in this regard are advantageous. Recently, research on investigating the link between ICT investment and economic growth has been growing, yet studies on cases from the MENA region are scarce. In addition, fewer studies have investigated the impact of capital accumulation in ICT on economic growth, and fewer have linked growth in ICT capital to GDP growth. This study investigates the impact of growth in the capital of ICT on economic growth in Egypt. Derived from the neoclassical model, the study utilizes a production function that takes the fundamental engines of growth in the economy into account and finds both the short-term and long-term impacts on economic growth. The study is sectioned into six sections. The following section is a literature review, followed by a section presenting the research methodology, an empirical data and analysis section, results and discussion section, and a final section for conclusions.

2. Literature review

Rapid global advancements in ICT over the last three decades have captivated the attention of several scholars from both developed and developing countries who study the dynamics and economic impacts of these advancements, particularly the effects on economic growth and development. While theoretical work has demonstrated a positive impact of technological development on economic growth, various empirical studies have generated mixed outcomes. Outstanding theories, such as Schumpeterian theories (Schumpeter, 1934) and neoclassical growth theory (Solow, 1956), are some basic theoretical foundations for supporting an argument that there should be a positive relationship between ICT and economic growth. The first stream of empirical research examined the effect of ICT diffusion on the economic growth both of developed and developing nations. The second stream examined ICT dissemination and its impact on economic growth using worldwide comparisons. The classification of research methods in this literature consists of four categories: regression analysis (REG), growth accounting analysis (GA), mixed (REG&GA), and other types of analysis (Vu et al., 2020).

Earlier scholars such as Qiang et al. (2004) identified three channels through which ICT can influence economic growth: mainly capital deepening and total factor productivity growth through reorganisation and ICT usage. Oliner and Sichel (2000) evaluated the impact of information technology on the economic recovery in U.S. labour productivity in the second half of the 1990s and found that two-thirds of the acceleration in productivity growth between the first and second halves of the 1990s is attributable to an increase in the utilisation of information technology capital and faster efficiency gains in the production of computers. Another earlier study done by Brynjolfsson and Hitt (2000) found evidence that over a longer time horizon (between 3 and 7 years), computerization (investments in ICT and organisational reforms) contributes more to productivity increases than its short-term impact. In their view, organisational reform takes time, hence computerization's full influence is long-term.

In recent studies, linkages between ICT investment and growth have been studied from different dimensions. Bahrini and Qafas (2019) assessed the impact of ICT on the economic growth of selected developing countries in the Middle East and North Africa (MENA) and Sub-Saharan Africa (SSA) regions over the period 2007–2016 using a panel generalised method of moments (GMM) growth model. The econometric model results revealed that, aside from fixed telephones, other information and communication technologies such as mobile phones, Internet usage, and broadband adoption have been the key drivers of economic growth in MENA and SSA emerging nations between 2007 and 2016. Aghaei and Rezagholizadeh (2020) used dynamic and static panel data approaches inside a growth model framework and applied them to the economies of Organization of Islamic Cooperation (OIC) countries from 1990 to 2014. The findings indicated that investments in ICT have a significant impact on economic growth in the countries studied. Hong (2017) bolsters the long-term effect of ICT investment by demonstrating the short- and long-term causal linkages between R&D investment and economic growth. The study proposes a virtuous cycle for public and private ICT R&D spending, implying a greater long-term impact. Another study on Sub-Saharan African countries done by Awad and Albaity (2022) using data from 2004 to 2020 found a causal mediation role of openness, education, and domestic investment, through which ICT indirectly increases per capita growth. Soomro et al. (2022) studied the BRICS countries from 2000 to 2018 to investigate the dynamic relationship between FDI, ICT, trade openness, and economic growth. The results show that ICT has a positive impact on the economic growth of a few countries. Similarly, Sinha and Sengupta (2022) studied Asia-Pacific developing countries over the period of 2001–2017 and found that ICT has a positive and significant impact on economic growth and that ICT expansion positively impacts FDI inflows. Belloumi and Touati (2022) studied a sample of 15 Arab countries over the period 1995–2019 and found that ICT and FDI have positive effects on economic growth in the long run and that ICT has a positive impact on FDI inflows. To explore the relationship between ICT diffusion and economic growth in Tunisia, Dahmani et al. (2022) studied data from 1997 to 2017. The study finds that the effect of ICT is heterogeneous depending on the sector of activity; sectors such as financial services and hotels have a positive and significant impact on the value added, while others such as trade and some manufacturing industries have a negative impact. Using a GMM estimator for 46 African countries between 2000 and 2019, Nchake and Shuaibu (2022) found that an increase in investment in ICT infrastructure increases inclusive growth by an average of 0.4% to 0.7%. Using a cointegration analysis, Sawng et al. (2021) used an error correction model and found a positive association between ICT investment and economic growth in South Korea. Similar findings were observed by Kim (2015) while studying data from the United States of America. Another study, Mim and Jeguirim (2021), looked at the impact of ICT on growth in 14 MENA countries and found that Internet use has a non-linear positive impact on economic growth; however, investment and human capital were found to be the primary transmission channels of this impact.

Due to the unavailability of data, several studies used different variables to represent ICT stock. For instance, Erdil et al. (2010) found a positive association between ICT (represented by mobile phone subscribers and internet users) and economic growth for underdeveloped and developing countries, analysing a dataset for the time period from 1995 to 2006. Another study by Sepehrdoust and Ghorbanseresht (2019) used an ICT index and linked it to economic growth in the petroleum exporting countries (OPEC) for the period from 2002 until 2015 using a panel GMM model. Aissaoui (2017) used ICT investment as a percentage of GDP and linked it to economic growth to explain the economic growth gap between the MENA region and the OECD. Similarly, Yousefi (2015) used ICT as a percentage of GDP for 70 developed and developing countries and found a positive association between it and growth in GDP per capita. Niebel (2014) used ICT capital services and found a positive association between them and economic growth. Findings revealed no statistical difference between this impact in developing, emerging, or developed countries. In contrast, Sedika and Emamb (2019) used ICT capital services and found that the impact was different depending on the region. Rahman et al. (2021) used exports and imports as proxies for investment to analyse data for Pakistan and found no association between ICT and economic growth. Using a similar methodology and variables to analyse data from Rwanda, Roger et al. (2021) found a similar finding.

The methodology used in this paper was similarly used by Kooshki and Ismail (2011), who studied data between 1990 and 2008 in newly industrialised countries and found a positive association between investing in ICT and economic growth; however, the author found that the impact occurs within considerable lags between the time of investment and the time when growth happens. Earlier, a similar methodology was used by Vu (2005), who found a positive impact of ICT on economic growth for 50 countries representing 90% of the international market in ICT. The study found that an economy can attain a greater growth rate for a given level of increase in labour and capital inputs by having a higher level of ICT capital stock per capita.

However, few studies have investigated the impact of growth in ICT capital and GDP growth. A positive association was found by Hanclova et al. (2014), who studied the EU-7 and EU-14 countries using data covering the time periods between 1994–2000 and 2001–2008. Earlier,

As seen from the literature, few studies have directly investigated the link between ICT capital growth and economic growth, and country-specific cases from the MENA region were found to be scarce. Therefore, this paper contributes to the literature by investigating this link in one of the most dynamic economies in the MENA region, the Egyptian economy.

3. Methodology

The goal of this study is to investigate the impact of growth in ICT capital on the GDP growth rate of Egypt. According to the neoclassical production function, labour and capital are the basic two determinants of national output, and a stable rate of economic growth is produced when the three economic forces of labour, capital, and technology are in balance. The Solow-Swan Growth Model is the simplest and most often used variation of the neoclassical growth model. The theory contends that different levels of labour and capital that are essential to the production process lead to short-term economic equilibrium. According to the theory, technological advancement has a significant impact on how the economy runs as a whole. The theory, however, emphasises its assertion that transitory, or short-term, equilibrium is distinct from long-term equilibrium and does not necessitate any of the three factors. Hence, variable levels of labour and capital result in a short-term economic equilibrium. Accordingly, an economy's capital accumulation and human capital utilization interaction is what determine economic growth. The theory contends that technology boosts labour productivity, raising overall output through improved labor productivity.

The neoclassical growth model's production function is used to measure an economy's equilibrium and rate of economic growth, and its general form has the following structure:

$$Y = AF(K, L) \tag{1}$$

where: Y is income or GDP, K is Capital, L is labor, and A is the level of technology.

Using time-series and an error correction model (ECM), the study uses two main control variables, growth in fixed capital formation and growth in the employment rate to estimate the following equation:

$$\begin{aligned}(GDP\ growth\ rate)_t &= n_0 + n_1(Employment\ growth\ rate)_t + \\ &+ n_2(Fixed\ capital\ formation\ growth\ rate)_t + \\ &+ n_3(ICT\ capital\ growth\ rate) + \varepsilon_t\end{aligned} \tag{2}$$

The normally distributed error term is represented by ε at time t. Growth in the employment rate is expected to have a positive effect on growth as well as growth in capital formation and growth in the share of ICT to total capital. The parameters n_i are the elasticities of production to factors of production. Several studies in the literature have used similar control variables to predict growth in GDP; see Youssef and M'henni (2004), El-Baz (2016), Colecchia and Schreyer (2002) and Bacchini et al. (2014).

There are three main limitations to this study. Firstly, data on ICT capital is not available, so it was estimated. Secondly, data on ICT investment in Egypt is only available for a period of 21 years. Thirdly, data on the ICT depreciation rate is not available for Egypt.

Growth rate in ICT capital was calculated using data on ICT investment collected from the International Telecommunications Union DataHub. In terms of depreciation rates, ICT capital stocks differ from non-ICT capital stocks (Jorgenson et al., 2000; Jorgenson, 2001). Many authors (Schreyer, 2000; Youssef and M'henni, 2004; Lee et al., 2005; Chabossou, 2018) proposed a depreciation rate of 12.5% for ICT capital. This study follows the same assumption. To calculate ICT capital stock, the study used the following formula:

$$K_{t+1} = (1 - \delta)K_t + I_{t+1} \quad (3)$$

where K_{t+1} is capital stock at time t+1, δ is the rate of depreciation, K_t is capital at time t and I_{t+1} is investment at time t+1.

To start with an initial value of ICT capital, the study uses the following equation:

$$K_t = K_t/(\delta + i) \quad (4)$$

where i is the average growth rate of investment over the sample period, see El-Baz (2016).

4. Empirical data and analysis

Egypt's information and communications technology (ICT) sector is thriving, with a growth rate exceeding Egypt's GDP overall growth rate of 15.2 percent in the fiscal year 2019/2020. Its GDP contribution increased from 3.5 percent in fiscal year 2018/2019 to 4.4 percent in the 2019/2020 fiscal year. Total sector investments increased by 35% in 2019/2020, reaching $3.5 billion. The Egyptian government is pursuing a series of investments, capacity building and training programs, digital government services reforms, and infrastructure enhancements as part of its ICT 2030 agenda. The strategy calls for the development of new projects to optimize the ICT sector's contribution to Egyptian economic growth, with an emphasis on capacity building, electronics design and manufacture, and technology parks. The strategy also includes a plan for digitalizing fundamental government functions in the areas of education, healthcare, and government services.

Egypt's Ministry of Communications and Information Technology (MCIT) has introduced a National Internet Plan with the goal of expanding high-speed broadband coverage throughout the country. MCIT is also developing Egypt's national strategy for e-commerce promotion. Between 2014 and 2017, mobile broadband customers increased from 38% to 62%, while Internet access increased from 29% to 41%. The government announced a plan in June 2020 to upgrade internet infrastructure by raising the average internet speed. In April 2021, internet speed has increased to 39.6 Mbps, up from 6.5 Mbps in January 2019.

The government is currently focused on transitioning to a digital economy and driving the country's digital transformation, both of which provide prospects for ICT firms. The government's continuing digital transformation provides a variety of opportunities for enterprises with proven technologies and competitive pricing.

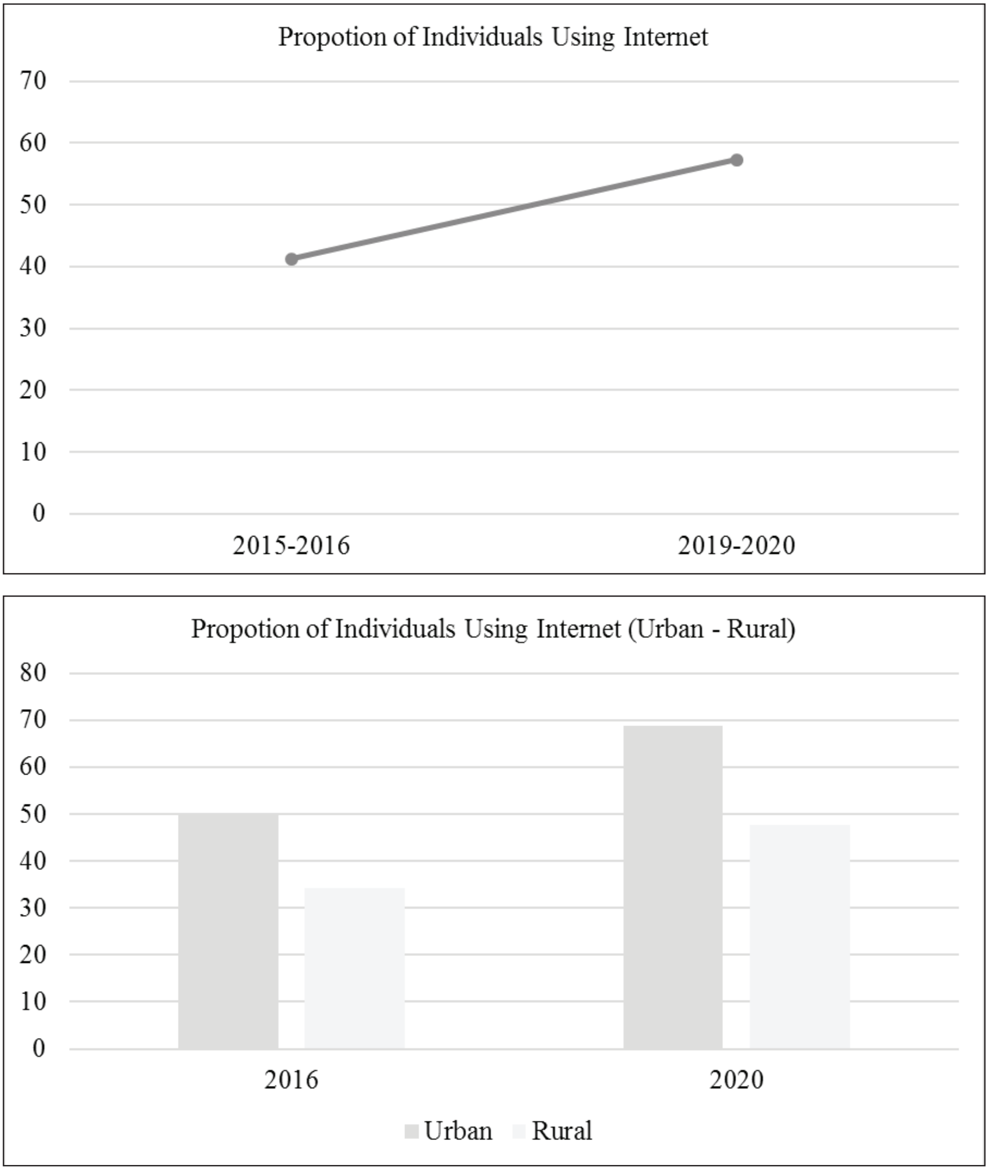
An expenditure of approximately 1 billion Egyptian pounds ($63 million) to modernize mobile networks on Egypt's important roadways and localities. In addition, $1.17 billion in new frequencies were awarded to mobile network carriers. To oversee cell phone services and protect users, the National Center for ICT Services Quality Control and Monitoring was established.

Decent Life (Haya Karima) is a presidential programme designed to improve the effectiveness of local communications infrastructure. This initiative is built on three main pillars: connecting villages with fiber optic cables for improved internet speed and stability, which will cover one million homes; developing 906 post offices with ATMs; and improving telecommunications services by establishing cell phone stations in those villages.

Egypt's digital transformation plan has been accelerated in part due to the Covid-19 epidemic. The number of peak hours for internet usage has increased from 7 to 15 per day, with a 99 percent increase in load. Cell phone internet usage has climbed by 35%, and international calls have increased by 19%. Zoom (3,465 percent), Telegram (1,100 percent), and YouTube have all seen significant increases in usage (115 percent). The National Telecommunications Regulatory Authority (NTRA) introduced its Mobile Number Portability (MNP) service in June 2020, allowing mobile phone subscribers to keep their phone numbers while transferring network service providers. This improves efficiencies and competitiveness.

Increased localization through increased local content is part of Vision 2030. As a result, various global corporations supply raw materials and collaborate with local organizations to establish an assembly line in Egypt. This increases the possibility of winning government tenders and adds value to the proposals through localization.

Figure 1: Key ICT Indictors in Egypt Between 2016 and 2020

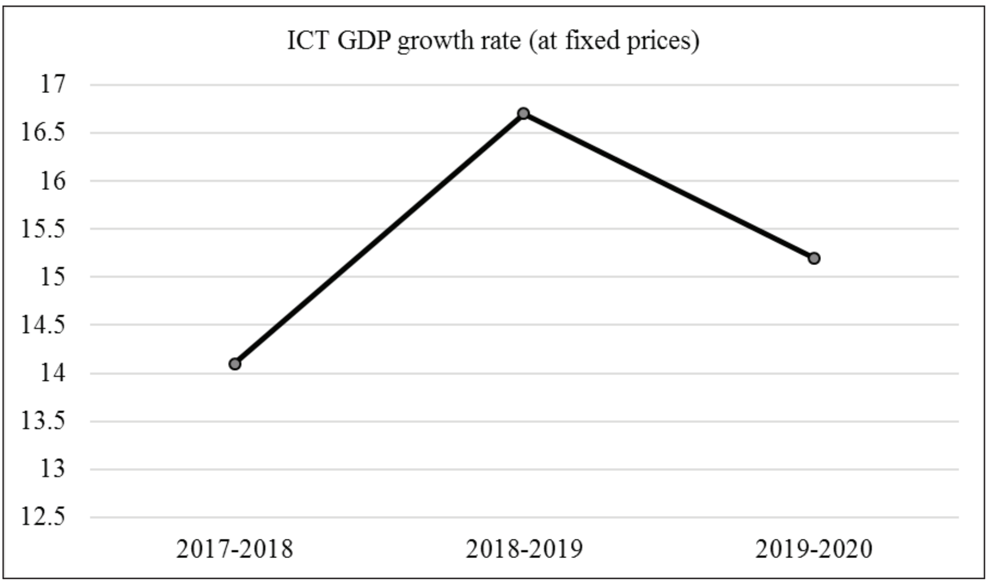


Source: MCIT, Annual Report 2020

Overall, the number of individuals using the internet in Egypt has been continuously rising. Within the 2015–2020 period, the country witnessed a 16% increase in the number of individuals using the internet. The rise is significant in both rural (13.6% increase) and urban areas (19% increase).

Numerous efforts have been made over the last few years to maintain a competitive environment for ICT companies and to bring an increasing amount of value to the economy. The Egyptian ICT sector generated 14% of GDP in 2017. In 2016, the outsourcing industry generated over $1.7 billion in exports and approximately $1.87 billion in 2017. The ICT sector had a considerable inflow of targeted investments, both domestic and foreign, resulting in a total growth of almost 16%. In 2016, the number of newly founded enterprises in the ICT sector surpassed 1,000. Additionally, investments began to flow into the electronic design sector to capitalize on the promise of the promising new sector. These flows are the result of policies and planning aimed at increasing the efficiency of the telecommunications infrastructure, strengthening the export sector's ability to export, and fostering a competitive environment that fosters work and innovation. This will ultimately increase sector productivity and benefit the local economy through added value, job generation, and cost savings.

Figure 2: ICT Economic Indicator Between 2016 and 2020 for Egypt



*The decrease in ICT GDP growth rate in 2019/2020 was led by COVID-19

Source: MCIT, Annual Report 2021

Economic growth continues to fluctuate today, even though it has improved in recent years. However, the digital economy has the potential to accelerate Egypt's economic growth and contribute to the country's ambitious sustainable development agenda by 2030.

The study covers annual data from 1999 to 2019 for Egypt. Table 1 summarizes definitions and data sources of all variables and Table 2 presents summary statistics.

Table 1: Variables Definitions and Data Sources

Variable	Definition	Source
GDP growth rate	Annual % change in Gross domestic product.	World Bank (2022a)
Employment growth rate	Annual % change in total employment to population ratio, 15 years and over.	World Bank (2022b)
Fixed capital formation growth rate	Annual % change in gross fixed capital formation.	World Bank (2022c)
ICT capital growth rate	Annual % change in ICT capital to total public/private/ public-private capital.	International Telecommunications Union ITU

Source: Author's elaboration

Table 2: Summary Statistics

Variable	Mean	Std. Dev.	Min	Max
GDP growth rate	4.470419	1.66261	1.764572	7.156283
Fixed capital formation growth rate	7.031688	9.356517	-10.2991	24.1446
Employment growth rate	-.5529982	2.58048	-.4665309	3.969745
ICT capital growth rate	2.10446	2.426425	-47.15337	51.91903

Source: Author's calculation

4.1. Unit Root Test

The study establishes the order of integration of the time series using the conventional augmented Dickey-Fuller (ADF) tests on the specified variables. The basic ADF tests for the null hypothesis of series non-stationarity, that is, the existence of a unit root in the series under consideration. The unit root test, which is derived from the standard Augmented Dickey-Fuller test, yielded the results shown in Table 3. At a 5% level of significance, the critical values of individual variables are less than the statistical ADF values. The null hypothesis that all series contain a unit root was accepted. This indicates that all variables were not stationary at the same level. Taking the first difference, all variables became stationary, I (1), as the critical values of all variables were higher than the ADF's statistical values at the 5% level. A co-integration test was performed to test the long-term economic relationship.

Table 3: Augmented Dickey – Fuller Unit Root Test Results with Trend and Intercept

Variable	Level Test statistic	First difference Test statistic
GDP growth rate	-1.891	-4.131***
Fixed capital formation growth rate	-3.030	-6.112***
Employment growth rate	-3.243	-6.205***
ICT capital growth rate	-3.176	-4.638***

***$p \leq .01$; **$p \leq .05$; *$p \leq .10$

Note: 5% critical value = - 3.600

Source: Author's calculation

4.2. Johansen Co-Integration and ECM

The study employs the Johansen co-integration test to examine the number of long-term cointegrating equations that exist between integrated variables. This test enables the identification of long-term relationships in integrated time series and the extraction of all cointegration vectors in a multivariate context. The results of the co-integration trace test are shown in Table 4.

Table 4: Johansen Co-integration Test Results

	Trace	
Hypothesis	Trace statistic	5% critical value
Null	55.9603	47.21
1	29.8651	29.68
2*	13.1028*	15.41*
3	5.1556	3.76

*The maximum number of co-integrating equations.

Source: Author's calculation

The trace test statistics indicated the existence of a maximum rank of two cointegrating equations between the variables. The statistics of the trace were lower than the critical value. As a result, the variables of this study were found cointegrated at the 5% level and an error correction model was applied. Table 5 shows the results of OLS estimation of the long-term relationship between GDP growth and the explanatory variables as well as the short-term results of the Error Correcting Model (ECM).

Table 5: Short and Long Terms Results

OLS Model Results (Long-term)			ECM Results (Short-Term)		
GDP growth rate	Coeff.	Prob.	GDPgrowth	Coeff.	Prob.
Fixed capital formation growth rate	.10057	0.005***	ΔL1 GDP growth rate	.06284	0.719
Employment growth rate	.16552	0.163	ΔL2 GDP growth rate	.22146	0.091*
ICT capital growth rate	.01022	0.451	ΔL3 GDP growth rate	.19559	0.255
CONSTANT	3.7849	0.000***	Δ Fixed capital formation growth rate	.06735	0.005***
			Δ Employment growth rate	.22462	0.004***
			Δ ICT capital growth rate	.000153	0.852
			ECM-1	-.80034	0.003***
			CONSTANT	.00579	0.973
R^2 = 0.5948 F-Statistic = 7.83			R^2 = 0.8635 F-Statistic = 8.13		

*** $p < .01$; ** $p < .05$; * $p < .1$

Source: Author's calculation

In the long term, the coefficient of determination for the OLS model (R^2 = 0.5948) and Fisher test p value (.0000) indicated that the exogenous variables in the model account for about 60% of the variability observed in GDP growth rate. Results show that only growth in fixed capital formation in Egypt had a significant impact on the level of GDP growth. For the short term, the lagged error correction term was included along with a number of lagged optimised variables. These results are derived by applying the ordinary least squares approach to an error correction model of the short-term dynamics represented by the variables in first difference. The coefficient of determination (R^2 = .8635) and Fisher test p value (.000) indicate that the model is statistically significant. Using residual robustness tests (Jarque-Bera test and White tests), the error term was found to be normally distributed and homoscedastic. The error correction term parameter is negative and significant at the 5% level, indicating the existence of an error correction mechanism over the long run. The coefficient of the error term is .8003465, which denotes the rate of absorption of an imbalance. Thus, 50% of a shock would be absorbed after about 6 months and entirely absorbed after about one year ($.2^n = .5$). As a result, the error correction model is sufficient. In both, the short and long runs, the model indicates that the coefficient of the ICT capital stock variable is positive and statistically insignificant. This finding is consistent with Morrison (1997) and Berndt and

Morrison (1995) who found that ICT capital has no impact on productivity compared to non-ICT capital, and consistent with O'Mahony and Vecchi (2003) who found no impact of ICT on growth. Similarly, Yousefi (2011) found that the effect of ICT differs across different income groups of countries. The impact was found to be significant in higher income groups and became insignificant in lower income groups. The impact of the growth in fixed capital growth on GDP growth was observed in both the short and long runs. However, the impact of the growth in the employment rate was only observed in the short run. A 10% increase in the growth of fixed capital and the growth of employment rates increases GDP growth by 6% and 22%, respectively.

5. Results and discussion

Several studies have shown that increased access to information and communication technologies results in increased employment opportunities, knowledge transfer, economic efficiency, and growth. The economic literature shows that the dispute over the relationship between ICT and growth is tilting in favour of a positive relationship; however, there is still a discussion about the magnitude of the effects and the conditions under which these effects can be observed. Efforts exerted in the field of ICT by the government of Egypt over the past 20 years have been in the hope that growth and development will cause economic growth. While many studies have found a positive association between ICT capital or ICT investment and economic growth, the results of this study found no association between growth in ICT capital and GDP growth in the short or long term in Egypt. However, both control variables were found significant, as expected. While a few studies have used a similar methodology, some were done on cross-sectional data from different countries or with different variables to represent ICT capital stock due to data scarcity, none were done on a specific MENA country. This is the first paper to address one specific country case from the MENA region using this methodology. While we did not find any supporting evidence that growth in ICT capital causes any change in the level of the GDP growth rate, several explanations can be derived. Firstly, the level of annual accumulation in the ICT capital over the past 20 years may have been inadequate to cause any immediate or late changes in the annual GDP growth rate. Secondly, a shift in thinking about the quality of these investments may be needed. Quality is critically important in many aspects: the quality of ICT investment policies, the quality of maintaining and handling the investment, the quality of workers in the field, and the overall quality of the country's environment, such as the quality of regulations and institutions, the level of inflation, the level of unemployment, market needs evaluations and government consumption. Thirdly, less focus on the channels through which investments in ICT flow back to the economy, such as the financial sector, may cancel out the impact of ICT capital growth on economic growth.

6. Conclusion

A growing body of literature is emerging to estimate the impact of ICT capital on economic growth. This study employs a production function and uses an error-correction model of time series data from Egypt between 1999 and 2019 and concludes that ICT capital growth is not impactful or sufficient to cause a resulting change in the GDP growth rate. Due to the absence of data, ICT capital was calculated using an assumed depreciation rate.

The Egyptian government is undergoing real changes and structural reforms in order to maximize the contribution of the ICT sector to economic growth. Based on findings of this study, the government is recommended to keep on the track of reforms, reconsidering both the volume and the quality of investments in ICT. Future research is needed to further investigate the influence of ICT capital accumulation on growth using longer time periods, better indicators of human capital, and adding total factor productivity to the model. In addition, more research is needed on the policy dimension. This includes applying the same methodology to investigate the impact of government interventions. Finally, databases for ICT capital and ICT depreciation rates for several MENA countries are missing; therefore, this study advises the Egyptian government and international organisations to help provide an updated and open source that comprehensively covers ICT capital data and its subcategories for this region.

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Utjecaj rasta ICT kapitala na gospodarski rast: slučaj Egipta

Hoda Mansour[1]

Sažetak

Kapitalna ulaganja u informacijsku i komunikacijsku tehnologiju (ICT) daju veliki doprinos rastu nekoliko razvijenih zemalja. U pokušaju da potaknu svoja gospodarstva, neke zemlje u nastajanju i razvoju slijede sličan put, u kojem ulažu velika sredstva u sektor IKT-a. Međutim, zbog drugih čimbenika, rast IKT kapitala možda neće uvijek proizvesti željeni ekonomski ishod. Svrha ove studije je procijeniti utjecaj rasta kapitala u ICT-u na gospodarski rast u jednoj zemlji u razvoju, Egiptu, koja značajno ulaže u sektor ICT-a. Studija analizira vremenske serije podataka koji pokrivaju razdoblje od 1999. do 2019. pomoću modela ispravljanja pogrešaka. Nalazi pokazuju da ne postoji dugoročna pozitivna povezanost između rasta ICT kapitala i gospodarskog rasta u Egiptu. Iako razvoj ICT-a Egiptu pruža potencijal za postizanje održivog gospodarskog rasta, značaj i veličina tih utjecaja trenutačno su zanemarivi. Studija zaključuje da bi, kako bi imali koristi od kapitalnih ulaganja u ICT, kreatori politika trebali donijeti visokokvalitetne investicijske politike i poboljšati ukupnu kvalitetu okolnog okruženja, kao što su regulatorna i institucionalna okruženja, uz kontrolu inflacije i državne potrošnje.

Ključne riječi: *gospodarski rast, ICT, rast kapitala, digitalna ekonomija*

JEL klasifikacija: *O47, O33, E22, O14*

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