Inclusive Transformation: Analysis of the Role of Electricity and ICT in Promoting Equitable Economic Development in Indonesia

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Abstract. Gaps between the poor and the rich are one of them caused by inequality infrastructure . Sector role private and quality government become important thing _ in create availability infrastructure . Study This aim For analyze impact infrastructure specifically infrastructure electricity on growth economy and improvement level life Indonesian society , as well evaluate How ICT infrastructure improves availability information , access education , and opportunities for public income low . Analysis results with eviews find that infrastructure electricity influential significantly negative towards poverty , as well as impacting ICT infrastructure significantly negative towards poverty in Indonesia. With so , in the future government need emit policies that can push equality access electricity in Indonesia and encourage digitalization especially in areas located inland . So For study next can done study related influential variables to access electricity and digitalization between resident villages in Indonesia. This thing simply For reach vision Indonesia Emas 2045.

Keywords: Infrastructure, Electricity, ICT, Poverty, Inclusive Development

1. Introduction

The concept of inclusive economic development refers to economic growth that aims to ensure that the benefits are evenly distributed and cover all of society, including less developed communities or vulnerable groups. This concept emphasizes that the economic growth to be achieved is not only measured by its value, materially, but economic growth must also be able to create a positive impact on all levels of society. The main characteristics of inclusive economic development are first, society has equal access in all economic, social and cultural fields, such as work, education and health services. Second, inclusive economic development that encourages economic growth is directed at reducing income, social and opportunity gaps, including overcoming inequalities in access to basic resources and services. Third, the goal of inclusive economic development is to reduce poverty and improve people's living standards, especially disadvantaged (poor) groups. Thus, inclusive economic development aims to create a more just and sustainable society by ensuring that economic policies are not only enjoyed by a few people or regions, but also the entire

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society, where these things ultimately contribute to creating social stability, inequality, and produce economic justice.

In the era of globalization and rapid technological progress, infrastructure plays a key role in efforts to realize inclusive economic development in various countries throughout the world, especially in poor countries and developing countries in particular, such as Indonesia. The lack of infrastructure in the form of access to clean water, electricity, roads and telecommunications services in developing countries causes a gap between low-income communities and high-income communities, in addition to the low quality of regulations and the implementation of the regulations themselves by the government, which further worsens the situation. Adequate infrastructure will attract investors to invest and run their businesses in an area or without infrastructure the return on investment obtained by investors will not be as large as expected, this is because infrastructure and private investment are two things that complement each other, so the better The infrastructure owned by a country will have an impact on the higher return on investment obtained. This is in line with the research results of Palei (2014), where national competitiveness is basically influenced by institutional conditions and several other factors, including infrastructure, main infrastructure such as roads, railways, air transportation and electricity supply.

Forie (2006) states that infrastructure contains two elements, namely capital and public facilities. Where infrastructure is assets that have a big influence on public welfare but are not necessarily social. When classified based on the degree of capital intensity and social significance, the following classification is obtained.

Table 1. Classification Infrastructure

Capital Publicity	High level	Low level
High level	road highway , road kingdom train fire , airport , harbor , electricity , water and pipes disposal , telecommunication	School, hospital, garden , field ,museums, theaters , libraries , University.
Low Level	infrastructure industry	Fountains and Statues , City Parks

Source : Pale, 2015

Thus, infrastructure is a capital-intensive facility that is actively used by the community. Economists call these objects physical infrastructure or infrastructure capital. Infrastructure services such as energy, transportation, telecommunications, clean water supply, sanitation and safe waste disposal are fundamental to all household and economic production activities

Transportation, water and sanitation, information and communications technology (ICT), and energy are all included in the general definition of infrastructure according to Dodson (2006). Seethepalli and others (2007), Seethepalli, Bramati, and Veredas (2008) examined the physical characteristics of communications infrastructure

(number of telephone lines, Roads (kilometers of paved roads, proportion of paved roads), mobile subscribers, electricity (energy use), and the percentage of the population that have access to better roads), sanitation, and water supply (the percentage of the population that has access to an improved water source). (2009) Grubesik, Straub, Vellutini, Yeaple, Golub, Canning, and Pedroni (2008), as well as Warlters (2008), evaluate their physical properties evaluating the performance of the telecommunications, energy and transportation industries, main telephone lines or their quantity, electricity generation capabilities , and the length of the railway line.

Measuring the impact of infrastructure investment on growth is difficult and almost impossible to do precisely, this is due to the heterogeneity factor, which is caused by differences in economic conditions in various countries. Apart from heterogeneity factors, other things such as institutional quality can also influence infrastructure investment and economic growth (Roland, 2014). For example, in countries that have a good institutional system, these countries tend to have good infrastructure and greater economic growth. Hadi and Maria have analyzed the influence of institutions, infrastructure and economic growth. His research focuses on 75 countries on telecommunications and electricity access. They found that law enforcement had a negative impact on infrastructure assessment. Esfahani and Ramirez found that the growth of telephone use per capita increased 5 percent per year, along with increasing economic growth in the region. Victor and Ana (2020) found that access to infrastructure in Brazil reduces poverty at the household level. Where in the end the impact of access to household infrastructure is heterogeneous. Communication and networks resulting from information and communication technology have proven to be economically, socially and politically transformational (Randy and Mtthew, 2003). Timoti and Obadia (2005) found similar things that ICT contributed to increasing people's income related to efficiency and cost savings in commercial transactions. Through the internet, people will determine real decisions when bad shocks occur. So this will indirectly ensure household security and resilience, apart from that ICT also encourages community knowledge and their concern for the environment, as resulting from agricultural innovation practices. In other words, the contribution of ICT to poverty depends on the ICT used and the challenges faced by households.

Apart from ICT, other infrastructure such as electricity plays an important role in encouraging inclusive economic development, especially in overcoming poverty in peripheral areas. Arouna and Richard (2020) found that access to electricity has a significant and positive effect on household consumption per capita. Apart from that, the results of this research emphasize that the lower the access to electricity in an area, the higher the percentage of poverty in that area. Lack of access to electricity for households includes exclusions due to weak electricity coverage (areas that do not have access to the national electricity grid) and exclusions due to household connection costs (for those living in areas with electricity). Electrical coverage weaknesses can be compensated for by the use of off-grid technology including solar home systems or other environmentally friendly energy sources. Even if the capacity is low, the impact on welfare has been shown to be the same as that of the electricity grid (Diallo and Moussa, 2020).

The United Nations Development Program (UNDP) defines energy poverty as the inability to cook with modern cooking fuels and the lack of electric lighting for

reading or other household purposes and other productive activities when the sun goes down (Gaye, 2007).

In addition, related to the formation of human resources, access to energy in general and access to electricity in particular can contribute to the education of children and adults. For children, living in a home with access to electricity not only reduces their household workload but also provides them with modern learning tools such as audio-visual learning systems (Alam et al., 2018). On the health side, access to electricity has a significant impact on public health. This allows for improved health status and reduced mortality rates thanks to improved indoor air quality caused by switching from polluting to light sources

Equal distribution of infrastructure is one of the Indonesian government's strategies in achieving the vision of a Golden Indonesia 2045. In 2045, it is projected that Indonesia will be able to create economic growth of 5-6 percent, with the hope that at that time Indonesia's GDP per capita will reach 233,119 US dollars. Thus, high inclusive economic growth is expected to ultimately increase labor absorption. Below in Table 1, the projection of Indonesia's GDP per capita up to 2045 is presented.

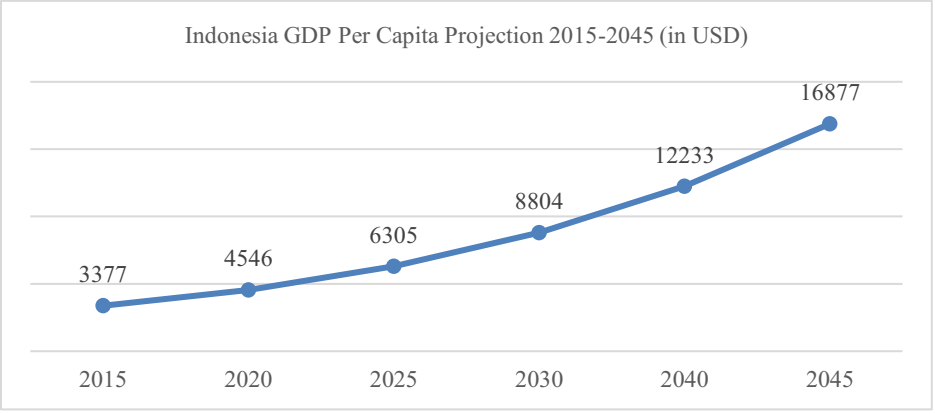

Fig1. Projection of GDP Per Capita for Indonesia 2015-2045
Source : Ministry of National Development Planning /National Development Planning Agency, 2019.

Projection an increase in Indonesia's GDP per capita is expected accompanied with exists expansion field work , and improve absorption power work . With Thus , it is projected that in 2045 the number class Indonesian society income intermediate will the more decrease or in other words, it happened enhancement standard live in society .

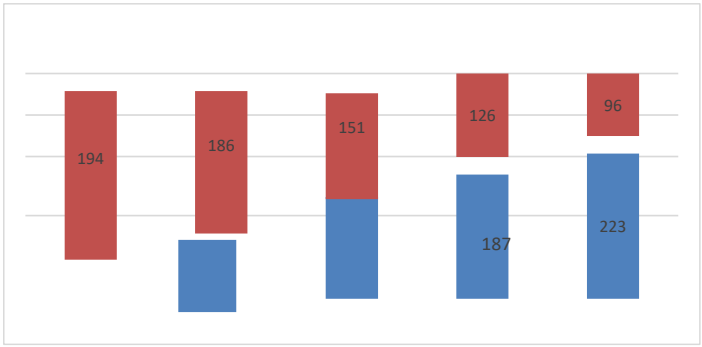

Fig 2. Projection Class Income Middle School in Indonesia 2010-2045
Source : Ministry of National Development Planning /National Development Planning Agency, 2019.

Figure 2 shows the projected decline in the number of Indonesians in the middle income class, which means that living standards are increasing. In order to realize the ideals of Indonesia 2045, electricity and ICT access are very important in accelerating development. Moreover, in the era of globalization, where technology is developing more rapidly and bringing changes to all areas of development and people's lives. Technology trends in the future are towards 1) digital technology such as mobile internet, automation, and cloud technology, 2) technology that increasingly reduces physical limitations and distance, such as IoT, transportation and distribution, 3D printing, nano technology, 3) renewable energy technology, such as solar, nuclear, biomass and geothermal energy), and 4) Health technology (genetics, treatment and recovery, and health services) (Bappenas, 2019).

This infrastructure is very important and has a positive impact on economic development. Information and communication technology has changed the way humans work, learn and interact. A strong ICT infrastructure will ultimately create opportunities and develop small and medium enterprises (SMEs), help citizens access public services and reduce gaps in access to information.

Based on Data from website Our World in Data, countries in the North American region are the countries with the highest internet users, while the lowest are in the Sub-Saharan-African region, while countries in the Asian part of the world use the internet quite high compared to countries in the African region, the more advanced a country's economy is, the higher the internet usage in that country. When compared with developed countries and underdeveloped countries, it can be seen that developed countries have a much higher number of cellular users and internet users compared to Indonesia and Zimbabwe. ICT infrastructure can encourage innovation and create comparative advantages, where in this case ICT can encourage innovation and job creation which is essential to support inclusive economic growth in the digital era
In Indonesia the internet users has significantly increasing in ten years lately. Fig 5 below show us the presentage of internet users in Indonesia from 1994 to 2021. In 1994 the internet user is below 1 percent from total population of Indonesia, but then it jumped to be 62 percent in 2021. One of the caused of The increase of internet users in Indonesia is Pandemi Covid 19 (Tempo.co, 2022). Due to the need for individuals to utilize the internet for daily tasks, employment, education, and shopping, the pandemic had a significant impact on the rise in internet usage and user numbers. The growing number of internet service providers was another indicator of Indonesia's increasing internet usage.

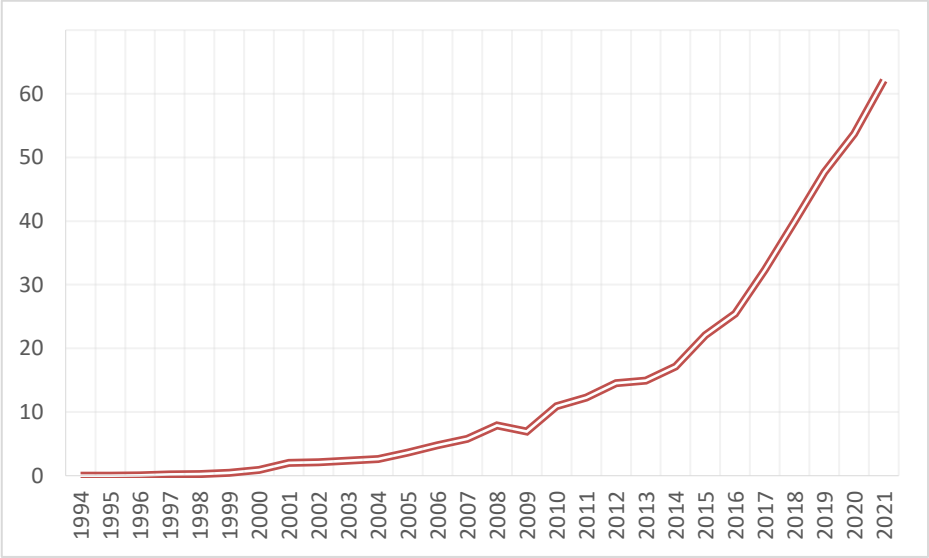

Fig 3. Internet Users in Indonesia 1994-2021

Source : Individuals using the Internet (% of population) - Indonesia | Data (worldbank.org)

Along with the enhancement in Internet user, electrical energy will also become increasingly important in the future, where electricity is the basis of life, both modern and traditional, electricity is used in almost all aspects of life, including production, health services, education and communication. Amaludin (2020) research entitled The Dynamic Link of Electricity Consumption, Internet Access, and Economic Growth in 33 Province in Indonesia, found The feedback hypothesis' proponents contended that while higher energy consumption has a positive impact on ICT usage and economic growth acceleration, higher energy consumption is also necessary for high economic growth and ICT advancement. In developing countries, there are still many people who do not have access to electricity. The following is a picture of access to electricity in Indonesia during 33 years.

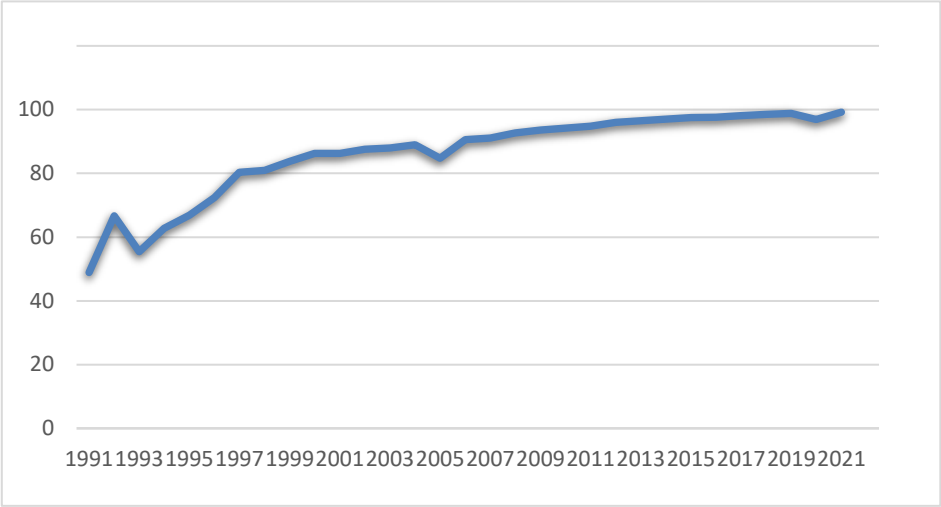

Fig 4. Access to Electricity in Indonesia 1991-2022
Source : https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=ID

Based on figure 4 above, it can be seen that the proportion of access to electricity in Indonesia continues to increase from year to year. In 2022, access will reach 99.21 percent in Indonesia, which means there are parties who do not have access to electricity. Meanwhile, to achieve inclusive economic development, Indonesia must be able to make all people have access to electricity, just as in developed countries, access to electricity covers all people. Developed countries with a GDP per capita that is relatively larger than other countries in the world have higher access to electricity in globally. Apart from that, there is still a gap in access to electricity, where developed countries tend to have greater access to electricity than developing countries and poor countries.

Based on the previous explanations, it can be explained that the role of electricity and ICT infrastructure in inclusive economic development is very important. Thus, to better understand the role of electricity and ICT infrastructure in inclusive development in Indonesia, the research aims to analyze the role of electricity infrastructure and communication and information technology (ICT) in inclusive economic development in Indonesia.

2. Methodology

The data used is time series data sourced from secondary data. The secondary data was obtained from the World Bank website, Our World Data, and The Global Economy during 1994-2020. The data used is within this time period because for all the variables used, complete data is available only for the period 1994-2020, so with this data it is hoped that we can see trends and conditions in the development of financial access, infrastructure development, economic growth and the environment over 26 years. . Analysis will be carried out using eviews.

The aim of this research is to analyze the linear relationship between the independent variables, namely X_1 is access to electricity in percent, and which is

measured by the percentage of extreme population. The analysis technique used is the Multiple Linear Regression Technique. Multiple linear regression analysis is an analysis of forecasting the influence of two or more independent variables on a dependent variable to prove whether there is a functional relationship between two or more independent variables and one dependent variable (Sugiyono, 2010:66).

To find answers related to the objectives of this research, the econometric model using the Multiple Analysis technique can be written with the following equation:

$IE_t = f(El_t, ICT_t)$

$IE_t = \beta_1 + \beta_2 El_t + \beta_3 IU_t + \varepsilon_t$

Information :

IE is inclusive economic development which is measured by the percentage of poverty estrem el El is the electricity infrastructure variable which is measured by the percentage of access to electricity. ICT is an ICT infrastructure variable which is expressed by 2 variables, namely IU is internet users measured by the percentage of internet users

3. Discussion

Table 1 shows the results of data processing with a multiple linear regression model using e-views. From Table 1, the model equation can be written as follows:

$IE_t = 164.8949 – 1.501692 Elt - 0.295431 IU_t + \varepsilon_t$

From the results of the analysis, it was found that the electricity infrastructure variable and the ICT variable simultaneously had a significant effect on inclusive development in Indonesia during 1994-2021. This is indicated by the Prob (F-Static) value of 0.00000.

Table 1 Results of Multiple Linear Regression Data Processing

Variables	**Coefficiebt**	**Std. Error**	**T-statistic**	**Prob**
C	164.8949	17.80683	9.260202	0.0000
EA	-1.501692	0.209620	-7.163892	0.0000
IU	-0.295431	0.113627	-2.600017	0.0154
R-squared	0.850642		**Mean dependent var**	26.50821
Adjusted R-squared	0.838694		**SD dependent var**	19.79477
SE of regression	7.950162		**Akaike info criterion**	7.085219
Sum squared resid	1580.127		**Schwarz criterion**	7.227955
Log likelihood	-96.19306		**Hannan-Quinn criter .**	7.128855
F-statistic	71.19173		**Durbin-Watson stat**	0.870325
Prob(F-statistic)	0.000000			

Source : data prossessing result

The significance test for the influence of partial variables is said to have a significant effect if the significance value is smaller than 0.05. Thus, the results of the partial analysis show that the electricity infrastructure variable as measured by access to electricity has a significant and negative effect on inclusive economic development in Indonesia as measured by the percentage of the population who earn less than $ 2 per day or known as extreme poverty. This is shown by the t test value for the significance of the EA variable which is 0.00<0.05. An electricity access coefficient value of -.1.5 means that every 1 percent increase in electricity access will reduce extreme poverty by 1.5 percent. The impact of improved electricity infrastructure, particularly increased access to electricity, can have a significant positive impact on job creation, business development and increased productivity. Wider access to electricity allows the development of industrial sectors that require electrical power, such as manufacturing, food processing and technology. This results in higher labor demand in these sectors. A strong electricity infrastructure supports micro and small businesses in a variety of sectors, including services, agriculture and crafts. These businesses are often the main providers of employment in rural and urban areas. Additionally, With a strong electrical infrastructure, businesses and individuals can access communications technology, such as computers and the internet, to manage inventory, track markets, and communicate with customers. This increases productivity. Reliable and affordable electricity infrastructure is the foundation for inclusive economic growth. This allows people to participate in the modern economy, helps reduce poverty, and improves the quality of life. Therefore, investment in electricity infrastructure must be a priority in inclusive economic development efforts.

Meanwhile, the internet infrastructure (ICT) variable, which is measured by the number of internet users, has a significant and negative influence on inclusive economic development in Indonesia, which is measured by the percentage of the population earning $2 per day (extreme poverty) in Indonesia. This is shown by the t test value for the significance of the IU variable which is 0.0154<0.05. The coefficient value of -0.29 indicates that an increase in internet users by 1 percent will reduce extreme poverty by 0.29 percent. The role of Information and Communication Technology (ICT) in education is very significant, and has changed the way education is accessed and delivered. The following is a description of how ICT can improve access to education and the quality of learning. The role of ICT in education is not only increasing access to education, but also changing the way we learn and teach. Better quality of learning, the possibility of lifelong learning, and wider access to information and educational resources are some examples of the positive impacts that have been created by the use of technology in the world of education. Apart from this, in the future internet use will become even more intensive. We are now in the era of digital society 4.0 leading to digital society 5.0, where digitalization plays an important role in achieving excellence and global competition. This is because all areas of life depend on digital technology (Febriani, 2023).

Thus, the development of electricity infrastructure and internet infrastructure is very important in realizing inclusive economic development, not only because it brings change and progress in all areas of life, especially social and economic, but also because these two things have positive externalities for the economic development of Indonesia as a developing country. . Positive externalities from improving electricity and ICT infrastructure can create a more dynamic economic

environment, benefiting entrepreneurs, communities and governments. Therefore, investment in this sector is often considered a strategic investment in inclusive economic and social development. Basically, electricity and the internet also complement each other. The linkage and interaction between electricity infrastructure and Information and Communication Technology (ICT) is an important aspect in inclusive economic development and social progress. Some examples of how electricity and ICT infrastructure can support each other and strengthen their positive impacts are:

1) Reliable electrical infrastructure is needed to run ICT devices and systems. Computers, data servers, routers, and other communications devices require a stable electrical power supply. Reliable electricity supports data center operations that run internet services, online applications, and data storage, all of which are an integral part of ICT services.
2) ICT is used to access the internet and enable global connectivity. A strong electrical infrastructure ensures that this internet access is always available, especially in areas that have reliable access to electricity. It allows people to access online resources, learn, find jobs, and grow their businesses.
3) ICT-based information and control systems are used in the management and monitoring of electricity infrastructure, such as electricity networks and smart grids. This helps in monitoring energy consumption, improving reliability of power supply, and reducing power leakage.
4) ICT is used in the development of technology that increases energy efficiency, such as smart regulation of household electricity use. This reduces energy consumption and helps in managing limited energy resources.
5) Electrical infrastructure enables the development of electricity-based ICT services such as connected home security systems, intelligent temperature control, and electric vehicles. This creates new business opportunities and provides convenience to the community.
6) Improving electricity infrastructure in rural areas opens up opportunities to bring internet access and ICT services to areas that were previously less accessible. This helps overcome the digital divide and improves educational and economic access in rural areas.
7) ICT is used for monitoring and management of electricity networks. This can help detect disturbances or problems in the electricity network quickly. Reliable electricity is critical in keeping these systems operational.
8) By using sensors and IoT (Internet of Things) technology, electricity and energy data can be monitored and managed in real-time. This helps in optimizing energy use, reducing waste and improving sustainability.

The close relationship between electricity and ICT creates an ecosystem that supports economic growth, wider access to services, and more efficient energy management. These two infrastructures work together to create a more connected and productive society and support inclusive economic development. mmm If seen from the R value in this research model, it is 0.850642, which means that the electricity access and internet access variables have an effect on the dependent variable by 85.0642 percent, the remaining 14.958 is influenced by other variables not included in the research model.

Data processing in this research using the multiple linear regression method using E-views 10 has carried out classical assumption tests. The results of the classical assumption test on this model show that the model is free from all classical assumption tests, but there is autocorrelation. Thus, future research will try to find other variables that also influence extreme poverty in Indonesia.

4. Conclusion

Infrastructure plays an important role in realizing an inclusive development economy. The role of electrical infrastructure and internet infrastructure is becoming increasingly important in this era of globalization, where almost all life uses electricity and the internet. Based on the results of multiple linear regression analysis with Eviews 10, it was found that simultaneously, electricity infrastructure as measured by electricity access and internet infrastructure as measured by internet users, had an effect on inclusive economic development as measured by the percentage of poor people with living costs below $2.15 per day. . Partially, the electricity access variable has a significant and negative effect on inclusive economic development in Indonesia, where an increase in electricity access by 1 percent will cause a decrease in the poor population by 1.5 percent. Internet users also have a significant and negative influence on inclusive economic development in Indonesia in 1994-2021, where increasing access to the internet by 1 percent will reduce the percentage of poor people with living costs below $ 2.15 per day,

The model used in this research succeeded in explaining the influence of the independent variable on the dependent variable by 85.0642 percent, while the remaining 14.958 percent was influenced by other variables which were not included in the research model. Thus, government efforts are needed through policies and strategies to increase electricity access and internet access to accelerate inclusive economic development in Indonesia, apart from that, the role of institutions with good governance is also needed. The research results of Fedderke (2006) show that productive government spending in the infrastructure sector can play an important role in increasing economic growth and encouraging foreign investment. Infrastructure investment in developing countries can encourage economic growth and increase productivity, this is because the presence of infrastructure can directly or indirectly increase the marginal productivity of capital. Gratitude addressed to the Bachelor of Economics Study Program which has give chance to every lecturer / teacher For express their research ideas in a published article accepted. We also say thank you to all party who has help from beginning , writing process , ending data processing , and editing publications this .

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