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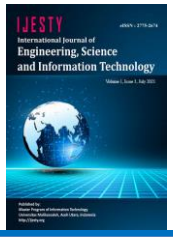

# The Effect of Information and Communication Technology on Poverty Reduction

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**Abstract**

Poverty is a problem that must be faced every year by the government. The government has made various efforts to overcome poverty. The field of information and communication technology has emerged as one of the factors that can influence poverty alleviation in this era of globalization. The development of information and communication technology in a country will impact the direction of people's behavior in various aspects. The development of information and communication technology has brought many changes for the better in human life worldwide. This study uses secondary data obtained from the Central Bureau of Statistics of Indonesia, the International Telecommunications Union, and other relevant sources in this study. This study aims to determine and analyze the effect of information and communication technology on poverty alleviation with case studies conducted in 34 provinces in Indonesia. This study uses a quantitative descriptive method using panel data regression analysis method using the OLS (Ordinary Least Square) with Fixed Effect Model approach. The partial test (t statistical test) with a 95% confidence level shows that information and communication technology significantly affect poverty alleviation in 34 provinces in Indonesia. Therefore, in this case, the government needs to make efforts to increase the sub-index for the formation of the information and communication technology development index such as public infrastructure facilities in the information and communication technology sector as a means of supporting community activities, as well as community expertise in utilizing technology that the government can do to reduce poverty in 34 provinces in Indonesia.

***Keywords***: *Poverty, Information and Communication Technology, Panel Data*.

## 1. Introduction

The Sustainable Development Goals (SDGs) and Millennium Development Goals (MDGs) have programs with one of the main objectives of overcoming the problem of poverty[1]. Indonesia has consistently shown positive developments in the poverty rate, where every year, the poverty rate in Indonesia has continuously decreased. The success of development and various poverty alleviation programs carried out by the government are the primary keys to reducing poverty in Indonesia. Development has three objectives: expanding economic and social choices, increasing living standards, and increasing the distribution and availability of essential goods[2].

**Table 1**. Indonesia Poverty Rate in 2015-2019

| | Year | | | | |
|---|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2018 | 2019 |
| Poverty rate | 11.78 | 11.44 | 11.44 | 10.64 | 9.86 |

The rate of poverty reduction in Indonesia has consistently decreased but is very slow and insignificant. This has made Indonesia unable to achieve the poverty target that has been set, where the poverty target that has been set is less than 10%[1].
Poverty is not just an expression of life but a state of self-perception and thought in a very complex social network[3]. The poor are not only those who cannot obtain material and financial resources but also do not have the opportunities they have in value-creating activities[4]. Poverty can be caused by a lack of access to information for the poor[5]. Poor people always experience obstacles where access to information quickly is limited, where the information they do not get is essential and can change their lives. Limited information is also an obstacle for the government, which will cause every program and assistance that the government will provide will not be right on target[6] [7].
Various groups need Information and Communication Technology (ICT) because the Indonesian people currently lack technology knowledge. This will make it difficult for them to manage technology, affecting the difficulty of getting access to information.
ICT is a series of activities carried out through processing, transmitting, and visualizing information through electronic means[8]. ICT uses modern technology to help capture, process, store, retrieve, and communicate information in various forms, both in images, sound,

text, and digital data[9]. The use of ICT is growing very widely, especially in the fields of education, health, and government. The use of ICT as an example in education is the implementation of E-learning in learning at various levels, both formal and informal[10]. ICT can connect information technology equipment with communication technology, in this case, such as personal computers with telephones and telecommunications network[11]. ICT has acquired a broader dimension in its development, including several media such as the internet, personal computers, fax, voice information systems, telex, video, radio, television, and telephone [12]. In addition to hardware and software devices, ICT developments have begun to penetrate further uses of the internet such as paid content services and video streaming streaming [13].

Information and communication technology has a role in encouraging social and cultural transformation in all aspects of people's lives and is also the primary sector that drives people's economic growth. From the start of developments in tourism, mapping and community perception needs, ICT has begun to be entered as part of technological adaptation [14] [15]. ICT facilitates: (a) agricultural and rural economic development; (b) dissemination of information and acquisition of value-added information; (c) knowledge exchange process; (d) development of skills, abilities, and abilities; and e) development of communication network. Through the use of information and communication technology, it must accelerate efforts to develop Indonesia from marginal areas, increase economic competitiveness, and empower rural communities [16] [17].

With the existence of ICT, it is undoubtedly very reliable where ICT has a role in obtaining various kinds of affordable and relevant information from various sources and will solve problems that occur [18] [19]. Information and knowledge are an essential part of poverty alleviation strategies, and ICT is expected to make it easier for the poor to get helpful information[20]. Advances in telecommunications and technology can contribute to changes in the social conditions of the world community [21] [22]. The development of increasingly advanced telecommunications technology can be explained by the increasing distance (inequality) between one person and another.

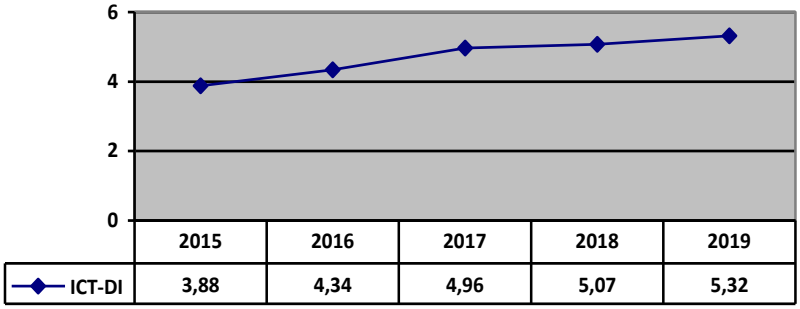


**Fig 1**. Indonesia ICT Development Index 2015-2019

The International Telecommunication Union (ITU) has developed a measuring tool to see the standard level of ICT development of a region that can be compared with other regions from time to time, namely the ICT Development Index (ICT-DI)[23]. In addition, ICT-DI can also measure the growth rate of ICT development, measure the potential for ICT development, and measure the digital divide or digital divide between regions[24] [25]. The higher the ICT-DI value, the better the development of ICT in the region.

ICT-DI is a composite index consisting of three sub-indices, and each sub-index consists of indicators that make up the sub-index[26]. The sub-index for the preparation of ICT-DI is:

a. The access and infrastructure sub-index describes ICT readiness using ICT access and infrastructure as a measurement standard and consists of five constituent indicators.
b. Sub-index of use, describing the intensity of ICT as measured using ICT, and the three constituent indicators that constitute the sub-index.
c. Skills Subscript, using three indicators from the compilers of the sub-index to describe the skills or experience required for ICT (ICT Skills).

The development of ICT-DI in Indonesia always increases every year, although not significantly. It can be seen that in the last five years, ICT-DI in Indonesia has increased by 1.44%. Until 2019, ICT-DI Indonesia was included in the medium category grouping, which was in the range of 5.01-7.27 percent on a scale of 0-10. DKI Jakarta is the province with the highest ICT-DI score with a value of 7.31%, while Papua occupies the province with the lowest ICT score with a value of 3.33%, and there are still 11 more provinces that have low ICT-DI scores. However, it cannot be denied that ICT-DI development, which continues to increase, is a potential that the government should optimize in overcoming poverty problems in Indonesia.

Based on this background, it is suspected that information and communication technology influences poverty alleviation in Indonesia, so it is crucial to study it. This study aims to determine and analyze whether, in 34 provinces of Indonesia in 2015-2019, the decline in poverty rates was influenced by information and communication technology.

## 2. Methods

This research was conducted using descriptive and quantitative methods to explain the relationship and influence of information and communication technology on poverty in 34 provinces of Indonesia. The variables used are ICT-DI and the percentage of poor people in 34 provinces of Indonesia.

This type of research data uses secondary data, data sourced from reading, understanding, and studies through various other media such as documents, books, and literature[27]. Secondary data can also be obtained from second-hand, and other sources that were already available before the study was conducted[28]. This data was obtained from BPS and other sources relevant to the research.

The analytical method used in this study is panel data regression which, combines two types of data: cross-section and time-series[29]. So the focus of the research was carried out in 34 Indonesian provinces from 2015 to 2019. This analytical method was chosen to see the magnitude of differences in intensity and period and determine the functional relationship between the variables studied under study. The model used can be formulated as follows:

$$PVT_{it} = \alpha + \beta_1 ICT_{it} + \varepsilon_{it} \quad (1)$$

Dimana: PVT = Poverty(%); ICT = ICT Development Index(%); $\alpha$ = Constanta; $\beta_1$ = Parameter; $\varepsilon$ = error; i = Provinces; t = time-series

# 3. Results and Discussion

The following results describe how data analysis was carried out in research where panel data is the analytical method used, and these results will later explain how much influence each research variable has. Based on the model selection procedure on the panel data, the tests carried out are as follows:

## 3.1. Panel data regression method selection

The panel data analysis model selected was adjusted to the research conditions that could be seen through the individual and research variables[30]. In this study, to choose which model is the best to use, the Chow test and Hausmant test are used.
Redundant Fixed Effect – Likelihood Ratio (Chow Test) was conducted to select and compare which model is the best between Fixed Effect or Common Effect[31]. Decision-making by comparing the probability value (p) for Cross-section F with a confidence level (α) of 5%. The hypothesis in this test is that if the P-value is < α, then the best model is the fixed effect. However, if the P-value > α, then the best model is the common effect.

**Table 2**. Chow Test

| Effects Test | Statistic | d.f. | Prob. |
|---|---|---|---|
| Cross-section F | 684.886364 | (33,135) | 0.0000 |
| Cross-section Chi-square | 871.494982 | 33 | 0.0000 |

The value of the Prob Cross-section F obtained is 0.0000, which means it is smaller than 0.05 or 0.0000 <0.05. Based on the hypothesis, the model chosen for the chow test is the fixed effect. Therefore, the next test will be carried out, namely the Hausman test.
Correlated Random Effect – Hausman Test was conducted to select and compare which model is the best between random effects and fixed effects[32]. Decision-making by comparing the probability value (p) for a random cross-section with a confidence level (α) of 5%. The hypothesis in this test is that if the P-value is <0.05, then the model chosen is a fixed effect. However, if the P-value > 0.05, then the model chosen is a random effect.

**Table 3**. Hausman Test

| Test Summary | Chi-Sq. Statistic | Chi-Sq. d.f. | Prob. |
|---|---|---|---|
| Cross-section random | 11.420850 | 1 | 0.0007 |

The random cross-section probability value obtained is 0.0007, which means it is smaller than 0.05 or 0.0007 <0.05. Based on the hypothesis, the model selected in the Hauman test is a fixed effect. Therefore, in this case, it is not necessary to carry out the Lagrange multiplier test because the test is carried out to select and determine which is the best between random effects and common effects[30].
Based on the model specification test that has been done, the regression model used in estimating the ICT Development Index (ICT) on Poverty (PVT) in 34 provinces of Indonesia is a fixed-effect model.

## 3.2. Classic Assumption Test

Normality, linearity, multicollinearity, heteroscedasticity, and autocorrelation tests are tests in linear regression (Ordinary Least Squared approach) to see whether or not there are problems with classical assumptions[33]. However, in panel data regression, not all classical assumption tests need to be tested in the study.
Linear regression models rarely test for linearity because the model is assumed to be linear. Since the normality test aims to determine whether the conducted research data is normally distributed, there is no requirement for the Best Linear Unbias Estimator (BLUE) for the normality test. Therefore, normality tests are not included[34]. The multicollinearity test was not run because it was performed to determine if there was a correlation between the independent variables in the panel data regression model, but there was only one independent variable in this study. Since the panel data is a combination of time series data and section data, we do not need to worry about the autocorrelation of panel data. Thus, panel data is a way to solve the problem of the classic assumption test. Moreover, this research model uses a fixed-effect model with an additional Dummy Variable to avoid autocorrelation[31]. Based on this description, the classical assumption used in this study is only the heteroscedasticity test.
A Heteroscedasticity test was performed to see if the regression model had variance inequality in the observer's residuals to other observers. There are at least two ways that can be used to determine the presence or absence of detectable heteroscedasticity symptoms, namely the Glejser test and the Park test. The Glejser test requires absolute residual value regression for the independent variables[35]. Probability results are declared significant, or there is no heteroscedasticity if the probability value in the Glejser Test is greater than the 5% confidence level (α). In this study, the test used was the Glejser test.

**Table 4**. Heteroscedasticity Test

| Variable | Glejser Test | |
|---|---|---|
| | t-Statistic | Prob. |
| ICT | 0.277433 | 0.7819 |

The probability value for the independent variable is higher than the confidence level (α) or (> 0.05). Following the provisions of the Glejser Test, the model used was concluded to be free from heteroscedasticity symptoms.

## 3.3. Goodness Fit Test

After conducting a series of model selection tests, after a model is selected and has been freed from the symptoms of classical assumptions, the next step is to perform a goodness fit test. In this study, the goodness fit test performed were: (1) t-statistical test; (2) Coeffi-

cient of Determination or ($R^2$). Statistical F test was not carried out because, in this study, only one independent variable was used where the use of this F test was to see the simultaneous effect of all independent variables (more than one) on the dependent variable.
The t statistical test was conducted to partially determine the extent of the influence of each independent variable on the dependent variable of the study. In this study, the t-test was performed by comparing the P-value (t-stat) with the level of confidence (α). The hypotheses in the t statistic test are:

$H_0$ : There is no partial effect

$H_1$ : Partially influential

Provided that $H_0$ is not accepted if the P-value < α. On the other hand, $H_0$ is not rejected if the P-value > α. The value used is 5%.

**Tabel 5**. Statistic t-test

| Variable | t-Statistic | | α = 5% |
|---|---|---|---|
| | t-Statistic | Prob. | |
| ICT | -15.50902 | 0.0000 | 0.05 |

The ICT Development Index (ICT) variable has a probability value of 0.0000. Then the P-value < or 0.0000 < 0.05. Based on the decision-making hypothesis, the ICT Development Index (ICT) variable partially has a significant effect on Poverty (PVT).
The coefficient of determination ($R^2$) test was carried out to obtain information on whether the estimated regression model was a good research model, or in other words, the numbers obtained in the coefficient of determination could reflect the closeness of the decision line. Actual data. The value of the coefficient of determination ($R^2$) obtained will reflect the extent to which the independent variable explains the dependent variable. In this test, if the coefficient of determination is equal to or close to zero ($R^2$ = 0), the independent variable cannot explain the change in the dependent variable. At the same time, if the coefficient of determination is equal to or close to 1 ($R^2$=1), the independent variable as a whole can explain the change in the dependent variable. Therefore, it can be interpreted that the closer to number one (1), the better the coefficient of determination.

**Table 6**. Regression Output

| No. | Dependent Variable: Poverty (PVT) | Model |
|---|---|---|
| | | Fixed Effect |
| **1** | Constanta | 15.08923 |
| | Std Error | 0.260449 |
| | Prob | 0.0000* |
| **2** | ICT Development Index (ICT) | -0.861432 |
| | Std Error | 0.055544 |
| | Prob | 0.0000* |
| **2** | $R^2$ | 0.995778 |
| **3** | Adj $R^2$ | 0.994714 |
| **4** | F | 936.4425 |
| | Prob F | 0.000000 |
| **5** | Durbin Watson | 1.091914 |
| **Note: * Significant level α=5%** | | |

The coefficient of determination ($R^2$) is 0.995778, meaning that in this study, the ICT Development Index (ICT) variable can influence and explain the poverty variable (PVT) of 99.57%. Meanwhile, 0.43% of poverty can be influenced by other variables outside of this study.

## 3.4. The Effect of Information and Communication Technology on Poverty

Based on the entire series in the panel data regression analysis that has been carried out, the results show that the ICT Development Index variable has a negative and significant effect with a negative elasticity of 0.861432 on poverty in 34 provinces of Indonesia. This shows that if the ICT Development Index ratio increases by 1%, there will be a decrease in poverty in 34 provinces of Indonesia by 0.8614.
Information and communication technology which continues to increase every year will have an impact on poverty alleviation, which will lead to an increase in the standard of living for people in 34 provinces of Indonesia, both urban and rural areas, especially in rural areas and areas that are less highlighted by the government[36][37][38][39]. The significant impact of ICT will be felt by people in rural areas throughout the province of Indonesia, where the benefits they will receive are such as (1) ICT will be able to make it easier for people to gain access to all information outside their domain; (2) ICT makes it easier for the public to carry out all online transaction activities; and (3) For farmers and traders in rural areas ICT will affect increasing negotiations by sharing parties so that they will be easy to gain access to markets which will lead to increased profits. The community will obtain these benefits through the use of ICT software and hardware available in their area, such as through the internet, GSM telephone, cellular telephone, SMS, Television, and radio[36][39][40].
In urban areas, ICT development has a significant impact where economic activities in urban areas are dominated by industrial activities, manufacturing, and service industries, which will need technology. Integrating the online world with industrial production will impact increasing the efficiency of the production process value. Increasingly involving technology in the economy will give birth to unicorn companies such as Gojek, Tokopedia, and others. This indicates that ICT will impact opening up new business opportunities and increasing income for the community and will also increase the effectiveness of community services to improve the quality of life[41][42].
Thus, the development of ICT in 34 provinces of Indonesia, both in rural and urban areas, will have an impact on poverty alleviation, this happens because more accessible access to information will increase the opportunities for people to get jobs and will also have an impact on expansion and development of employment opportunities which will then increase the absorption of labor both locally and nationally. This will lead to an increase in the community's welfare, and the level of poverty will decrease, which is marked by the decreasing number of poor people in 34 provinces of Indonesia.

So it can be concluded that the development of information and communication technology as measured through the ICT Development Index will impact and influence reducing poverty levels in 34 provinces of Indonesia.

## 4. Conclusion

From the results of research conducted on 34 provinces of Indonesia, it is known that the development of information technology impacts reducing poverty levels. Based on this, there are several suggestions put forward in this study so that ICT becomes an effective tool in poverty alleviation:

a. To overcome poverty, the central government and the provincial government must focus on the development and equitable distribution of ICT supporting infrastructure so that all levels of society can access and use technology.
b. The government should try to provide some kind of training on the use of various types of technology, especially computers for the poor and the internet for the community so that people will get convenience in various aspects.
c. The government needs to make ICT an inseparable part of various programs and policies to overcome poverty problems.

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