Digitalization and Poverty Reduction: Case in Indonesia

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ABSTRACT
The Indonesian government has set a target of 0 extreme poverty by 2024. Pandemic covid-19 make this target become more challenges. Various strategies have been designed by the government to achieve the poverty target, such as digitalization. The purpose of this article is to estimate the impact of digitalization on poverty reduction and economy growth in Indonesia. Using data from 34 provinces in Indonesia from 2015 to 2020. This article's empirical analysis is based on panel data, Random Effect Model (REM) with an estimation technique of Two Stages Least Square (2SLS). Our results show, digitization has a significant effect on reducing poverty. On the other hand, digitalization has negative impact on economic growth. In order for digitalization to have a major impact in encouraging poverty alleviation, various things are needed, including increasing community capacity and supporting regulations made by the government. Capacity building is carried out so that the community is able to take advantage of digitalization for productive activities so as to encourage increased community welfare. Government policy support is also needed to support the wider use of digitalization.

Keywords: *digitalization, poverty, capacity building*

1. INTRODUCTION

Poverty is a problem faced by many countries, including Indonesia. Poverty will continue to be a global issue [1] so that currently poverty alleviation is included in the first sustainable development goal (SDG), namely "No Poverty" proposed by the United Nations (2020). In Indonesia, the Government's commitment to poverty alleviation is also proven by setting a target of 0 percent extreme poverty in 2024. This is certainly not something that is easy to do because currently we are still in the COVID-19 pandemic situation so hard work is needed from all parties, both the Central Government and the Central Government. Local government. BPS data shows that the poverty rate in Indonesia until September 2021 was 9.71% or 26.50 million people, decreased by 1.04 million people in March 2021 and decreased by 1.05 million people in September 2020. Poverty reduction activities, including reduction of extreme poverty, which is spread across various ministries/agencies and local governments are generally divided into two program groups, namely programs/activities in order to reduce the expenditure burden of the extreme poor through social assistance and subsidies, and empowerment programs to increase productivity in order to increase their economic capacity. Based on data from the Ministry of Finance, the poverty-related budget in 2021 will reach IDR 526 trillion. Thus, the main issue in accelerating extreme poverty reduction is how to ensure that social protection and empowerment programs can be effective and convergent in reducing poverty, including extreme poverty. However, until now the results of the efforts made by the government in poverty alleviation have not been maximized. To overcome this, digitalization can be used as a strategy in poverty alleviation. The use of digitalization is an important supporting factor for community activities, especially in the midst of activity restrictions due to the COVID-19 pandemic situation [2]. Digitalization in the form of using ICT reduces transaction costs (eg transportation fares and service fees) and increases the possibility of saving, borrowing, and receiving remittances, contributing to accessing digital financial services [3]. So far, there is a gap in the use of ICT between villages and cities. The internet gap prevents rural households from having access to the benefits of ICT [4], resulting in income inequality and poor poverty reduction effectiveness. At the microeconomic level, the use of digitalization, namely ICT, can increase labor productivity, reduce transaction costs and company production [5]. Other research results show the advantages of using digital for the community, namely access to a wider market

L. Winarni et al. (Eds.): ICoSaPS 2022, ASSEHR 716, pp. 129–137, 2022.
https://doi.org/10.2991/978-2-494069-77-0_19

[6], convenience of public services such as education and health [7], broad business opportunities [8], lower transaction costs [9] and better income opportunities [10]. Utilization of ICT also makes it easier to conduct business, marketing and pricing more efficiently [11] (Salahuddin and Gow, 2016), making it easier to deal directly with consumers thereby reducing time and effort spent on communication and marketing. ICTs can also encourage increased skills of the workforce and provide access to human resources [12].

Various studies have been conducted to reveal the impact of using digitalization on poverty alleviation. The results of the study [13] show that increasing internet use has a multidimensional impact on poverty reduction in rural China. The same thing was also found by Yilmaz and Koyuncu [14]; Zhang [15]; Pradhan [12], ICT penetration can lead to higher economic growth; the results showed that increasing access to information had a significant positive effect on poverty reduction efforts [16]. Research in Bangladesh shows that ICT has a very good ability to alleviate poverty despite the many challenges that must be faced [17]. But on the other hand there are different findings that the use of ICT does not always have a positive impact on poverty alleviation. Negrete [18] looks at how the Internet affects agricultural productivity and poverty rural areas, finding that the Internet has almost no impact on agriculture and that its effect on rural productivity and poverty is minimal. Sujarwoto and Tampubolon [19] analyzed the relationship between spatial inequality and Internet inequality in Indonesia and concluded that the Internet deepens spatial inequality and spatial inequality increases Internet inequality.

The findings of various studies show that the use of ICT will not only have an impact on poverty but also on economic growth. The results of research by Garcia Zaballos and Lopez-Rivas [20], found that broadband was correlated with a 3.2 percent increase in GDP in 26 Latin American countries. Qiang [21] found that an increase in the national broadband penetration rate of 10 percent would lead to an increase in GDP per capita growth of 1.21 percent and 1.38 percent in developed and developing countries, respectively. Katz and Callorda [43] found that broadband penetration led to an increase in average annual income of 3.67 percent respectively in Ecuador overall. Toader et al. 2018 states that ICT infrastructure has a beneficial and strong effect on economic growth in EU countries. Bahrini and Qaffas [22] found that mobile phones, internet usage, and broadband adoption are the main drivers of economic growth. The results of research by Raeskyesa and Lukas [23] show that ICT indicators have important beneficial consequences for economic growth and physical and human capital in ASEAN. Myovella et al. [24] found the positive contribution of digitalization to economic growth in 41 Sub-Saharan African countries and 33 OECD member countries. Based on the discussion above, this research tries to see the relationship between Digitalization and Poverty in Indonesia.

2. RESEARCH METHOD

The data used in this study is panel data for 2015 - 2020 in 34 provinces in Indonesia. Variables observed include digitization, poverty and economic growth. Digitization is described by the Information and Communication Technology Development Index (ICT). The estimation equation used is a simultaneous equation model that is used to estimate variables that are thought to influence each other. The most prominent feature in simultaneous equations is that the dependent variable in one equation may appear as the independent variable in another equation in the system (Gujarati, 2004). The simultaneous model in this study is expected to be able to capture the phenomenon of the relationship between digitization and poverty levels.

3. RESULT AND DISCUSSION

This study uses two research models and there are dependent variables in one equation that appear as independent variables in other equations in the system, therefore in this study using simultaneous equations. The provisions in using simultaneous equations are that the system of equations must be identified first. Simultaneous equation identification in this study aims to determine whether the model can be estimated or not or commonly referred to as order condition identification.

Poverty equation:

Povit = c0 + c1 $\widehat{Growth}$ it + c2 ICTit + c3 IHKit + c4 Unemployit + regional dummy + εit

Economic growth equation:

Growthit = c0 + c1 $\widehat{Pov}$it + c2 Investmentit + c3 Populationit + c4 IPMit + c5 ICTit + c6 Giniratioit + εit

Table 1. Result of identification of order condition Model

Model	K	k	K-k	M-1	Category
Poverty	8	4	4	1	Over identified
Economic Growth	8	5	5	1	Over identified

If a simultaneous equation is in overidentified condition, then the appropriate estimation method used is Two Stage Least Square (2SLS). In testing the order condition in Table 1. it can be seen that the two

structural equations in this study are over identified so that the above variables have met the requirements in the simultaneous equation model and can be estimated. The most appropriate estimation method for the simultaneous equation in this study is Two Stage Least Square (2SLS) because the equation is in an overidentified condition.

3.1 MULTICORRELATION TEST

The multicollinearity test in this study was carried out before performing the regression, the aim was to see if there were independent variables that experienced serious correlations between other independent variables. The multicollinearity test in this study uses a correlation matrix which according to Gujarati (1995) multicollinearity testing can be done by looking at the Variance Inflation Factor (VIF) value and the correlation between the independent variables. If the VIF value is < 10 or the tolerance value is > 0.10, or you can also use the coefficient on the correlation test. It is said that there is a symptom of multicollinearity if the correlation between the independent variables is greater than 0.9.

Table 2. Poverty Model Correlation Matrix

	ICT	IHK	Unemployment	Regional Dummy	Economic Growth
ICT	1.0000				
CPI	-0.0697	1.0000			
Unemployment	0.1969	-0.1015	1.0000		
Regional Dummy	0.3161	0.0374	0.1791	1.0000	
Economic Growth	-0.2958	0.5099	-0.1593	-0.1331	1.0000

Based on table 2. the correlation matrix in the poverty model shows that all independent variables, namely ICT, CPI, Unemployment, Regional Dummy, Economic Growth have values below 0.9 so that multicollinearity between these variables does not occur.

Table 3. Correlation Matrix of Economic Growth Model

	Investment	Population	ICT	HDI	Gini Ratio	Percentage Ratio of Poor
Investment	1.0000					
Population	0.8659	1.0000				
ICT	0.4099	0.1438	1.0000			
HDI	0.4752	0.2559	0.8358	1.0000		
Gini Ratio	0.2141	0.2707	0.0889	0.0537	1.0000	
Percentage Ratio of Poor	-0.3151	-0.1484	-0.5250	-0.6672	0.3131	1.0000

Based on table 3. the correlation matrix in the economic growth model shows that all independent variables, namely investment, population, ICT, HDI, Gini Ratio, the Poor have a value below 0.9 so multicollinearity between these variables does not occur.

3.2 DATA PANEL REGRESSION TEST

In this study, the poverty model was estimated using random effects, this is because according to Widarjono [25] the random effects model is used to overcome the weaknesses of the fixed effect model that uses dummy variables. Panel data analysis method with random effects model must meet the requirements, namely the number of cross sections must be greater than the number of research variables. In this study, the number of cross sections used was 34, and the number of time series used was 6, so it can be said that the poverty model has met the requirements to be estimated using random effects.

Table 4. MODEL POVERTY

VARIABLES	Random Effect	
	Koef	Prob
Pertumbuhan Ekonomi	-0.61*	0.082

ICT	-3.22*	0.000
CPI	0.038	0.548
Unemplyment	-0.32	0.130
Regional Dummy	-1.61*	0.039
Konstanta	26.57*	0.000
Observations	204	
R-squared	0.2688	
F- Stats	0.0000	

* significant at 10% alpha

Test of Statistical Criteria

1. Simultaneous test (F – test)
   Simultaneous test on the poverty model can be seen in the F-Stat value in Table 4. The results of the simultaneous test on the poverty model show that the F-Stat value is 0.0000, because the value is less than 0.05 it can be concluded that the independent variables in this research model together have a significant influence on the dependent variable, namely the level of poverty.
2. Coefficient of Determination/Goodness of Fit (R2)
   The value of R-squared (R2) in the poverty model can be seen in Table 4. The results show that the magnitude of the Goodness of Fit in the poverty model is 0.2688. The meaning of this value is that 26.88% of the poverty rate variable can be explained by independent variables, namely economic growth, ICT, CPI, unemployment rate and Sumatran Java, while the rest is explained by other factors outside the model.

DISCUSSION POVERTY MODEL

a. *Effect of Information and Communication Technology Development Index (ICT) on Poverty*

The results of the random effect regression found that the ICT variable was significant at 10% alpha with a coefficient of -3.22. So it can be concluded that poverty has a negative relationship to the level of poverty. If ICT increases by 1%, poverty will decrease by 0.32% ceteris paribus. This is in line with previous research which stated that the use of ICT, and particularly the Internet, can help reduce poverty [26] [9]. The results of Mushtaq and Bruneau's 2019 research also state that the development of ICT has a role in poverty reduction [8]. ICTs can help the poor in a number of ways including through e-banking, mobile-banking and mobile ATMs, as well as helping access to timely and inexpensive information and better connectivity and making it easier to obtain micro-loans. Various evidences from studies show that better access to finance can encourage poverty reduction and improve household welfare. The use of ICT, namely the Internet, also provides benefits ranging from easy access to information, the purchase of goods and services, to interaction with various individuals and groups in the broader government process. Rural residents are able to get more opportunities and opportunities because the use of the Internet reduces and removes previous barriers. But on the other hand, the use of the internet has the possibility of causing consequences for vulnerable groups of non-Internet users, rural residents lose their rights by these developments [27]. In order for digitalization to have a major impact in encouraging poverty alleviation, various things are needed, including increasing community capacity and supporting regulations made by the government. Capacity building is carried out so that the community is able to take advantage of digitalization for productive activities so as to encourage increased community welfare. López Ruiz and Alfaro Navarro [28] state that in the era of digitalization, the key to development is investment in improving the knowledge and skills of human resources. Isman, Gungoren [29] consider that the increasing use of digital tools in a digital society creates new requirements for individual skills. who use this tool and ensure the safe use of information, and are responsible for the use of new technology. An increase in qualifications in the field of technology is obtained through training within the organization. In addition, government policy support is also needed to support the wider use of digitalization Heeks in 2018 stated that in order for the target of digitalization development to be achieved properly, improving the effectiveness of governance can be increased by increasing the accountability of public services in the form of improving the quality of public services and information disclosure; developing an economic strategy [30]. Digital omi through a multi-stakeholder collaborative approach and also involving the community in decision-making for digital development; conduct policy evaluations, develop initiatives and innovations

b. *The Effect of Economic Growth and Regional Dummy Variables on Poverty*

This study uses 2SLS simultaneous estimates, so that the economic growth variable in this model is an endogenous variable whose magnitude is estimated from other equations. Economic growth is an independent variable in the equation in the poverty model. The regression results showed that the economic growth variable was significant at 10% alpha with a coefficient of -0.61. So it can be concluded that economic growth has a negative relationship to the level of poverty. If economic growth increases by 1%, poverty will decrease by 0.61% ceteris paribus. This is in line with previous research which states that

economic growth will reduce poverty levels [31] (Suryadarma and Suharyadi, 2007).

This study uses a regional dummy variable to see differences in the development of poverty levels, by giving treatment based on the non-Java-Sumatra region as a reference area (benchmark). The reason for using the non-Java-Sumatra region as a benchmark is because the non-Java-Sumatra region has the highest average poverty rate compared to the Java-Sumatra region. Meanwhile, a positive or negative number in the dummy coefficient indicates that the area indicated by the dummy variable has a lower poverty level (for the negative sign) or higher (for the positive sign) than the area used as the benchmark [32]. The regression results showed that the regional dummy variable was significant at 10% alpha with a coefficient of -1.61. This means that the Java and Sumatra regions have lower poverty conditions than the non-Java-Sumatra areas. This difference in conditions occurs because each region has a condition of factors that affect the level of poverty, such as differences in economic growth, minimum wages and gaps in development achievement between provinces. The problem of the lack of equitable development, especially between the Western and Eastern Regions of Indonesia, has emerged for a long time. The development which is dominated by the provinces that are included in the Western Region of Indonesia, makes development in the Eastern Region of Indonesia still relatively far behind. BPS data shows that 80s of percent of Indonesia's GDP is dominated by provinces in the Western Region of Indonesia, while the rest is distributed across provinces in Eastern Indonesia (Central Bureau of Statistics, 2016). The phenomenon of inclusive growth in reducing poverty, reducing inequality, and increasing employment absorption is more common in the Western Region of Indonesia. [33] [34] [35].

Table 5. ECONOMIC GROWTH MODEL

VARIABLES	Random Effect	
	Koef	Prob
Poverty	-1.092675*	0.002
Invesment	-0.188864	0.916
Population	-1.844898	0.323
ICT	-2.058873*	0.002
HDI	-0.7094952*	0.065
Gini Ratio	79.81461*	0.000
Konstanta	55.54829*	0.0031
Observations	204	
R-squared	0.480	
F- Stats	0.0002	

* significant at 10% alpha

Test for Statistical Criteria

1. *Simultaneous test (F-test)*

   Simultaneous test on the economic growth model can be seen in the F-Stat value in Table 5. The results of the simultaneous test on the poverty model show that the F-Stat value is 0.0002, because the value is less than 0.05 then it can be concluded that the independent variables in this research model together have a significant influence on the dependent variable, namely economic growth.

2. *Coefficient of Determination/Goodness of Fit (R2)*

   The value of R-squared (R2) in the economic growth model can be seen in Table 5. The results show that the amount of Goodness of Fit in the economic growth model is 0.48. The meaning of this value is that 48% of economic growth variables can be explained by independent variables, namely poverty, investment, population, ICT, HDI and Gini ratio while the rest is explained by other factors outside the model.

DISCUSSION ECONOMIC GROWTH MODEL

a. *Effect of Information and Communication Technology Development Index (ICT) on Economic Growth*

The results of the random effect regression found that the ICT variable was significant at alpha 10% with a coefficient of -3.05. So it can be concluded that ICT has a negative relationship to the rate of economic growth. If ICT increases by 1%, economic growth will decrease by 0.30% ceteris paribus. This is in accordance with the research of Papaioannou and Dimelis 2007 [36]; Yousefi 2011 [37]; Pradan et al. 2015; which mentions that economic growth in many countries and regions of the world is negatively affected by ICT.

b. *The effect of the variable Poverty Level, HDI and Gini Ratio on Economic Growth*

This study uses a simultaneous estimate of 2SLS, so that the poverty rate variable in this model is an endogenous variable whose magnitude is estimated from other equations. Poverty level which is an independent variable in the economic growth equation. From the regression results, it was found that the poverty level variable was significant at alpha 10% with a coefficient of -1.09. So it can be concluded that

the variable poverty rate has a negative relationship to economic growth. If the poverty rate decreases by 1%, then economic growth will increase by 1.09% ceteris paribus. This is in line with previous research, namely Rogoff (2004) and Tambunan (2005) which stated that the lower the poverty rate, the faster economic growth. The influence of the HDI variable has a significant negative relationship to economic growth. From the regression results, it is found that the HDI variable is significant at alpha 10% with a coefficient of -0.7, meaning that if the HDI increases by 1%, economic growth will decrease by 0.7% ceteris paribus. These results are in line with research [38], namely the human development index and economic growth have a negative relationship in the short term in Nigeria. Gini ratio variable has a significant positive relationship to economic growth. From the regression results, it was found that the Gini ratio variable was significantly positive at 10% alpha. This result is in accordance with the findings of Henderson et al. [45], inequality in the distribution of economic activities has a positive relationship with the level of development. Later, Shahbaz [41] and Majeed [42] both used the ARDL technique to study the relationship of growth in income inequality in Pakistan, with the first investigation covering the years 1971-2005, and the second, 1975-2013. Both studies identify a positive correlation between income inequality and economic growth in Pakistan during the investigated period.

4. CONCLUSION

The use of digitalization has a significant positive effect on reducing poverty levels. But on the other hand, the use of digitalization also has a negative effect on economic growth. Utilization of ICT, and especially the Internet, can help reduce poverty in several ways including through access to digital banking such as e-banking, mobile-banking and mobile ATMs, helping access information to wider network interactions.

In order for digitalization to have a major impact in encouraging poverty alleviation, it is necessary to increase community capacity and support regulations made by the government. Capacity building is carried out so that the community is able to take advantage of digitalization for productive activities so as to encourage increased community welfare. The use of technology that is not wise will have more negative impacts, namely a lack of productivity.

AUTHORS' CONTRIBUTIONS

Dewi Regina and Febrina Elia Nababan are the main author. All author has equal contribution to the research study from design the study framework, analysis and to the writing of the manuscript.

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