Analysis of The Effect if ICT on Poverty Reduction at The National Level

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A B S T R A C T

The condition of poverty, which is not only in terms of meeting food needs, but also digital poverty, makes this study aim to analyze and determine the effect of internet accessing households and mobile phone user households on poverty at the national level in 2009-2021. In accordance with the theory of Endogenous Growth Theory (The New Growth Theory), which explains the role of technological progress as an endogenous variable factor in the model and assumption framework of imperfect competition for innovation (Paul Romer, 1986). Using a quantitative approach method with secondary data in the form of time series and sourced from the Central Bureau of Statistics. Technically, the data was analyzed using multiple linear regression analysis, classical assumption test and statistical test. The results showed that Information and Communication Technology (ICT), especially internet internet accessors and cellular telephone user households had a partial and simultaneous effect on reducing the poverty rate in Indonesia from 2009 to 2021. If poverty decreases, then a country's economic growth will increase. It is hoped that the government and related institutions can provide equal distribution of internet access through free wifi points such as in schools, hospitals and other public places.

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INTRODUCTION

Poverty is a state in which a person or group does not have sufficient resources, such as income, assets, or access to basic services, so that they are unable to fulfill their basic needs for a decent life. Poverty can cover various dimensions, including economics, education, health, and access to resources. In its development, poverty has become a social issue of serious concern around the world. The United Nations (UN) in its sustainable development agenda, the 17 Sustainable Development Goals (SDGs), made poverty the first point of "End Poverty in All Its Forms Everywhere" for peace and prosperity for people and planet earth in 2030 (UNDP, 2023).

According to Esther Duflo and Abhijit Banerjee (2020) in their journal (Mora-Rivera & García-Mora, 2021), concluded that poverty is the most severe form of human deprivation and is one of the greatest challenges of all time because it is not only defined in terms of material needs, but also limits the development of abilities to improve one's well-being. This condition is a complex problem, not only in economic terms, but also in social, cultural, psychological and geographical terms. This condition occurs in Indonesia (Khoirunnisa & Budiarti, 2020).

Furthermore, Khoirunnisa & Budiarti (2020) found that inter-regional poverty in eastern Indonesia is higher than in urban areas and western Indonesia. Rural areas and eastern Indonesia are often left behind, causing development in these areas to be hampered. According to data from the National Socio-Economic Survey (SUSENAS) from BPS, the percentage of poor people in villages is relatively high at 12.33 percent, compared to only 7.52 percent in cities. The archipelagic nature of Indonesia also makes equalizing ICT access in different parts of the country more complicated.

Poverty alleviation is one of the biggest challenges for governments. The majority of poor people in Indonesia come from or live in rural areas, while others are people who move from other areas to urban areas. From the data above, it can be seen that the percentage of poor people in Indonesia in September 2022 reached 9.57 percent, equivalent to 26.36 million people. With a percentage level of 12.29 percent of the poor in rural areas, and 7.50 percent of the poor in urban areas (BPS, 2023a). According to the Central Bureau of Statistics, by applying the basic needs approach or the ability to meet basic needs, poverty in Indonesia is seen as an economic inability to meet basic food (rice, eggs, meat,
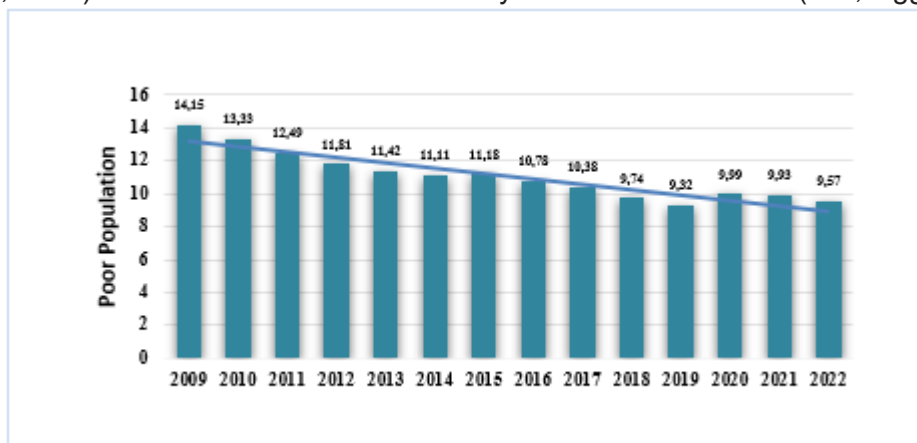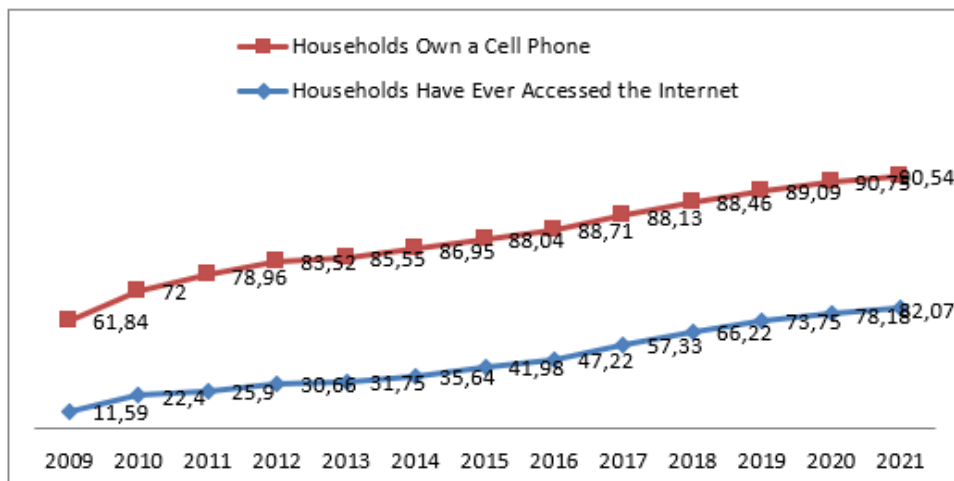

Source: BPS, 2023

Figure 1.
Poverty Percentage in Indonesia 2009-2022

vegetables, etc.) and non-food (housing, education, health, etc.) needs. The magnitude of basic food needs makes the government often pay more attention to basic food needs than the basic non-food needs of the community. Non-food basic needs are just as important in supporting a better life for the community.

ICT is a combination of Information Technology and Communication Technology (Qinthara Syahriar & Syahriar, 2006). ICT is one of the factors that is considered to reduce poverty levels and support the economic development of a country. According to Paul Romer (1986) in his theory (The New Growth Theory) also explains the role of technological progress as an endogenous variable factor in the model and the imperfect competition assumption framework for innovation (Wijayanto, 2019). Technological household variables in this study are a form of endogenous variables described in The New Growth Theory. Technological advances in every household are a new innovation in the world of economics, especially in poverty reduction factors. Technology is able to increase the productivity of goods and services in various fields through the absorption of labor capable of using technology. This is able to

reduce unemployment which has an impact on reducing the poverty rate in Indonesia. This is in line with research from (Mora-Rivera & García-Mora, 2021) that having Internet access has a positive and significant impact on reducing the probability of being multidimensionally poor in the rural sector by 1.20% and in the urban sector by 9.81% in Mexico.

From the data above, it can be seen that ICT users in Indonesia have increased every year. In Endogenous Growth Theory (The New Growth Theory), Paul Romer (1986) explains the role of technological progress as an endogenous variable factor in the model and the framework of imperfect competition assumptions for innovation (Wijayanto, 2019). Since the end of the last century, technology has been considered important due to the demands of conditions and circumstances in the digital era. Technology is able to increase the productivity of goods and services in various fields through the absorption of competent labor. This is able to reduce unemployment, which has an impact on reducing the poverty rate in Indonesia. Technology that was once only used by the upper class is now used by all levels of society. Even so, the number of poor people who benefit from

Source: BPS, 2023

Figure 2.
Percentage of ICT Users in Indonesia

technology, especially the internet, is still minimal in Indonesia, one of the causes is limited access to using digital technology (digital poverty). This can occur not only because of economic factors, but also because of the lack of knowledge of using technology (illiterate) (A. Susanto, 2016).

In a previous study, in Mexico Information and Communication Technology (ICT) was considered to have a relationship with poverty. According to (Mora-Rivera and García-Mora, 2021), having Internet access has a positive and significant impact on reducing the probability of being multidimensionally poor in the rural sector by 1.20% and in the urban sector by 9.81%. Meanwhile, from the results of research (Widiyastuti, 2015) from Indonesia, the effect of Internet penetration affects the poverty rate, but the penetration of cellular telephones and broadband has no effect on reducing the poverty rate. Therefore, this research focuses on the study of the impact or contribution of ICT to poverty alleviation in Indonesia. The aim is that this research can contribute to the theoretical debate in reducing poverty and equalizing internet access in Indonesia. Through this research, it is expected to push Indonesian society into the digital era through Internet access, especially for rural and peripheral communities.

The lack of research results linking ICTs and poverty in Indonesia motivates researchers to conduct research that focuses on the study of the impact or contribution of ICTs, especially the internet and cellular phones, on urban and rural poverty alleviation in Indonesia. Cellular phones are one of the variables that are quite influential in this study because they are a medium for the poor to benefit from Internet access. This is certainly a novelty in this study because previous studies only used computers as the medium, which in fact is an expensive item for the poor. Meanwhile, Android cellular phones with their lowest prices are enough to support the needs of the poor in Indonesia.

METHODOLOGY

This type of research uses quantitative research using secondary data sourced from the Central Bureau of Statistics, World Bank, and UNDP as the source of research data. By using descriptive analysis techniques and inferential statistical analysis, this research aims to describe the data that has been obtained systematically and factually according to the development of sample and population data. The population in this study is users of Information and Communication Technology (ICT) which includes households accessing the internet and households using cellular phones in Indonesia in 2009-2021. While the data sample is only taking the poor population in Indonesia in 2009-2021.

The variables used in this study are ICT users as the independent variable and the poor as the dependent variable. The indicators in this ICT variable are internet access as the X1 variable and cell phone users as the X2 variable. Meanwhile, the analysis model used in this study is the multiple linear regression method with time series data as a gap (difference) with previous studies. In addition, this study also uses the Classical Assumption Test and Statistical Test. The lack of ICT user data in Indonesia and previous research, makes the results of this study will fill the limitations of similar studies.

The following is the Multiple Linear Regression Analysis model used:

$$Y = a_0 + \beta_1 X_1 + \beta_2 X_2 + e$$

where Y is poverty rate in Indonesia, X1 is percentage of households accessing the internet, X2 is percentage of households with cell phones, a is constant, β_1 is regression coefficient of variable X1, β_2 is Regression Coefficient of Variable X2, e is standard error.

RESULTS AND DISCUSSION

Data Description

This research was conducted at the national level with the focus of the research being the percentage of poor people in Indonesia with relative poverty as the dependent variable. While the independent variable is ICT with indicators of households that have accessed the internet as X1, and households owning a cellular phone as X2. The following is the data of the variables used in the study in table 2.

Selection of Time Series Data Regression Model

This study uses multiple linear regression analysis models with time series data. Multiple regression is a form of complex correlation test that aims to explore the predictive ability of several independent variables on the dependent variable.

The regression results above can form a multiple linear regression equation model as follows:

Y (kemiskinan) = $a + \beta_1$(internet) + β_2 (telepon seluler) + e

Kemiskinan = 20.30826 - 0.0315246 (X1) - 0.0909256 (X2)+ e

Further modeling is to use classical assumption test analysis. This test aims to provide certainty that the regression equation obtained has accuracy in estimation, is unbiased and consistent (Sihono Raharjo & Santosa, 2020). The following are the test results and discussion in table 4.

Table 2.
Data Description

Year	Percentage of Poor Population	RT Never Access the Internet	RT has a Mobile Phone
2009	14.15	11.59	61.84
2010	13.33	22.4	72
2011	12.49	25.9	78.96
2012	11.81	30.66	83.52
2013	11.42	31.75	85.55
2014	11.105	35.64	86.95
2015	11.175	41.98	88.04
2016	10.78	47.22	88.71
2017	10.38	57.33	88.13
2018	9.74	66.22	88.46
2019	9.315	73.75	89.09
2020	9.985	78.18	90.75
2021	9.925	82.07	90.54

Source: BPS, 2023

Table 3.
Regression Resuls of Time Series Data

	Coefficient	Std. err	t	P>|t|	[95% conf. interval]	
internet	-0.0315	.00661	-4.77	0.001	-0.0463	-0.0168
telephone	-0.0909	0.0180	-5.07	0.000	-0.1309	-0.0509
cons	20.308	1.287	15.78	0.000	17.441	23.175

Source: Stata, 2023

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Normality Test

From the results of testing the Normality Test using the Shapiro-wilk w test, the probability value or p value is 0.45455> 0.05 so that it can be concluded that the poor population variable (Y) and the information and communication technology variable (X) are normally distributed.

Heteroscedasticity Test

From the results of the heteroscedasticity test using the Breusch-Pagan test above, the significance or probability of chi2 0.1052> 0.05 so it can be said that there are no symptoms of heteroscedasticity.

Multicollinearity Test

From the results of the multicollinearity test above, the Variance Inflation Factor (VIF) result is 2.55, where if the Variance Inflation Factor (VIF) value is <10 then it is passed or free of multicollinearity. Tolerance guidelines that are free of multicollinearity are Tolenace < 0.1.

Table 4.
Normality Test Results

Shapiro-Wilk W test for normal data

	Obs	W	V	z	Prob>z
uhat	13	0.39982	1.060	0.114	0.45455

Source: Stata, 2023

Table 5.
Heteroscedasticity Test Results

H0 : Constant variance	
chi 2 (1)	= 0.62
Pro > chi 2	= 0.1057

Source: Stata, 2023

Table 6.
Multicollinearity Test Results

	VIF	1/VIF
X1 internet	2.55	0.392835
X2_telepon	2.55	0.392835
Mean VIF	2.55	

Source: Stata, 2023

Table 7.
Autocorrelation Test Results

Breuch-Godfrey LM test for autocorrelation

Lags(p)	chi2	df	Prob > chi2
1	0.874	1	0.3575

H0: no serial correlation

Source: Stata, 2023

Autocorrelation Test

From the test results above, it can be seen that the probability value using Breusch-Godfrey (LM test) is 0.3575> 0.05, so it is declared to pass autocorrelation.

Statistical Testing

After obtaining the right analysis model, the next step is to conduct statistical testing. The statistical test serves to see the significant level of each regression coefficient of the independent variable on the dependent variable. Here are the results of the statistical testing:

Partial Test (t-test)

From the results of the t-test above, it can be seen that the significant value of t on the internet and cellular phone variables are both 0.001 <0.05, so it can be said that hypothesis X1 and hypothesis X2 are accepted. In conclusion, there is a relationship between the variable of internet-accessing households and the variable of poverty reduction partially, and there is also a relationship between the variable of cell phone-using households and poverty reduction partially, so both hypotheses are accepted.

Simultaneous Test (F Test)

This test aims to see the effect of the independent variable on the dependent variable simultaneously or simultaneously. This test is carried out to compare the F-hiting value with the F-table. Then it can be formed into a test prediction by determining the probability of F < 0.05, it is stated that there is an influence of the X1 and X2 variables together on variable Y. From the results of the F test above, it can be seen that the probability value of F is 0.0000 < 0.05, it can be concluded that there is an influence of internet accessing households and cellular telephone user households together in influencing the poverty rate in Indonesia.

Test of the Coefficient of Determination (R²)

Testing the coefficient of determination or commonly called R-squared aims to measure how much the X1 and X2 variables explain the Y variable. The contribution

Table 8.
T-test Results

	Coefficient	Std. err	t	P>|t|	[95% conf. interval]	
internet	-0.0315	0.0066	-4.77	0.001	-0.0463	-0.0168
telepon	-0.0909	0.0180	-5.07	0.000	-0.1309	-0.0509
cons	20.308	1.287	15.78	0.000	17.44	23.175

Source: Stata, 2023

Table 9.
F Test Results

Number of obs	= 13
F(2,10)	= 109.48
Prob > F	= 0.0000
R-squared	= 0.9563
Adj R-squared	= 0.9476
Root MSE	= .33024

Table 10.
Detetrmination Coefficient Test Results

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Prob > F	= 0.0000
R-squared	= 0.9563
Adj R-squared	= 0.9476
Root MSE	= .33024

Source: Stata, 2023

of the independent variable to the explanation of the dependent variable is measured using R-squared. The coefficient of determination is 0 (zero) and 1 (one). It can be seen from the test results above that the determinal coefficient (R^2) value of 0.9563 is close to 1, so it can be concluded that the higher the ability of the independent variable (Information and Communication Technology) to influence the dependent variable (Poor Population).

The Effect of Internet Accessing Households on the Poverty Level in Indonesia

From the calculation using the multiple linear regression equation, it shows that Internet Accessing Households (X1) has a significant negative effect on reducing the "poverty rate in Indonesia" (Y)." Looking at the value of $\beta 1$ which is - 0.0315246, it can be explained that if the variable of households accessing the internet increases by 1 percent, the poverty rate in Indonesia is expected to decrease by - 0.0315246 percent. This is in line with previous research which states that there is a negative and significant correlation between the IP-ICT variable and the poverty rate (Khoirunnisa and Budiarti, 2020).

Meanwhile, the results of statistical testing analysis using the t test show that the variable of households that have internet access has a significant t value of 0.001, where if the significant value of t is less than 0.05, it can be concluded that the hypothesis is accepted. This result is in line with H1 that it is suspected that households with internet access have an effect on reducing the poverty rate in Indonesia. So it can be said that hypothesis 1 (H1) is accepted. In other words, the variable of households accessing the internet has a partial influence on reducing the poverty rate in Indonesia. (Ruhyana and Essa, 2020) with their research entitled "Opportunities of Using Information and Communication Technology in Reducing Poverty" also confirmed that partial access has the

potential to reduce the likelihood of individuals becoming poor.

According to James O'Brien, 2005 in (eko yulianto, 2007) the Internet is a system consisting of thousands or even millions of computers, including local networks connected via channels (such as satellites, telephones and cables) that cover the entire world. The uneven distribution of internet access in Indonesia, especially in eastern and rural areas, has caused many people who have not benefited from internet access or what is commonly referred to as digital poverty. Based on the survey results of the Central Bureau of Statistics, the percentage of households accessing the internet in cities is higher at 90.90 percent than in villages, which is only 80.54 in 2022 (BPS, 2023). This condition needs to be considered in order to overcome the digital divide that can result in the number of poor people in Indonesia. According to (Widiyastuti, 2015) internet penetration has an influence in reducing the poverty rate in Indonesia. Some previous studies also explain that having Internet access can increase household income in cities and villages, so it can help in dealing with multidimensional poverty in Mexsico and in Ghana (García-Mora and Mora-Rivera, 2023; Siaw et al., 2020). This study can refine previous studies that having internet access, especially within households, can reduce the poverty rate by -0.0315246 percent.

The Effect of Cell Phone User Households on the Poverty Rate in Indonesia

From the calculation using multiple linear regression equations, it shows that Cellular Phone User Households (X2) has a negative and significant effect on reducing the poverty rate in Indonesia (Y). Judging from the value of $\beta 2$ which is -0.0909256, this shows that if the variable cell phone user households (X2) increases by 1 percent, the poverty rate in Indonesia (Y) will decrease by -0.0909256 percent.

This is in line with point 2 of the purpose of this study, which is to see the effect of cellular telephone households on reducing the poverty rate in Indonesia.

While the results of the statistical test analysis using the t test show that the cellular telephone user household variable has a significant t value of 0.000 where if the significant value of t is less than 0.05, it can be concluded that the hypothesis is accepted. This result is in accordance with H2 that it is suspected that households with cellular phones have an effect on reducing the poverty rate in Indonesia. So it can be said that hypothesis 2 (H2) is accepted. This means that the variable of households using cellular phones has a partial influence on "reducing the poverty rate in Indonesia." This finding is in line with research (Ruhyana and Essa, 2020) that partially owning a cell phone or cellular phone can reduce the probability of poverty in Sumedang Regency.

A cellular phone or mobile phone (HP) is an electronic telecommunications device that has almost the same function as a conventional telephone that uses a fixed line, but does not require a cable connection to the telephone network (Ilato et al., 2019). As technology develops in Indonesia, especially in the cellular telephone sector, cellular telephone users in Indonesia have also increased. According to a survey from the Indonesian Central Bureau of Statistics, the percentage of households using cellular phones in villages increased to 89.34 percent and in cities to 94.56 percent in 2022 (BPS, 2023). This figure can increase again with the latest types and models of cell phone feature developments that can support human needs.

The Effect of Internet Accessing Households and Cell Phone User Households on the Poverty Level in Indonesia

Based on the research results above using the coefficient of determination test, it shows that the X1 and X2 variables in this study have an R-squared coefficient value of 0.9563 or 95.63% on the Y variable. This means that internet accessing households and cell phone user households have an influence of 95.63% on poverty in Indonesia. This shows that the rise and fall of poverty in Indonesia involves Information and Communication Technology (ICT) variables where internet accessing households and cell phone user households can be linked to poverty levels. While the remaining 4.37% is explained by other factors outside this study.

From the results of statistical testing with the F test, it can be seen that the variables of internet accessing households and cellular telephone user households have an F probability value of 0.0000, where if the F probability is less than 0.05, it can be concluded that the hypothesis is accepted. This finding is in accordance with H3, which states that it is suspected that internet-accessing households and mobile phone users have an effect on reducing the poverty rate in Indonesia. So it can be said that hypothesis 3 (H3) is accepted. This means that internet-accessing households and cell phone-using households simultaneously affect poverty reduction in Indonesia.

The findings of this study are in line with Paul Romer's (1986) theoretical concept of Endogenous Growth (The New Growth Theory) which explains the role of technological progress as an endogenous variable factor in the model and the imperfect competition assumption framework for innovation (Wijayanto, 2019). Technology in this study is a factor of endogenous variables, namely households with a national scope. Technological advances in every household are a new innovation in the world of economics, especially in poverty reduction factors. The increase in internet access and cell phone users in each household can reduce the poverty rate in Indonesia by 95.63%.

Previous research also stated that

ICT has a significant influence in efforts to reduce poverty levels, especially by providing support in providing information related to employment and market conditions that can improve the business of business people (Qinthara Syahriar and Syahriar, 2006). According to (Badari Burhan, 2018; Setyaningsih, 2017) the role of ICT is very important and effective for poverty alleviation. Another study also explained simultaneously that ICT variables such as cell phone ownership, computer use, and internet use, were proven to reduce the possibility of poverty in Sumedang Regency and Bandung City (Ruhyana and Essa, 2020). Based on the research results and case studies in previous research, the government should also pay attention to reducing poverty from a technological point of view. Equitable access to the internet and cellular phone subsidies are very helpful for the welfare of each household to be better, so that it can help reduce the poverty rate in Indonesia.

CONCLUSIONS

From the results of the research analysis it can be concluded that, partially, the variable of households that have internet access has a negative and significant effect on reducing the poverty rate in Indonesia. Judging from the magnitude of the regression coefficient of variable X1, namely - 0.0315246, which explains that if the variable households that access the internet increases by 1 percent, the poverty rate in Indonesia will decrease by - 0.0315246 percent. Partially, the variable of households owning a cellular phone has a negative and significant effect on poverty reduction in Indonesia. Judging from the regression coefficient value of the X2 variable of - 0.0909256, this indicates that if the variable of households using cellular phones (X2) increases by 1 percent, the poverty rate (Y) will decrease by - 0.0909256 percent.

Simultaneously, households with internet access and households with cellular phones simultaneously affect the poverty rate in Indonesia. Judging from the coefficient of determination test, it shows that the X1 and X2 variables in this study have an R-squared coefficient value of 0.9563 or 95.63% on variable Y. This means that internet accessing households and cell phone user households have an influence of 95.63% on poverty in Indonesia. This shows that the rise and fall of poverty in Indonesia involves ICT variables where internet accessing households and cell phone user households can be linked to the poverty rate. From these results, efforts that can be made by the government in supporting the needs of its people are by equalizing internet access, especially in the regions and providing cellular phone subsidies to support ICT needs for the poor in Indonesia.

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