



## The Effect of Economic Potential and Social Heterogeneity on Electricity Distribution By Government in Rural Indonesia from 2005-2018

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### Article Information

Article of History:  
Received May 2022  
Approved October 2022  
Published December  
2022

### A B S T R A C T

Indonesia is country that has a plural society. The plural society here is interpreted by the diversity of social identities, namely ethnicity, language, and religion. This study aims to analyze the effect of diversity of economic potential and the diversity of social identities on access to electricity distribution provided by the government in rural areas of Indonesia. The data source used is secondary data, which are Badan Pusat Statistik (BPS-Statistics Indonesia) data on village potential, namely Potensi Desa (PODES) in 2005, 2008, 2011, 2014 and 2018. The analysis used is pooled cross section regression. The estimation results using Ordinary Least Square (OLS) found as follows. The OLS estimation found in terms of social diversity, the distribution of access to electricity outside Java is better than in Java. Meanwhile, based on economic diversity and geographical barriers and accessibility, villages in Java have better access to electricity than Non-Java.

**Keywords:** Access To Electricity, Social Diversity, Economic Potential, Public Goods, Village Potential.

**JEL Classification Code:** C40, H31, H41, R50

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DOI: <http://dx.doi.org/10.21107/mediatrend.v17i1.14609>

## INTRODUCTION

Modern society and people living in the information and communication technology (ICT) era need access to electricity to support their daily activities. Some literature mentions that access to electricity is part of access to public goods, particularly concerning the augmented public goods market (Besley and Ghatak, 2006). Market-augmented public goods are access to public goods that support market systems and activities to run more efficiently. Several studies show that access to public goods in developing countries, especially electricity, is still unequal (Banerjee and Somanathan, 2006; Brennenman and Kerf, 2002; Jackson, 2010).

Electricity is needed to complement ICT technology, such as the internet network, to facilitate economic activity. Electrical energy has the characteristics of a weak substitution level in utilization, especially regarding the power or strength that can be generated. Low access to electricity will make a country have low competitiveness, for example, measured by infrastructure availability and other logistics performance. In the manufacturing industry, the added value per worker will not increase if electricity as a complement to ICT is not universally available. Therefore, the government needs to continue reducing inequality and increasing access to electricity.

The distribution of Indonesia's electricity network provided by the government through PLN is still relatively unequal. The electrification ratio in West Indonesia is 95.39 percent, while in East Indonesia is 86.54. The most significant inequality is felt in rural communities in the West and the East, reaching more than 7% (Ministry of Energy and Mineral Resources, 2019). Furthermore, the Village Potential data (PODES) shows that in 2018 11,471 households had not received electricity. The household is located in a village on the Outer Islands of Java, especially in

Eastern Indonesia.

Variations in Indonesia's geographical conditions are an obstacle to expanding Perusahaan Listrik Negara (PLN)'s electricity network. Development of electricity infrastructure in areas with hilly geographical conditions, unpaved roads, and close to forests takes a long time and requires higher costs. Electrical infrastructure, such as network cables and substations, is challenging to distribute. Furthermore, in areas with these conditions, they tend to have a smaller population and limited housing quality. This causes the potential demand for the region's people to be lower. This condition applies in most parts of Eastern Indonesia, such as Papua (Institute for Essential Services Reform, 2019). This condition may explain why economic activity in eastern Indonesia is relatively low.

The provision of access to electricity in Indonesia is also related to the quality of electricity received by the community. In addition to geographical and accessibility factors that pose challenges to the distribution of access in remote areas and villages, people who already have access to electricity also do not fully experience good quality electricity. Electricity in certain areas can only be obtained for a few hours and through low voltage. An increase in the electrification ratio is expected to reduce inequality in economic activity. (Institute for Essential Services Reform, 2019).

Based on the background described above, it is known that the government's distribution of access to electricity still prioritizes the efficiency factor and the problem of inequality in remote areas and villages is still high. Therefore, further research is needed on the factors influencing access to electricity in Indonesia. Previous studies explained that several factors affect access to electricity, such as social diversity (Alesina et al., 1999; Banerjee et al., 2012; Bros and Couttenier, 2015; Das et al., 2011; Gupta and Pushkar,

2010; Jackson, 2013), the diversity of economic potential (Brenneman and Kerf, 2002), and geographical constraints and the accessibility of a region.

Social diversity such as ethnicity and religion has been found to reduce access to public goods (Alesina, Baqir, Easterly, 1999; Banerjee and Somanathan, 2007; Baldwin and Huber, 2010; Gupta and Pushkar, 2010; Vigdor, 2004; Miguel and Gugerty, 2005; Habyarimana et al, 2007). Das, Kar, and Kayal (2011) examined the relationship of religious minorities to the provision of public goods in rural West Bengal. The results show that minority groups enjoy significantly lower public goods. This is explained because ethnic minorities lack political rights and representation in government institutions.

In India, social groups that can influence and provide public support are the Brahmin and Vaisya castes. Scheduled Tribes and Scheduled Castes, such as the Sudra caste, are less recognized in political voting. This condition causes this group to have low access to almost all public goods. Cultural and religious diversity in India is reported to be related to unequal access to public goods. The highest caste, the Brahmin caste has traditionally been associated with reading, writing and religious activities. Therefore, this group has a higher preference for access to education. Empirically it was found that in areas dominated by residents with the Brahman caste, budget allocations were prioritized to gain access to education (Banerjee and Somanathan, 2007). Regarding effective demand for educational infrastructure, the Brahmana group is reported to have the most elastic demand elasticity of price and income changes (Bros, 2010).

Another factor that can affect access to public goods is the diversity of economic potential. Research conducted by Baldwin and Huber (2010) explains that income inequality between groups

in a village affects the provision of public goods. Differences in the status of economic groups can create different preferences in prioritizing public goods choices. Government policies regarding public goods will also affect economic inequality between groups.

FAO (Food and Agriculture Organization of the United Nations) publications report that more than one billion people in developing countries are poor. The majority of the poor live in rural areas. FAO (1995) states that agriculture is vital in alleviating poverty in rural areas. This relates to the majority of the rural poor depending on agricultural activities as the primary source of income and employment. Therefore, agricultural villages generally have lower access to public goods. Communities in agricultural villages tend to have a more limited income. This is caused by the condition of agricultural production, which has a time lag and is related to the risk of crop failure due to bad weather.

There is a research gap that shows different results from the studies that have been mentioned. Some studies have found that ethnic diversity positively affects access to electricity. Sunday et al. (2019) classifies electricity access as a non-targetable public good. The provision of access to electricity is carried out by generating and distributing it through poles and cables. Therefore, it is difficult to discriminate against certain ethnic groups.

Jackson (2010) provides specific arguments for classifying public goods into two types; ethnic goods and community goods. School is an example of ethnic goods; access to electricity and water is included in community goods. The research shows that access to electricity and water does not correlate with ethnic diversity. All ethnic groups in society needs water and electricity to sustain their lives. Jackson's study shows that access to electricity and water does not correlate with ethnic diversity. Any ethnicity in society needs

water and electricity to sustain their lives.

On the other hand, a correlation was found between ethnic diversity and the demand for schools. This finding causes Jackson (2010) to classify schools as ethnic goods. Jackson explained that preferences for different ethnic groups were seen from the level of responsiveness to the utilization of school access. Certain ethnic groups need schools, and other ethnic groups do not much use school access. Various empirical studies related to these public goods can be used as a reference for studying access to electricity for conditions in Indonesia.

Bedi and Edwards (2002) conducted a survey in 1986 in Honduras which aimed to see the impact of electrification on education. The results of the study show that there is a positive and strong correlation between the percentage of schools that have access to electricity and the level of school years. The results show an increase in the length of schooling from 31.5% to 56.5%. Herrin (1979) found a relationship between rural electrification and birth rates in the Philippines. The results showed that there was a decrease in the birth rate of 9.2% compared to the previous condition which only decreased by 0.5%. This is largely due to improved economic prospects and the perception that parents in households with access to electricity have that their children will not provide much of an advantage.

Foley (1990) showed that as many as 72% of households with access to electricity in Malaysia experienced improved nutrition at the health level as a result of it being easier to preserve food in the refrigerator and boil water using a water heater. The World Bank (1994) reported that households in rural India with access to electricity experienced an increase in the average length of listening to the radio. This shows that there is a positive impact of electrification on the information obtained by the community. Venkataraman (1990)

shows the benefits and importance of access to electricity in the lives of the poor. The results show that in the Philippines, 60% of low-income households are affected by the rural electrification program because housework is easier to do with electricity.

There is a gap in the research of this study with previous research. Previous studies have focused on the supply side; how the government distributes public goods; there are constraints on public preferences caused by diversity factors. This study adds to the demand side by using economic potential variables. The agricultural sector is considered to generate low income. When the majority of the population of a village earns from the agricultural sector, the village has a low potential demand for access to electricity. This study presents the variable No. Excavated C, meaning that if the village does not have excavation C as an alternative for the income of the majority of the population, then the village also has a lower probability of getting access to electricity.

Various empirical studies use more than one type of public goods in their research, while this study will focus only on access to electricity distribution. The majority of studies only use Ethno-Linguistic Fractionalization (ELF) as an index of ethnic diversity, but this study uses a dummy variable to identify ethnic and religious diversity. The similarity of this study with previous research is the use of the Ordinary Least Square (OLS) method. If the estimation results on all variables; the vector variables of economic potential, social diversity, geographic difficulty and accessibility factors show a negative coefficient, so the government through PLN distributes electricity focusing on areas that have high demand potential. The government tends to the principle of efficiency.

This study will focus on examining

the influence of diversity, geographical barriers as well as accessibility access to electricity in rural areas of Indonesia, and how they affect small industries. The data source used is pooled cross-section data in the form of surveys related to Village Potential (PODES) in 2011, 2014, and 2018. Two types of diversity, namely social and economic diversity are used as explanatory variables in this study. Social diversity is identified through religious and ethnic or ethnic groups.

**METHODOLOGY**

This study uses a quantitative approach with village potential microdata (PODES) for 2011, 2014, and 2018. PODES is survey data conducted by the Indonesian Central Bureau of Statistics (BPS) every four years. The Pooled Least Square (PLS) method is used to analyze the effect of economic potential and social diversity on PLN's electricity distribution in rural areas of Indonesia. Furthermore, estimates are made based on the year and region disaggregation of Java – Non-Java. The sample data used is 238,138 villages in Indonesia, with details for each survey period as follows. In 2011 there were 75,817 villages; in 2014, as many as 80,337 villages; and in 2018 as many as 81,984.

$$Y_{1it} = \beta_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + e_{it} \dots (1)$$

$$Y_{2it} = \beta_0 + \beta_1 Y_{1it} + e_{it} \dots (2)$$

Equations (1) and (2) show the model used in this study. Y1 notation is the number of PLN electricity customer families; Y2 notation is the number of small industries, which include leather, wood, metal, wicker, pottery, food, and other small sectors; X1 notation is social diversity, including religion and ethnicity; X2 is the diversity of economic potential including agricultural villages and villages with excavation C as an alternative source

of income; X3 is a geographical barrier factor which includes littoral, forest, type of village road surface, access to the road throughout the year, and village distance to the sub-district.

**RESULT AND DISCUSSION**

Electricity is an essential infrastructure in sustainable development. Bannerman and Kerf (2002) explain the importance of access to electricity which can affect access to other public goods and its effect on the poverty line. Law No. 30 of 2009 concerning Electricity mandates the government and local governments to guarantee access to electricity for all people through DAK Infrastructure for undeveloped, underdeveloped, and border areas, as well as rural communities. The provision of electricity must be carried out sustainably by utilizing new and renewable energy sources.

The electrification ratio and power generation capacity continue to increase but have not reached 100 percent until 2018. BPS data shows that 60 percent of Indonesia's population lives in Java-Bali. Therefore the Java Madura and Bali Network (JAMALI) dominates the contribution of 65 percent of total household electricity sales throughout Indonesia throughout 2018. This means that Indonesia's electricity access is still unequal and centered on the island of Java. Electricity distribution by PLN is still focused on the principle of efficiency, not universal access or equity. From the supply side, the terms and conditions for an area to receive electricity are entirely based on a PLN decision.

Table 1 shows the regression results that explain the relationship between social diversity and economic potential for access to electricity from 2011 to 2018. The regression results in this study show that the value of R2 is 0.089. This means that the independent variables can explain the dependent variable by 8.9

percent; the rest is explained outside the model. The estimation results show that simultaneously the independent variables significantly affect the dependent variable at the 1 percent level.

**Table 1.**  
**The Effect of Economic Potential and Social Diversity on Access to Electricity based on Survey Period and Island Disaggregation**

VARIABLES	All	Period of Survey			Island	
		2011	2014	2018	Jawa	Non Jawa
Constant	365,7*** -3,417	416,6*** -5,826	365,4*** -5,995	319,1*** -5,935	382,9*** -7.138	328.6*** -3.863
Diversity Factors						
religion_diver	3,878** -1,821	-3,839 -3,045	2,860 -3,207	10,90*** -3,178	-73.36*** -4.816	32.61*** -1.905
ethnicity	-12,12*** -1,689	-12,14*** -2,760	-18,57*** -2,936	-2,971 -3,083	-50.24*** -3.672	29.45*** -1.792
agri	82,79*** -2,749	25,39*** -4,904	103,8*** -4,823	111,8*** -4,565	218.5*** -5.459	29.95*** -3.202
no_mineralc	-16,08*** -1,735	-20,55*** -2,812	-21,35*** -3,078	-6,965** -3,115	-9.952** -4.184	-13.41*** -1.803
Geography and Accessibility Factors						
near_ocean	-67,24*** -1,870	-81,76*** -3,141	-71,06*** -3,246	-50,93*** -3,294	-102.5*** -5.533	-45.99*** -1.918
near_forest	-65,03*** -1,614	-59,91*** -2,630	-67,19*** -2,860	-70,32*** -2,892	-85.69*** -4.175	-66.34*** -1.644
jalan	-128,1*** -1,647	-132,5*** -2,707	-127,7*** -2,871	-121,8*** -2,993	-100.2*** -4.855	-116.5*** -1.645
trans	-165,0*** -1,795	-145,1*** -2,777	-166,5*** -3,206	-178,5*** -3,423	-303.8*** -5.83	-130.9*** -1.744
jarak	-1,908*** (0,0481)	-2,651*** (0,0759)	-1,839*** (0,0789)	-1,172*** (0,0996)	-1.619*** -0.19	-1.552*** -0.0475
<b>Prob &gt; F</b>	<b>0,000</b>	<b>0,000</b>	<b>0,000</b>	<b>0,000</b>	<b>0,000</b>	<b>0,000</b>
<b>Observations</b>	<b>238.138</b>	<b>75.817</b>	<b>80.337</b>	<b>81.984</b>	<b>59.909</b>	<b>178.229</b>
<b>R-squared</b>	<b>0,089</b>	<b>0,112</b>	<b>0,089</b>	<b>0,074</b>	<b>0,11</b>	<b>0,091</b>

Robust standard errors in parentheses

\*\*\* p<0,01, \*\* p<0,05, \* p<0,1

Overall, religious diversity has a positive association with access to electricity. This shows that access to electricity is not based on whether the area has residents with the same religion. Even though the village has residents with various religions, the number of recipients of the PLN electricity network continues to increase until 2018, namely 10.90 families. Estimates based on regional disaggregation show varying results. In

the case of villages on the island of Java, it shows that if a village has a population that is diverse in terms of religion, then it will have several users of the distribution of access to electricity of 63 households, which is lower than if it is a village with residents who adhere to the same religion. This follows the theory of collective action (Schultz & Strauss, 2008) and the findings of Das et al. (2011) and Habyarimana et al. (2007). Surprisingly, in villages outside the

island of Java, religious diversity will have a significantly greater number of users of the distribution of electricity access, 32 families, than in villages that are uniform. The findings of this study follow the results of research by Bros and Couttenier (2015) and Jackson (2013).

Another factor of social diversity is ethnic diversity. The development of ethnic diversity in access to electricity distribution in Indonesia from 2011 to 2018 shows a trend of negative associations. Villages with ethnic diversity have the most minor electricity access distribution users 12 (2011) and 2 (2018) than homogenous villages. This follows the study of Alesina et al. (1999), Banerjee et al. (2005), Das et al. (2011), Habyarimana et al. (2007), Miguel and Gugerty (2005), and Vigdor (2004). However, although it shows a negative association, the variable coefficient of ethnic diversity in year disaggregation has a decreasing trend. This can be interpreted as people's thinking is growing, and societal tolerance in Indonesia is also increasing. PLN, as the company authorized to distribute the electricity network, is also increasingly making efforts for equity.

The results of regional disaggregation show similarities with the variable religious diversity. In the case of villages on the island of Java, it shows that if a village has a population of various ethnicities, it will have a lower number of electricity access distribution users than if the villagers adhere to the same ethnicity. The findings of this study follow the results of research by Alesina et al. (1999), Banerjee et al. (2005), Das et al. (2011), Habyarimana et al. (2007), Miguel and Gugerty (2005), and Vigdor, (2004). In the case outside Java Island, a village with significant ethnic diversity will have 29 more families using the distribution of access to electricity than villages that are uniform. This finding follows the results of research by Bros and Couttenier (2015), Jackson (2013), and Sunday et al. (2019).

This is because, in Java, there are still several tribes that are reluctant to accept modernization, such as the Baduy and Samin tribes.

Agricultural villages have a positive association with access to electricity in all samples; while the village without excavation C showed a negative association across all samples. In 2011 villages with the majority of the population working in the agricultural sector will have access to electricity for 25 more families than other sectors. Conditions continued to improve with a marked increase in users of access to electricity in agricultural villages in 2018, namely 111 families per village. This is because since 2011, the government has had a Special Allocation Fund budget for infrastructure. Agricultural productivity will increase if it is supported by adequate accessibility and transportation infrastructure (Jalan & Ravallion, 2002).

Electric access continues to grow rapidly in agricultural villages on Java and non-Java islands. Conditions in the Java Island region show that agricultural villages have 218 more families receiving access to electricity than non-agricultural villages. In comparison, in the case of agricultural villages outside Java Island, there are 25 families receiving access to electricity more than in non-agricultural villages. The estimation results indicate that farming communities outside Java are still not prosperous and have low potential demand. This follows the research by Baldwin and Huber (2010) that economic diversity is the most crucial aspect and influences the procurement of public goods. If the problem in the diversity of economic potential is resolved, the issue in social diversity will automatically be determined.

Geographical access and transportation to the village also have an essential influence on the procurement of public goods. This is in accordance with the results of research by Duflo and Pande (2005) that coastal villages, forest villages,

roads that have not been paved, village roads that cannot be traversed by four-wheeled vehicles throughout the year, and the distance between villages and sub-districts that are increasingly remote will result in access to electricity distribution. PLN is worse. Coastal villages have a lower number of users of the distribution of access to electricity, 67 households, and forest villages have a lower number of users of the distribution of access to electricity, 65 households. Villages that have roads with unpaved surfaces receive access distribution of electricity to 128 families less, and village roads that cannot be traversed by four-wheeled vehicles

throughout the year receive distribution access to electricity to 165 families less. An increase of 1-kilometer distance from the village to the location of the sub-district office is associated with a decrease of 2 households using the distribution of PLN electricity access in each village. These geographical difficulties and accessibility factors will lead to a cost gap and a reduction of profits received by PLN. The government needs to provide access to better infrastructure and subsidize electricity rates so that Indonesian rural households can experience the flow of electricity evenly throughout the country.

**Table 2.**  
**The Association of Electricity Access on Small enterprises**

Variable	Small enterprises
Constanta	13,84*** (0,190)
Akses Listrik	0,0106*** (0,000522)
Prob>F	0,000
Observasi	182.935
R-squared	0,004

Robust standard errors in parentheses  
\*\*\* p<0,01, \*\* p<0,05, \* p<0,1

Table 2 shows that access to electricity positively affects small industries. The small industries referred to in this study include leather, wood, metal, wicker, pottery, cloth, food, and other small enterprises. An increase in 1 household using PLN electricity access will increase 0.01 the number of small industries in a village. In another sense, when a village wants to increase the number of small business actors by 1, it takes around 10 households that use PLN electricity. This condition is in accordance with the study of Brenneman & Kerf (2002) that in areas without electricity productivity is lower. In line with the government's policy of one village, one superior product, access to

electricity distribution helps people create small industries. The certainty of the electricity network is associated with technology and the working hours of business actors that are not limited to the sun. The growth of small industries will create productivity and increase people's purchasing power. So that through improving access to electricity, the government will also reduce unemployment and poverty rates.

## CONCLUSION

Access to electricity is an essential aspect of modern society. All activities will always require electricity as the primary support for the people's productivity and



quality of life. Even so, it turns out that not all regions in Indonesia receive equal access. Aspects of social and economic diversity, geographical barriers, and transportation accessibility barriers are associated with the distribution of access to the PLN electricity network. The results of this study indicate that areas outside Java have a lower chance of receiving the PLN electricity network, although based on social aspects, it is superior. In the case of the island of Java, differences in ethnicity and religion are still associated with the availability of access to electricity. Ultimately, districts/cities can plan policies to increase access to electricity by focusing more on villages without PLN electricity through renewable energy sources such as solar power, wind power, biological process water currents, and geothermal energy. Government Business Entity Cooperation (PPP) can be carried out as a form of CSR in infrastructure development to improve access which is a geographical and transportation barrier, especially for isolated villages.

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