Determinants of Information and Communication Technology Sector Development in Pulau Jawa, 2016-2020

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ABSTRACT

The Information and Communication Technology (ICT) sector is one of the main drivers of economic growth, so the condition of the ICT sector becomes an essential factor in development. The ICT sector consists of the manufacturing and service sectors whose main activities are related to the development, production, commercial and intensive use of ICT. In 2016-2020, six provinces on Pulau Jawa became the provinces with the highest IP-ICT scores. Pulau Jawa had a GDP share of 59 percent of Indonesia's GDP in 2020. Meanwhile, the ICT sector's GDP share of Indonesia's total GDP was 4.25 percent in 2020. This study aims to analyze factors that affect the development of the ICT sector in Pulau Jawa, 2016-2020. The data used is secondary data from Statistics Indonesia. Using the panel data regression, the results show that the number of workers in the ICT sector, the average length of schooling, and internet users had a significant and positive effect on the development of the ICT sector in Pulau Jawa in 2016-2020. The level of household consumption for telecommunications has no significant impact on ICT sector development in Pulau Jawa in 2016-2020. The results of this study can be used as an example for other provinces to increase the role of ICT in regional economic growth

Keywords: ICT Sector, Pulau Jawa, Panel Data Regression

ABSTRAK

Sektor Teknologi Informasi dan Komunikasi (TIK) menjadi salah satu pendorong utama pertumbuhan ekonomi sehingga kondisi sektor TIK menjadi faktor penting dalam pembangunan. Sektor TIK terdiri dari sektor manufaktur dan jasa yang kegiatan utamanya terkait dengan pengembangan, produksi, komersial dan penggunaan TIK yang intensif. Pada tahun 2016-2020, enam provinsi di Pulau Jawa menjadi provinsi dengan nilai IP-TIK tertinggi. Pulau Jawa menjadi wilayah yang memiliki share PDB sebesar 59 persen dari PDB Indonesia di tahun 2020. Sementara share PDB sektor TIK terhadap total PDB Indonesia adalah sebesar 4,25 persen pada tahun 2020. Penelitian ini bertujuan untuk mengetahui gambaran umum perkembangan sektor TIK dan menganalisis faktor yang memengaruhi perkembangan sektor TIK di Pulau Jawa tahun 2016-2020. Data yang digunakan adalah data sekunder yang bersumber dari publikasi BPS. Dengan menggunakan metode analisis regresi data panel, diperoleh hasil bahwa jumlah tenaga kerja di sektor TIK, rata-rata lama sekolah, dan pengguna internet berpengaruh signifikan dan positif terhadap perkembangan sektor TIK di Pulau Jawa tahun 2016-2020. Tingkat konsumsi rumah tangga untuk telekomunikasi tidak berpengaruh signifikan terhadap perkembangan sektor TIK di Pulau Jawa tahun 2016-2020. Hasil penelitian ini dapat dijadikan contoh bagi provinsi lainnya dalam meningkatkan peran TIK pada pertumbuhan ekonomi.

Kata Kunci: *Sektor TIK, Pulau Jawa, Regresi Data Panel .*

INTRODUCTION

One of the goals of the Sustainable Development Goals (SDGs), which is a development agreement for all countries worldwide, is to encourage economic growth. In digital era, the economy is strongly supported by advances in Information and Communication Technology (ICT). ICT is an important part of people's lives. ICT can be interpreted as all the tools needed to carry out and facilitate the management of information and the implementation of communication. ICT is growing rapidly to meet people's needs for information and communication. ICT is used in various fields and can encourage progress, especially in the economy. A study by Bank Dunia (2013) shows that increasing ICT utilization significantly increases productivity and economic growth. ICT can drive productivity and overall economic growth because the use of ICT can reduce communication and interaction costs.

The ICT sector is the most important part of a country's economy. It is one of the main drivers of economic growth, so the condition of the ICT sector becomes an important factor in development. The ICT sector consists of the manufacturing and service sectors whose main activities are related to the development, production, commercial and intensive use of ICT. The total added value of the ICT sector reflects the utilization of output (goods and services) produced by the ICT sector. The higher the total added value generated by the ICT sector in a region, it indicates the utilization of the output (goods and services) of the ICT sector in the area is also getting higher (EUSTAT, 2020). The community's economy will not run without the support of ICT development and infrastructure. It can be seen in the contribution of ICT to GDP, international trade, and labor (Anandhita, 2015). Although the growth of Gross Domestic Product (GDP) in 2020 still experienced a contraction of 2.07 percent, the ICT sector grew by 10.58 percent. Hence, the ICT sector became a booster of Indonesia's economic performance.

Five sectors occupy the position with the highest average growth rate from 2016 to 2020. The ICT sector has the highest average growth rate compared to other sectors. From 2016-2020, the total value added of the ICT sector on average reached 9.14 percent per year. The ICT sector continues to increase by 1.71 percent per year (BPS, 2020). Technology that develops from time to time affects human life in various aspects, including employment and working methods. According to Jung & Lim (2020), The relationship between technology and labor is an issue that is constantly debated. The technology currently developing and acts as a driver of other technological innovations is ICT in the form of the emergence of the internet (Curran et al., 2012). The increase in population in Indonesia is followed by an increase in internet users (BPS, 2020). Until 2020, internet users in Indonesia are 53.73 percent of the total population. The number of internet users that year increased by 6.04 percent from 2019. The high and increasing percentage of internet users shows that Indonesia has the potential to support the development of internet technology.

The proper use of ICT can trigger the growth of new businesses and increase the effectiveness and efficiency of public services so that, indirectly, the quality of life will also increase (Widiyastuti, 2015). ICT is a stimulus in spurring economic growth (Agustina & Pramana, 2019). Through ICT, people can easily access information, communicate, and get social and economic services quickly. Advances in technology and the distribution of information and communication in the economic field will create opportunities for new business fields and better incomes. Although ICT is considered effective in reducing income inequality, the government has not maximized its use. It can be seen from the development of ICT in Indonesia as measured by the Information and Communication Technology Development Index (IP-TIK) by BPS. The higher the index value, the better the potential and progress of ICT development in an area. Conversely, the lower the index value indicates that ICT development in an area is still lacking. In addition, IP-TIK can also measure the growth of ICT development, measure the digital gap or digital divide between regions, and measure the potential for ICT development (BPS, 2020).

The development of ICT at the provincial level in Indonesia has not been evenly distributed. Inequality occurs because not all regions have available ICT infrastructure. However, Pulau Jawa is an area that has rapid availability of ICT infrastructure and easy access to technology, and Pulau Jawa is an area that has a GDP share of 59 percent of Indonesia's GDP. Meanwhile, other regions outside Pulau

Jawa adopting ICT developments are still limited (Kementerian Komunikasi dan Informasi, 2020). Khuong (2014) concluded that the number of workers and the intensity of use of ICT have a significant and positive impact on the total value added growth of the ICT sector in Singapore. Smith & Graham (2012) concluded that the education variable affects household consumption expenditures for Information and Communication Technology (ICT). Arif (2017) shows that the household expenditure variable for ICT is influenced by the education level of the head of the household, the number of children attending school, the use of ICT in the household such as landline ownership, the number of household members who use the internet, and the number of active cellphone numbers in the household also affect household consumption expenditure on ICT.

Previous studies related to the development of the ICT sector have not focused on six provinces in Pulau Jawa. So there are no previous findings that examine the contribution of the ICT sector to the total value of GDP. This study aims to analyze: (1) an overview of the ICT sector development in Pulau Jawa in 2016-2020; (2) the variables that affect the development of the ICT sector in Pulau Jawa in 2016-2020.

METHODS

The unit analysis of in six provinces on Pulau Jawa, namely the Province of Banten, DKI Jakarta, Jawa Barat, Jawa Tengah, Jawa Timur, and the Province of the Special Region of Yogyakarta with annual data. There are 30 observations. The dependent variable used is the GDP in the ICT sector. The independent variables used are the number of workers in the ICT sector, the average length of schooling, household consumption for telecommunications, and internet users.

The operational definitions of the variables in this study are (1) Gross Regional Domestic Product at Constant Prices (GRDP ADHK). The ICT sector is GRDP according to category J business field; The number of workers in the ICT sector is the number of workers working in the ICT sector, symbolized by TNG, which has units of thousands of people; The average length of schooling is the average number of years used by residents aged 15 years and over in undergoing formal education, symbolized by the RLS which has units of years; Household consumption for telecommunications is the average level of household consumption in using ICT denoted by KNSM which has units of thousand rupiah; Internet users are the percentage of the population who use/access the internet, denoted by INT, which has units of percent.

The data used in this study is secondary data from the publication of Information and Communication Business Fields by Province, Reports on the Situation of Workers in Indonesia, and Indonesian Telecommunications Statistics by Statistics Indonesia (BPS). The method used is panel data regression. The specifications of the general model formed in this study are $Y_{it} = \alpha + \beta_1 TNG_{it} + \beta_2 RLS_{it} + \beta_3 KNSM_{it} + \beta_4 INT_{it} + u_{it}$. The stages of panel data regression analysis used in this study are choosing the best model from three possible panel data regression models, testing the classical assumptions and testing the significance of the model using simultaneous and partial tests as well as assessing the accuracy of the model by looking at the value of the model Adjusted R^2.

RESULTS AND DISCUSSIONS

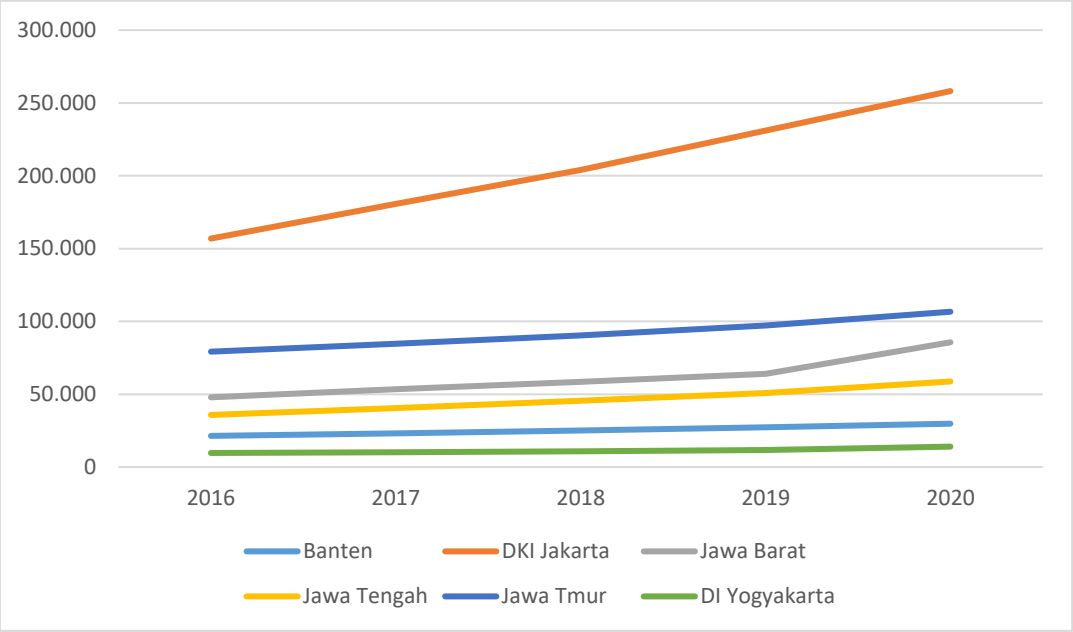
Overview of the Development of the ICT Sector in Pulau Jawa in 2016-2020

The ICT sector is one of the economic sectors with great potential in Indonesia. Based on BPS in 2020, the total value added and share of the ICT sector is relatively small compared to other sectors, only 4.25 percent in 2020. The growth rate from 2016 to 2020, the ICT sector is the sector with the highest average growth rate compared to other sectors in Indonesia. From 2016 to 2020, the average share of the ICT sector continues to increase by 1.71 percent per year. So, from year to year, the ICT sector's role in the economy is getting stronger.

GRDP ADHK ICT sector in six provinces on the island of Pulau Jawa every year always experiences a positive growth trend. DKI Jakarta Province has always been the province with the largest GRDP ADHK value in the ICT sector, among other provinces on the Pulau Jawa. GRDP ADHK ICT

sector in DKI Jakarta in 2016 reached 156.8643 trillion rupiahs. In 2017 GRDP ADHK in the ICT sector grew to a value of 180.7437 trillion rupiahs. The development of GRDP ADHK in the ICT sector continues to develop until 2020, reaching 258.1325 trillion rupiahs. In 2020 there was a bigger increase than the previous year. This is because, in 2020, the Covid-19 pandemic emerged. Everything is made online based to avoid crowds and the spread of the virus (Ministry of Communication and Information, 2020). Everyone began to take advantage of ICT, for example, internet access. The value of GRDP ADHK in the ICT sector, which increases every year in all provinces on the island of Pulau Jawa, illustrates the progress in the ICT sector in Pulau Jawa.

Based on Figure 1, there are differences in the value of GRDP ADHK in the ICT sector between provinces on the island of Pulau Jawa. DKI Jakarta Province has the highest GRDP ADHK value in the ICT sector. Meanwhile, DI Yogyakarta Province is the lowest. The low value of GRDP ADHK in the ICT sector in the DI Yogyakarta Province is influenced by several things such as Regional Original Income (PAD), General Allocation Funds (DAU), inflation, local government spending, and the lack of labor in the ICT sector in DI Yogyakarta Province. (BPS, 2020).



Source : Statistics Indonesia

Figure 1. GRDP ADHK ICT sector in 6 provinces in Pulau Jawa (trillion rupiahs)

According to the GRDP ADHK of the ICT sector in six provinces on Pulau Jawa in Figure 2, DKI Jakarta Province during the 2016-2020 period produced a more significant growth than other provinces. Meanwhile, Jawa Tengah Province has the smallest growth. This is because Jawa Tengah Province is still an area where the average community is conventional or thick with customs (BPS, 2020).

DKI Jakarta is driven by the achievement of three ICT development sub-indices, namely the access and manufacturing sub-index, usage sub-index, expertise sub-index access, and manufacturing sub-index. ICT can reflect DKI Jakarta Province's readiness for ICT, such as fixed line and cellular telephone subscribers per 100 population and the percentage of households with computers and internet access in DKI Jakarta Province. The usage sub-index reflects the level of ICT use in DKI Jakarta Province, such as the percentage of individuals who use the internet. The skills sub-index reflects the required skills in ICT, such as average length of schooling, secondary gross enrollment rate, and tertiary, the gross enrollment rate in DKI Jakarta Province (BPS, 2020).

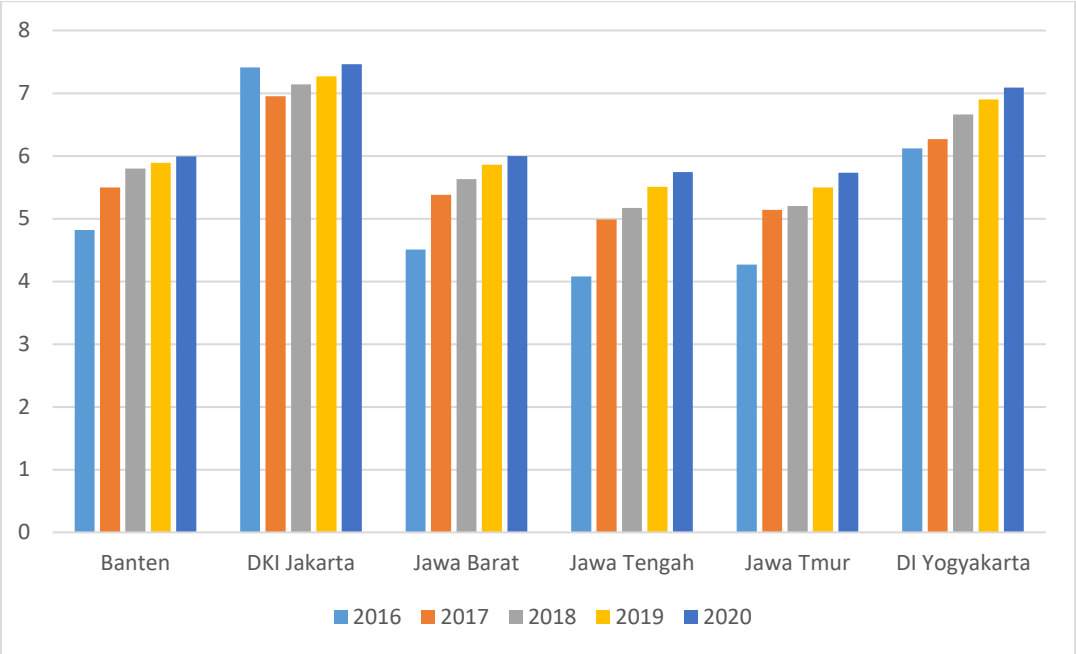


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Figure 2. ICT sector growth in 6 provinces in Pulau Jawa (percent)

Variables Affecting the Development of the ICT Sector in Pulau Jawa in 2016-2020

In panel data regression analysis, three possible models are formed in estimating parameters, namely the common effect model (CEM), fixed effect model (FEM), and random effect model (REM). Then, the selection of the best model was carried out by several tests, namely the Chow test (CEM vs. FEM), Hausman test (FEM vs. REM), and the Breusch-Pagan Lagrange Multiplier test (CEM vs. REM).

Table 1. Selection of the best model

Test	H_0	H_1	Test statistics	P-value	Conclusion
(1)	(2)	(3)	(4)	(5)	(6)
Chow	CEM	FEM	49.4037	0.0000	Reject H_0
Hausman	REM	FEM	6.6282	0.1569	Fail to reject H_0
BP-LM	CEM	REM	16.3236	0.0001	Reject H_0

Based on the table, the Chow test gives a decision to reject H_0. Thus, it can be concluded that with a significance level of 5 percent, the fixed effect model is better used in this study than the common effect model. When the decision on the Chow test is rejected H_0 then the test is continued with the Hausman test. Hausman test gives a fail-reject decision H_0. It can be concluded that with a significance level of 5 percent, the random effect model is better used in this study than the fixed effect model. Followed by the Breusch-Pagan Lagrange Multiplier test. The Breusch-Pagan Lagrange Multiplier test gives a rejection decision H_0. Therefore, the best model that is appropriate to be used in this study is the random effect model.

If the classical assumptions in the regression model are met, the resulting estimator will be BLUE (Best Linear Unbiased Estimator), which is unbiased, has a minimum variance, consistent, and sufficient (Netter et al., 1985). For the random effect model, using the GLS method, the assumption test that needs to be used is only a normality test and a non-multicollinearity test. The GLS method on the random effects model can overcome the problems of heteroscedasticity and autocorrelation in panel data (Greene, 2003).

The normality assumption test uses the Jarque-Bera test. The test statistic value is 0.956961, and the p-value is 0.6197, which is greater than the significance level. The decision is rejecting H_0. It

can be concluded that a significance level of 5 percent error in the model meets the normality assumption.

Based on the results, the VIF value for each independent variable is less than 10. It can be concluded that there is no high collinearity between the independent variables. The value of Adjusted R^2 of 0.6560. These results can be interpreted that the independent variable of 65.61 percent can explain the diversity of the ICT. The statistical value of the F test is 0.0000, so the decision to reject H_0. It can be concluded that there is at least one independent variable that significantly influences the development of the ICT sector.

Meanwhile, to determine the significance of the effect of each independent variable on the dependent variable, a partial test was carried out. The variables of the number of workers in the ICT sector, the average length of schooling, and the percentage of internet users have a significant and positive effect on the development of the ICT sector in Pulau Jawa in 2016-2020. Meanwhile, the household consumption variable for telecommunications has no significant impact on the development the ICT sector in Pulau Jawa in 2016-2020.

Table 2. Estimated results of Random Effect Model

Variable	Coefficient	T-test	P-value
(1)	(2)	(3)	(4)
C	-373.0566	-5.3214	0.0000*
TNG	0.0004	2.4335	0.0224*
RLS	26.3687	3.1449	0.0043*
KNSM	-0.0001	-1.6443	0.1126
INT	2.8241	4.0690	0.0004*

Note: *) significant at the 5 percent level

The number of workers in the ICT sector has a significant and positive effect on the development of the ICT sector. The positive relationship between the two variables is indicated by the regression coefficient value of 0.0004. If the number of workers in the ICT sector has increased by one thousand people, then the value of the development of the ICT sector will increase by 0.0004 trillion rupiahs with the assumption that other independent variables are constant. This is in line with research conducted by Dharmawan (2020), which shows that the more the number of workers in the ICT sector, the more development of the ICT sector will increase. In line with research conducted by Khuong (2014), which concludes that the number of workers and the intensity of use of ICT have a significant and positive impact on the development of the total value added to the ICT sector.

The average length of schooling has a significant and positive effect on the development of the ICT sector. The positive relationship between the two variables is indicated by the regression coefficient value of 26.3687. This means that if the average length of schooling increases by one year, the value of the development of the ICT sector will increase by 26.36879 trillion rupiahs with the assumption that the other independent variables are constant. This is in line with research conducted by Krchova & Hoesova (2021), which shows that the higher a person's education makes, the number of workers in the ICT sector increase. Then according to Kemkominfo (2020), adequate knowledge skills will make the use of ICT balanced and productive.

The size of the average household consumption for telecommunications does not have a significant influence on the development of the ICT sector. In 2018 and 2019, the provinces that had the highest technological contribution, namely the provinces of Banten and DKI Jakarta, natural disasters occurred which made consumption of telecommunications decrease drastically. In line with research conducted by Dharmawan (2020), which concludes that at the same price level but with different levels of ICT development, consumption behavior shown through the average consumption for telecommunications does not show a significant difference. Hence, the average household consumption for telecommunications cannot explain the diversity of ICT sector development between provinces.

Internet users have a significant and positive effect on the development of the ICT sector. The positive relationship between the two variables is indicated by the regression coefficient value of 2.8241. That is, if internet users experience an increase of one percent, the value of the development of the ICT sector will increase by 2.8241 trillion rupiahs with the assumption that other independent variables are constant. This is in line with research conducted by Howard (2009), which shows that the increase in internet use affects telecommunications policy. Kementerian Komunikasi dan Informasi (2020) mentions the productive use of ICT. It is necessary to use the internet so that the use of the internet for education and business can increase the use of ICT.

CONCLUSIONS

DKI Jakarta Province was the province with the highest development in the ICT sector in Jawa. It is followed by Jawa Timur, Jawa Barat, Jawa Tengah, Banten, and DI Yogyakarta. The variables of the number of workers in the ICT sector, the average length of schooling, and the percentage of internet users have a positive and significant impact on the development of the ICT sector in Pulau Jawa in 2016-2020. Meanwhile, the household consumption variable for telecommunications has no significant effect on the development the ICT sector in Pulau Jawa in 2016-2020.

To encourage the development of the ICT sector in order to obtain alignment of development plans between provinces, there are several steps that the government can take. One of which can be done by increasing the number of workers in the ICT sector by increasing investment in the ICT sector and opening job vacancies in the ICT sector. ICT fields such as software development, database administration, hardware engineering, system analysis, and system management. In addition, it supports the community by providing better internet access services, for example, by ensuring the availability and proper use of internet facilities throughout the region. In addition, building appropriate educational facilities and ensuring the 9-year compulsory education program runs well.

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