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THE CAPABILITY OF INFORMATION COMMUNICATION TECHNOLOGY TO BOOST INDONESIA ECONOMIC GROWTH: STUDY FROM 34 PROVINCES

Muhammad Dzaky Roshif Prasetyo, Ariska Nurfajar Rini*
Faculty of Economics and Business, Diponegoro University, Indonesia

Abstract

The Information Communication Technology (ICT) development in Indonesia is in line with the development of ICT globally. The development of ICT has major challenges because there are still gaps, both in terms of users and signal. Technology and education are one of the determining factors that affect economic growth. However, inequality occurs not only in ICT but also in education. Based on the phenomena, this study aims to examine the impact of ICT users, ICT signal, and education on economic growth in 34 provinces in Indonesia for the 2015-2020 period. Data analysis uses the Fixed-Effect Model with secondary data in the form of panel data from 2015-2020. The results show that all ICT variables have a positive and significant effect on Indonesia's economic growth, except for the variable, fixed line telephone users and education have a negative effect on Indonesia's economic growth. This different findings may due to the heterogeneous characteristics of the provinces in our sample.

Keywords: *Economic Growth; ICT; Education; Inequality.*

JEL Classification: *A1, N3, N7.*

INTRODUCTION

The process of economic development is very oriented toward growth. Economic growth is an essential factor because it has a direct impact on the welfare of society. Each group of people has different levels and patterns of growth depending on the process of economic development that occurs. Economic growth is essential in the progress of a country, and this can benefit to all citizens. Economic growth can be known by calculating economic growth at the macro level, which is reflected in changes in Gross Domestic Product (GDP). The better condition of a region can be reflected in the high economic growth.

Various sectors contribute to economic growth, and one of them is technology. Technology is developing rapidly, accelerating the displacement of human life patterns from those who previously lived conventionally very quickly shifted to more modern life because of the existence of technology. The technology sectors that are interesting to discuss are the information and communication sector. Information and communication technology (ICT) is related to the retrieval, collection, processing, storage, dissemination, and presentation of information. The tools that use computers, the internet, and cell phones, make the flow of information smoother (Andriani, 2015). Information has significant economic value in the digital era because increased investment and economic growth are obtained from obtaining, utilizing, and processing information, in addition to advances in information and

*Corresponding Author: Ariska Nurfajar Rini, Faculty of Economics and Business, Diponegoro University Jl. Prof. Moeljono Trastotenojo, Tembalang Semarang, ariskanurfajarrini@lecturer.undip.ac.id

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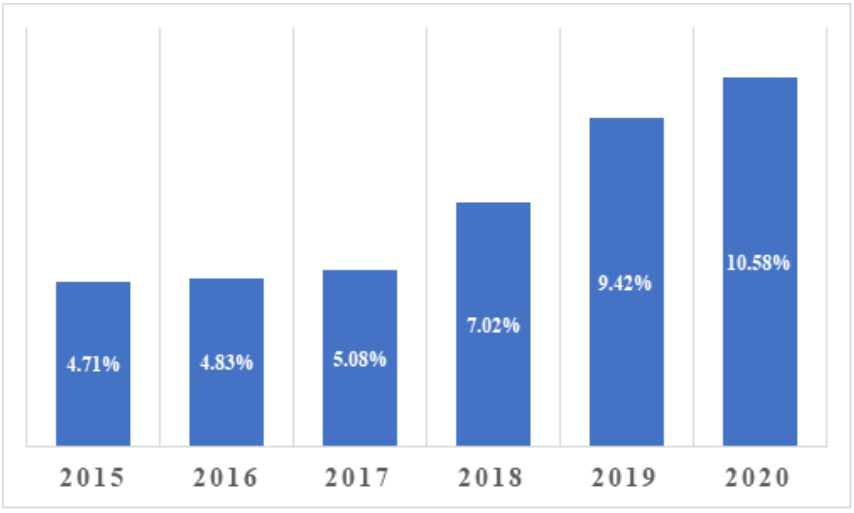
communication technology that encourage people's productivity and increase economic growth (Tamara, 2011). In addition to being used in daily activities, ICT can encourage a country as it replaces traditional methods of boosting productivity. The existence of ICT can trigger productivity gains because it can lower transaction costs and speed up the process of knowledge creation (Niebel, 2018).

Figure 1 Contribution of the ICT Sector to Indonesia's GDP (2015-2020)



Source: Publications of the Directorate General of Postal and Informatics Resources and Devices (2018 and 2020), Processed (2022)

Based on the figure number 1, the increase in the contribution of the information and communication sector to Indonesia's GDP when compared to 2015-2020 reached 124%. A significant increase occurred in 2017-2018, initially 5.08% and increased to 7.02%. Then in 2018-19, which was initially 7.02%, it grew to 9.42%. This increase is due in part to the tendency to increase the use of information and communication technology in people's lives in the modern era today. The information and communication technology in question are fixed-line telephone, mobile telephone, and the internet (Directorate General of Postal and Informatics Resources and Devices, 2020).

According to Prasetyo (2021), technological developments have helped economic activity become more efficient so that the production process can increase. This is due to technology that affects the increase in output with the same amount of input quantity, becoming savings in the overall production factors, so that an adequate telecommunications infrastructure is needed to distribute such information and has value in the economy because, in simple terms, this correlation can be described with the phenomenon when ICT changes conventional economic activities to digital, flexible, and effective, will ultimately boost productivity and economic growth. ICT has improved resource allocation efficiency, lowered production costs, and driven demand for large investments across all sectors of the economy.

During 2015-2020 period, Mobile Cellular Phone and Internet service users were the highest, while Fixed-Line Telephone users were shallow because they had been replaced with Mobile Cellular Phones. These ICT services in each province has a different number. There are several provinces whose ICT services percentage is

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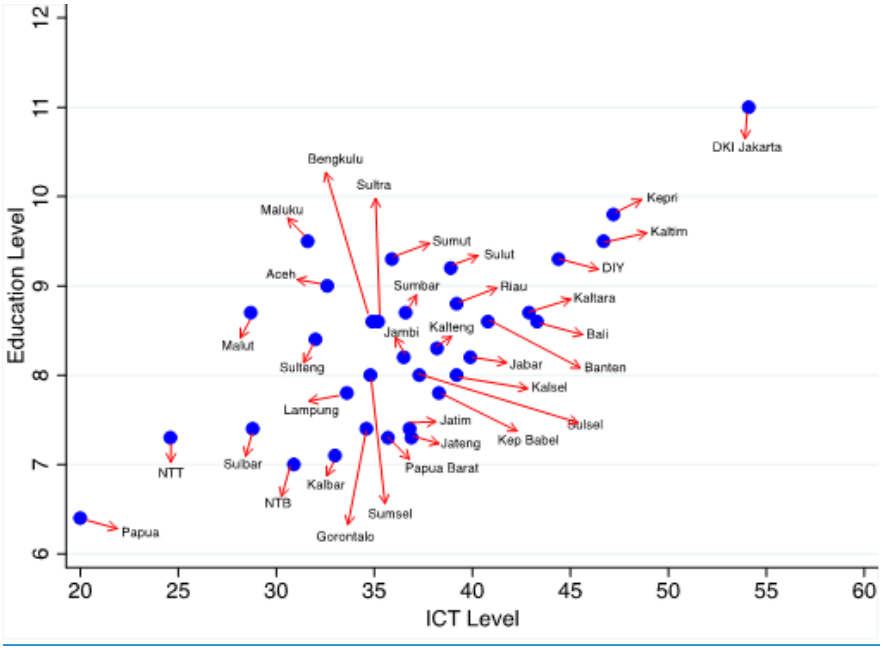
still below the national average, such as Papua, West Papua, Maluku, and North Maluku. Different access ranges between regions and differences in the demand for ICT services cause differences in ICT developments between provinces. Significant differences between provinces can be seen, where the distribution of networks is still uneven. There is signal inequality where there are provinces where the distribution of the network is evenly distributed at the village level, some have low network distribution rates, and some even do not get a signal. This inequality in ICT signal is undoubtedly a big challenge in the era of globalization, where all activities have been digitized.

Education and ICT are interrelated in the process of economic growth because one of the factors that can encourage it is to improve the quality of human resources and technology, increasing the level of use of technology can create effectiveness so that there is an acceleration of the output process that helps human resources as the driving capital of the economy in contributing, with an increase in the level of education, the acceleration of economic growth is also accelerated (Lucya et al., 2019). Human capital, as the root of education, is considered the primary determinant of economic growth and plays an essential role in technological progress. A high level of education is also closely related to the economy because it is considered the key to obtaining greater economic rewards and social mobility in most countries (Habibi et al., 2020).

Figure 2 Education Level and ICT Level in Indonesia 2015-2020 (by Province)



Source: Statistic Indonesia, Processed (2022)

Figure 2 shows the average number of ICT users and the mean years of schooling in 34 Provinces of Indonesia from 2015 to 2020. The figure shows the relationship between ICT and education levels in 34 Provinces of Indonesia. Most provinces with high levels of ICT tend to have higher levels of education. Although the conditions for each province are different, there are provinces with low levels of

ICT and education. The level of education is reflected in the mean years of schooling; the longer a person stays in school, the more all levels of education have been exceeded to the college level. Education can contribute to paving the way for technological progress. In other words, education plays an essential role in maintaining the knowledge necessary for creation and innovation. Therefore, a high level of education can affect the use of ICT and in turn, will affect economic growth.

Conditions in Indonesia in the 2015-2020 period, most provinces with high levels of ICT tend to have higher levels of education. Although the conditions for each province are different, there are provinces with low levels of ICT and education. Therefore, a high level of education can affect the use of ICT and in turn, will affect economic growth. Based on the phenomenon in 34 provinces in Indonesia during 2015-2020, technology and education level were initially considered as determining factors affecting economic growth. It turned out that it was still not optimal because there was still inequality in technology and education. Digital inequality can determine a person's ability to overcome poverty, unemployment, and a decreased quality of life, such as the risk of learning loss (Diningrat, 2021). Concerning education, digital inequality can also hinder the educational process of human development because it eliminates the opportunity to benefit from technology (Silaban, 2019).

In a broader context, the digital divide can weaken a country from competing globally because using information and communication technology is significant in winning the competition (Putra, 2009). Based on the previous explanation and supported by research gaps in previous research, the question arises, with inequality, how do technology and education contribute to the economic growth of 34 provinces in Indonesia. This study contributes to empirically testing the role of ICT, education, and ICT signal in economic growth in 34 provinces in Indonesia.

LITERATURE REVIEW

Economic growth is the process of using production factors to produce an output. This process will realize the flow of remuneration for the production factors owned by the population and increase the people's income in a certain period. (Mankiw, 2007). There are three main economic growth factors: (1) Capital accumulation in various types of investments planted on land, physical and human resources. (2) Population growth that a few later periods will create a growth in the labor force itself. (3) Technological advances to complete tasks (Todaro, 2011).

Neoclassical economics is a conventional economic growth theory that prioritizes the positive impact of technology and innovation on economic growth. Technology enters the production process as an input that will help reduce production costs or improve product quality. The technology is assumed to be used in conjunction with conventional technology, and the model allows for technological progress but is exogenous (Solow, 1956) in (Maneejuk and Yamaka, 2020).

$$Y^e = Y.$$

Aggregate expenditure (Y^e) is formed from the accumulation between the amount of consumption *(C)* and gross investment *(I)*. The gross investment in question means any additional capital goods during a certain period consisting of

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new additions or additions that are in lieu of existing goods, so that the following equation can be written:

$$Y^e = C+I \quad (1),$$

Equation 1 means that national income is the result of the sum of consumption and investment. Consumption is part of the disposable income (Y_d) minus the national savings (S). Disposable income means an income that is willing to be used to buy goods and services for consumption. The correlation can be written as follows:

$$C = Y_d - S \quad (2),$$

Equation 2 can be written as:

$$Y - Y_d = I - S \quad (3),$$

on established conditions requires that the level of investment amount equal to the amount of savings, or the amount of national income is equivalent to the disposable income. This will happen when the right field or the left segment in Equation 3 is valued at 0. This means $Y = Y_d$ or

$$I = S.$$

In the end, gross investment is equivalent to national savings. National savings are part of the national income stored, so it is written as follows:

$$S = sY$$

with s as a proportion of savings. Then you can see the rate of capital accumulation against time which is the result of reducing gross investment with depreciation, namely $K = I - \delta K$

$$K = sY - \delta K,$$

with I as gross investment, δ as the depreciation rate, and $K = \frac{dK}{dt}$. The change in capital inventory per number of effective labors is obtained, namely:

$$\frac{K}{AL} = s\frac{Y}{AL} - \delta\frac{K}{AL}$$

Because $y = \frac{Y}{AL}$, $k = \frac{K}{AL}$ then

$$\frac{K}{AL} = sy - \delta k$$

On the other hand, it is assumed that the number of workers (L) will grow constantly at level n and technological advances (A) at level g, it means that the number of effective labors will grow at the level of

$$\frac{A}{A} = g \text{ and } \frac{L}{L} = n$$

Because $k = \frac{K}{AL}$ so that $k = \frac{d(\frac{K}{AL})}{dt}$ by using partial derivative properties is obtained

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$$k = \frac{K}{AL} - \frac{K}{AL}\left(\frac{A}{A} - \frac{L}{L}\right)$$

Obtained the Solow Swan equation, namely

$$k = sy - \delta k - (g + n)k$$

$$\Leftrightarrow k = sf(k) - \delta k - gk - nk$$

$$\Leftrightarrow k = sf(k) - (n + g + \delta)k$$

So that the Solow-Swan growth model with technological advances is

$$k = sf(k) - (n + g + \delta)k \quad (4)$$

with k as the change in capital supply between a given year and the following year, $sf(k)$ as a break even investment, s as the level of investment per number of labor, δ as the depreciation rate per number of labor, n as the growth rate of the number of labor per number of labor, k as the rate of accumulation of capital per number of labor, g as a level of technological development that optimizes the number of workers (Amalia, Kiftiah, and Sulistianingsih, 2016).

METHODOLOGY

The data in this research were collected by documentation method by recording data from various relevant literature sources. The data used is panel data, a combination of cross-section and time series data, with I in the form of cross-section, a research object consisting of 34 provinces in Indonesia. While t is in the form of a time series, which is an annual period starting from 2015 to 2020. The data source was obtained from the Statistic Indonesia (BPS). The economic growth variable in this study uses indicators of Gross Regional Domestic Product (GRDP) at Constant Prices, which aims to measure economic progress because of national development. The ICT User variable in this study uses fixed-line telephone, mobile cellular phone, and internet. The education variable in this study used the average length of schooling. The ICT Signal variable in this study uses the Number of Districts that Receive Signals in dummy.

This study uses panel data analysis as a data processing tool using Stata 14 software. The analysis technique used in this research is multiple linear regression analysis with fixed effect model panel data. Based on the hypothesis proposed, the regression equation used in this research is:

$$\mathbf{GROWTH_{it} = \alpha_{it} + \beta_1 TELEPHONE_{it} + \beta_2 MOBILE_{it} + \beta_3 INTERNET_{it} + \beta_4 EDUCATION_{it} + \beta_5 SIGNAL_{it} + e_{it}}$$

Information:
GROWTH = GRDP Growth
α = Constant
TELEPHONE = Percentage of Fixed Line Telephone Users
MOBILE = Percentage of Mobile Cellular Users
INTERNET = Percentage of Internet Users
EDUCATION = Mean Years of Schooling

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SIGNAL = Dummy, a Sub-Districts That Receive or does not receive the Signal

RESULT AND DISCUSSION

Table 1 Main Regression Results

GROWTH	Coefficient	Robust Std. Error	t-statistics	Prob.
TELEPHONE	-0.0839651	0.2586982	-0.32	0.748
MOBILE	0.6150743**	0.2774103	2.22	0.034
INTERNET	0.0088316	0.0246807	0.36	0.723
EDUCATION	-15.57844***	2.402085	-6.49	0.000
SIGNAL	0.1859044	0.8427034	0.22	0.827
constant	96.76142***	16.9426	5.71	0.000

Note: * significant at 1%, ** significant at 5%, and *** significant at 10%.

Table 1 main regression results can be explained that the variables that affect economic growth are mobile cellular users and education. While the fixed-line telephone users, internet users, and signal variables are not significant in influencing economic growth.

Based on the fixed-effect test, fixed-line telephone users variable is not significantly affect economic growth. In Indonesia, fixed-line telephone users continue to decrease every year. Based on the data in 2015, the percentage of households that own/control fixed telephones were 4.01%, while in 2020, it decreased by 1.65%. Although economic growth since 2015 has decreased, until 2020, it decreased significantly due to the COVID-19 Pandemic. This is in line with Maneejuk and Yamaka (2020) that fixed-line telephone users negatively and insignificantly affect economic growth. The presence of insignificant influence of telecommunications technologies on economic growth is due to the heterogeneous characteristics of the countries in the group. The inequality of fixed-line telephone users is due to the shift between fixed-line phone users toward another kind of communication.

Mobile phone users significantly positively affect economic growth. Mobile cellular phone users in Indonesia always increase every year, as evidenced by the data from the Statistic Indonesia (BPS), which shows data on cell phone users during the 2015-2020 period. In 2015 it was 56.92%, then increased to 62.84% in 2020. Although economic growth since 2015 has decreased, until 2020, it decreased significantly due to the COVID-19 Pandemic. This is in line with the research of Hussain et al. (2021) that mobile phone users positively affect economic growth, which means that an increase in mobile phone subscriptions can increase economic growth. The use of mobile phones is considered to encourage economic growth because with the various conveniences obtained when using mobile phones can facilitate business routines so that the economy includes the utilization of convenient and efficient economic resources in less affordable times and accelerates the process of economic development so that it can encourage economic growth.

The different behavior is coming from internet users variable, which is not significantly affect economic growth. This is evidenced by BPS data that there was a

very significant increase in internet users, where in 2015 it was only 21.98%, then a significant increase to 78.18% in 2020. Although economic growth since 2015 has decreased, until 2020, it decreased significantly due to the COVID-19 Pandemic. This is in line with Albiman and Sulong (2017) research that internet users have a negative and significant relationship with economic growth. The significant relationship is due to the growing number of services on the internet that help daily activities, including business and educational matters. So that internet users can be productive and produce economic output.

Final noteworthy, ICT Signal does not significantly affect economic growth. Thi study, we use sub-districts that receive or unreceived the signal. The number of sub-district receiving signal is not affected to province's economic growth. This variable bridges user communication devices with networks to other networks, thereby contributing to ICT users in Indonesia and influencing economic growth. However, this finding is in line with the research of Tamara (2011), which shows that telecommunication signal in the form of a variable number of BTS has a positive effect on teledensity but not directly affect the economic growth. The addition of the number of telecommunications signals will increase the capacity of telecommunications services.

On the other variable, education level significantly negatively affects economic growth. Indonesia's education level is diverse, there are provinces with a high level of education, and there are also provinces with a low level of education. A negative relationship is possible because provinces with high education levels do not guarantee high economic growth directly. Someone who takes higher education does not necessarily get a return quickly. This is in line with research from Birgitta (2017) that in Indonesia, highly educated workers are still working in the informal sector. The informal sector, by definition, is an employment status that includes self-employed, trying to be assisted by temporary workers, trying to be administered by permanent workers, labourers or employees, casual workers in agriculture or non-agriculture, and family workers or unpaid (BPS, 2022). Higher education has not been able to determine whether someone can work in the formal sector and will not work in the informal sector. So, education is only limited to reducing opportunities to enter the informal sector but does not guarantee to provide jobs in the formal sector.

CONCLUSION

Based on the results and discussions from this study, Information and Communication Technology (ICT) users have contributed positively to the economic growth of 34 provinces in Indonesia for the 2015-2020 period. If divided into several variables, these telephone subscriptions still contribute negatively and insignificantly to economic growth. Mobile phone subscription users contribute positively and significantly to economic growth, while internet users contribute positively and insignificantly to economic growth. Information and Communication Technology Signal positive but insignificant affect economic growth. This study uses the number of sub- district indicators that receive the signal. This is because there are still sub-districts that have not received the signal, or there is still a gap in ICT Signal.

The limitations of this study are that the data used in this study is panel data, which is a combination of time series and cross-section, where the time series data in this study is annual, and the period in this study is from 2015-2020. It will be more specific and up-to-date if using monthly data by looking at the post-COVID-19 Pandemic conditions. The ICT variables used are only the main indicators, namely fixed telephone subscription users, telephone mobile subscription users, and internet users. There are a variety of other ICT indicators that can be explored in future studies. As a suggestion for further research, it is hoped that they can continue to research this topic by exploring new independent variables that are still relevant and can consider this research as one of the reference materials.

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