Robust Least Square Model: Increasing Literacy through Sanitation and Electricity in Indonesia

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Abstract

Good sanitation is not only the basis for creating a healthy environment for human resources, but also good sanitation will support and make a learning atmosphere for illiterate people become literate. So, electricity is a basic requirement for at least household lighting. but with the development of technology making electricity can be used for various kinds of equipment. Sufficient electricity in households also supports the atmosphere when people learn to pursue literacy. Literacy is a crucial because it is a gateway for information, knowledge, and technological mastery. Literacy can be a key factor in someone working to find a good income. Therefore, literacy will not only increase purchasing power (income) but also individual welfare. This study wants to reveal how crucial the availability of sanitation water and electricity are in increasing literacy in every district and city in Indonesia surveyed. This study uses cross section data with 501 districts and cities throughout Indonesia. The test results prove that the presence of sanitation water and electricity significantly influences literacy. The results of this study also suggest increasing access to sanitation water intensively and electricity to increase literacy.

Keywords
literacy, sanitation, electricity, economic welfare

1. Introduction

Literacy completion is one of the focuses of the Government of the Republic of Indonesia program. At the beginning of Indonesian’ Independence in 1945, the number of illiterate people reached 97 percent. However, in 2015, the number of illiterate people has decreased to 3.4 percent or as much as 5.6 million people (Kemendikbud, 2019). So, the government of the Republic of Indonesia drastically reduced illiteracy it took 70 years. This number continues to decline in line with the efforts of the Ministry of Education and Culture of the Republic of Indonesia in carrying out various programs and activities to resolve illiteracy. Among other things, strengthening literacy education programs with culture, skills, and languages (Budiono et al, 2020). The Ministry of Education and Culture of the Republic of Indonesia has implemented a literacy program at two levels, namely basic literacy for people who are still illiterate, and advanced literacy for those who have completed the basic literacy program.

The Ministry of Education and Culture has also rolled out literacy programs that take into account regional conditions, such as a literacy-intensive basic literacy program, a basic literacy program for remote / special indigenous
communities, an independent business literacy program, and a multicultural program. In addition, the Ministry of Education and Culture is carrying out illiteracy eradication with a block or cluster system, namely by concentrating programs in illiterate areas such as Papua (22.88%), South Sulawesi (4.63%), West Sulawesi (4.64%), Nusa West Southeast (7.51%), East Nusa Tenggara (5.24%), and West Kalimantan (4.21%) (Kemendikbud, 2019).

The Indonesian Ministry of Education and Culture also implements a post illiteracy program. These programs include independent business literacy education and multi-literacy education. independent business literacy education is oriented towards literacy maintenance with a focus on independent business skills (Budiono et al, 2020), Tan et al (2019), Purba et.al (2020)). Meanwhile, multiculturalism is oriented towards the maintenance of literacy with a focus on five themes of community empowerment, namely profession / work, development of cultural arts, socio-politics and nationality, health and sports, science, and technology.

Continuation of efforts to make literacy is a program to empower people economically. The goal of community empowerment is economic prosperity (Budiono & Purba, 2020). First, work profession. After successfully attaining literacy, literate people are directed to their area of interest and their abilities. Advanced skills courses must be conducted for them to become productive workers (Rajagukguk et al, 2020). Second, empowering people to know more about cultural aspects. Through cultural development, people become aware of how important culture can support work and the formation of a worldview. Third, social-politics and nationality. An understanding of socio-politics and nationality is very important because this understanding can guide people in social life and direct the proposed political views in the right corridor to achieve the goals of the country. People with nationality will encourage the spirit of life and achieve good performance. Fourth, healthy and exercise. With a state of literacy become aware of health and exercise. A healthy body through its improvement (exercise) becomes the foundation for human resources (Purba and Budiono, 2019a). Fifth, science and technology. Literate people will find it easier to understand science and technology. Mastery of science and technology makes people more productive, not only increasing coal production and services but also increasing wage incentive benefits (Budiono (2011), Purba et.al (2020)). Increased wages make welfare increase and purchasing power also increases so that the economy grows (Budiono, 2012).

The success of the Indonesian government in eradicating illiteracy received an award from UNESCO in 2012, namely the King Sejong Literacy Prize. In addition, since the end of 2018, the Indonesian government has been selected as the UNESCO Global Alliance for Literacy Steering Committee for Indonesia's success in eradicating illiteracy (Kemendikbud, 2019). The following is a graph of the development of literacy rates in Indonesia from 1980 to 2018.

![Figure 1. Indonesia’s Literacy Rate in 1980 to 2018](image-url)

The success of the Indonesian government in receiving the award from UNESCO in 2012 has generated further success in trying to reduce illiteracy to zero. This effort is not easy due to various social, geographic, and isolation constraints for people who are still illiterate. Therefore, the authors want to know how far the existence of sanitation and electricity can increase literacy rates in every city and district in Indonesia.
2. Literature Review

The poorest Indonesians still lag with significant gaps in access to sanitation. Nearly 25 million people in Indonesia do not use a toilet. They defecate in fields, shrubs, forests, ditches, roads, rivers, or other open spaces. Open defecation is not only degrading to human dignity, but also poses a huge risk to public health. Open defecation and untreated wastewater can contaminate water supplies and promote the spread of diarrheal diseases such as cholera. A quarter of all children under 5 years of age in Indonesia suffer from diarrhea, which is the leading cause of child mortality in Indonesia.

Clean water that can be used by the public / households for sanitation and the environment (ecosystem) in each district and city. Poor water quality is inseparable from socio-economic conditions. Household drinking water can become contaminated with fecal bacteria if the sanitation system is poor. Build latrines and manage feces safely - and washing hands is key to keeping a family healthy. Safely managed sanitation is recognized as a top priority in improving community health, nutrition, and productivity, and is an explicit target of the Sustainable Development Goals (SDG). Therefore, achieving the SDG requires a closer strategy to reach the poorest Indonesian children and families by providing easier access to safely managed water supply, sanitation, and hygiene (Purba et al., 2020). The Indonesian government has accelerated access to a safe, managed water supply, sanitation, and hygiene. At the national level, these efforts are focused on carrying out high-level advocacy and joint political will by aligning WASH policies and programs with basic realities and ensuring that policies are based on reliable and up-to-date information and data. Availability of sanitation improves mental health of individuals, hence better mental health increase literacy rate.

One of the biggest challenges to achieving safely managed sanitation is changing behavior - starting from building political will to creating new national social norms in support of safely managed sanitation. In Indonesia, UNICEF motivates social behavior change through advocacy and high-level involvement in the Sanitation and Water for All partnership, peer to peer learning to support subnational advocacy and through social mobilization in marginalized communities where open defecation is still widespread (Adirinekso et al, 2020). Primary schools and local communities are also major partners in strengthening hygiene behavior. The capacity of teachers, parents, and local village government to develop and implement sanitation plans, which support healthy practices such as hand washing and hygiene management.

An electric power service has been the basic requirement for improving living standards and supporting social development for five main reasons (Niu et al., 2013). First, when obtaining electricity, food, vaccines, and drugs can be stored in a refrigerator for a longer time, thereby improving people’s health conditions. Second, lighting makes people study longer with the result that the adult literacy rate increases. In addition, the application of computers, televisions and the internet improve people’s ability to obtain information and knowledge. It can be said that modern society is highly reliant on network information and communication technologies (J.T. Purba, Budiono, Rajagukguk, et al., 2020). Third, the available electricity makes widespread use of various household appliances. It is more convenient for people in heating, cooling, sanitation, entertainment, and equipment, last which greatly improves quality of life. Fourth, electricity can take the place of traditional biomass energy and coal, which is able to reduce indoor pollution and improve the quality of the environment. Finally, the utilization of electricity not only releases people from hard work, but also saves much time for people (Adirinekso et.al, 2020). In particular, for rural individual it provides opportunities for self-employment and potential development (Tang, 2009). By looking the research results of Ghura & Goodwin (2017) concluded that the private investment in developing countries is stimulated by real GDP growth, increases in government investment, improvements in financial intermediation, reduced the credit to the government, and declines in world interest rates (Budiono (2009), Purba & Budiono (2019b), Budiono & Purba (2019)). The results indicate that developing economies can indeed benefit from the virtuous cycle that links increased private investment and real GDP growth, given that investment becomes the key in contributing factors toward the real GDP growth (Ghura & Goodwin, 2017).

Literacy rate (Lit_15) is defined as the proportion of the population aged 15 years and over who has the ability to read and write simple sentences in Latin letters, Arabic characters, and other letters (such as Javanese characters, kanji, etc.) to the population aged 15 years and over (BPS, 2020). The Literacy Rate formula as follows,

\[
Lit_{15} = \frac{LP_{15+}}{Pt_{15+}} \times 100
\]

Lit_15: literacy Rate for ages 15 and over in year t.
LP_15+ : total population aged 15 years and over who are literate in year t.
Pt_15+ : total population aged 15 years and over in year t.

The existence of literacy rates is useful for seeing the achievement of basic indicators that have been achieved by an area, because reading is the main basis for expanding knowledge (Badan Pusat Statistik (2020), Purba and
The literacy rate is an important indicator to see the extent to which the population of an area is open to knowledge (J.T. Purba, 2015). High literacy rates indicate the existence of an effective primary education system and/or literacy program that allows a large proportion of the population to acquire the ability to use the written word in everyday life and continue learning (Budiono 2001).

3. Methodological Approach

Based on the problems and possible causal relationships between sanitation waters with literacy and electricity with literacy, then we compile an economic model as outlined in the following figure.

![Research Model](image)

Next, the analysis tools used are the econometrics and statistics methods to test the models and their respective parameters. The analysis tools used are the econometrics and statistical methods to test the model and their respective parameters (Greene, 2018). The unknown parameters of the stochastic relation \( y_i = x_i' \beta + \varepsilon_i \) are the objects of estimation. It is necessary to distinguish between population quantities, such as \( \beta \) and \( \varepsilon_i \), and sample estimates of them, denoted \( \hat{\beta} \) and \( \hat{\varepsilon}_i \). The population regression is \( E[y_i|x_i] = x_i' \beta \), whereas authors estimates of \( E[y_i|x_i] \) denoted,

\[
\hat{y}_i = x_i' \hat{\beta}
\]

The disturbance associated with the \( i \)-th data point is

\[
\varepsilon_i = y_i - x_i' \hat{\beta}
\]

For any value of \( b \), we shall estimate \( \varepsilon_i \) with the residual

\[
e_i = y_i - x_i' \hat{\beta}
\]

From the definitions, so the basic framework for analyzing cross section data is a regression model of the form (Greene, 2018)

\[
y_i = x_i' \hat{\beta} + \varepsilon_i = x_i' \hat{\beta} + e_i
\]

This study uses cross section data that includes in 501 districts & cities in Indonesia Territory. The purpose of this study is to analyze impact of availability of sanitation water (HH_S) and electricity (HH_Elt) towards literacy (Lit_15). The following is an explanation of the sanitation water, electricity, and literacy variables used in the economic model. Literacy is the proportion of the population aged 15 years and over who has the ability to read and write Latin letters and other letters, without having to understand what they read/write, to the population aged 15 years and over. Indicator of electricity variable (HH_Elt) is the proportion of households that can access electricity in regencies and cities. Indicator of sanitation variable (HH_S) is proportion of household access sanitation water. Therefore, variable sanitation is the number of households that can access sanitation water in regencies and cities. Based on the basic framework of this regression model, the applied regression model for this study is

\[
\text{Lit}_15 = \beta_0 + \beta_1 \text{HH_S} + \beta_2 \text{HH_Elt}
\]

Subsequently a calculation is made by estimating the suitability of the econometric model that is the magnitude of the R-squared and F-test with a significance level of 5%. Based on the theoretical estimates for each parameter to achieve the desired model conditions in mathematical equations are as follows.

\[
\beta_1 = \frac{\partial \text{Lit}_{15}}{\partial \text{HH_S}} > 0 \quad \text{and} \quad \beta_2 = \frac{\partial \text{Lit}_{15}}{\partial \text{HH_Elt}} > 0
\]

Based on the calculus equation, the partial test of each independent variable is one way. sanitation water (HH_S) affects literacy (Lit_15) in the same direction, and electricity (HH_Elt) also affect literacy (Lit_15) in the same direction. Thus, the value of each parameter \( \beta \) is expected to be positive.
While the partial testing of each independent variable on the dependent variable is carried out by t-test with a significance level in this study amounting to 5%.

By using the null hypothesis (H₀) and alternative hypothesis (H₁) for partial testing on the β₁ parameter as follows:

H₀: β₁ = 0, availability of sanitation water does not affect literacy (Lit_15).
H₁: β₁ > 0, availability of sanitation Water affects literacy (Lit_15) in the same direction. With social process, availability of sanitation improves mental health of individuals, so better psychology increase literacy rate.

The null hypothesis (H₀) and the alternative hypothesis (H₁) for partial testing on the β₂ parameter are as follows

H₀: β₂ = 0, the availability of electricity (HH_Elt) does not affect literacy (Lit_15).
H₁: β₂ > 0, the availability of electricity (HH_Elt) affect literacy (Lit_15) in the same direction.

4. Result and Discussion

Based on the proposed econometrics model, we conduct data processing in 501 observations (districts and cities) cross section. By using linear regression and robustness feasibility, the output of data processing is as follows.

Table 1. Result of Linear Regression for Literacy in Districts and Municipalities.

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>COEFFICIENTS</th>
<th>ROBUST STANDARD ERROR</th>
<th>T-TEST</th>
<th>P-VALUE &gt; T</th>
</tr>
</thead>
<tbody>
<tr>
<td>HH_S</td>
<td>0.121</td>
<td>0.026</td>
<td>4.65</td>
<td>0.000</td>
</tr>
<tr>
<td>HH_Elt</td>
<td>0.171</td>
<td>0.040</td>
<td>4.24</td>
<td>0.000</td>
</tr>
<tr>
<td>Constant</td>
<td>70.291</td>
<td>3.392</td>
<td>17.74</td>
<td>0.000</td>
</tr>
</tbody>
</table>


Based on the value of R-squared = 0.28 shows that 28% changes in Lit_15 are influenced by independent variables in the model, while the influence of variables outside the model is 72%. Probably, literacy teaching program has a dominant influence outside the built model. The test results for the proposed model that the results of the value of F-test = 20.26 and probability F = 0.00 smaller than the significance level of 5%, we reject the null hypothesis. The independent variable household access to sanitation and electricity simultaneously influence the Lit_15 in every city and district throughout Indonesia.

Based on the results of partial testing the HH_S variable is t-test = 4.65 and probability value t = 0.000 states that we reject null hypothesis and accept alternative hypotheses. Household access to sanitation (HH_S) significantly influences the Lit_15 in every district and city throughout Indonesia. Subsequent partial testing of the household access electricity (HH_Elt) variable. The results of t-test = 4.24 and probability value t = 0.000 states that we reject null hypothesis and accept alternative hypotheses. The existence of Electricity (HH_Elt) significantly influences the Lit_15 in every district and city throughout Indonesia. So, testing together or partially shows the behavioral model in this study has met the statistically requirements.

Next, we construct the equation of the econometric model in this study as follows.

\[ \text{Lit} \_15 = 70.29 + 0.121 \times \text{HH}_S + 0.171 \times \text{HH}_Elt \]

From the results equation existence of sanitation water and electricity affects literacy in Indonesia.

Both value of the parameter coefficients is positive, this show the results of this study are in accordance with the hypotheses and theoretical basis. The magnitude of the parameter coefficient reflects the magnitude of the impact of the independent variable on the dependent variable. The value of sanitation water parameter with coefficient of 0.121 shows that each 1% increase in household access to sanitation resulted in an increase literacy of around 0.121 in each district and city throughout Indonesia. Likewise, for the household access to electricity coefficient of 0.171 it shows that an increase 1% in electricity results in an increase literacy of about 0.171 in every district and city in Indonesia.

The value of the sanitation water parameter coefficient is smaller than the electricity parameter coefficient, this shows that the impact of sanitation water on literacy is smaller than the electricity. Electricity is a basic component for all activities in every social and economic sector. Whereas sanitation also affect the literacy through domestic activities support.
There are several reasons why people cannot read and write characters. First, illiteracy is caused by the population in the provinces in eastern Indonesia where the provinces are far from the central government. So specifically, for the islands of Java and Sumatra, most people can read or literate, on the contrary conditions outside Java, Bali, and Sumatra. Furthermore, the illiterate population is usually the poor in Indonesia.

The next cause is that they live in rural areas of Indonesia. These villages are usually located in areas that are difficult to reach. Most of those who are illiterate are women. This happens because they are victims of a patriarchal culture that promotes men in many fields. Furthermore, most of the illiterate people are over 45 years old. People under 45 are literate, all literate. Because maybe the success of the 12-year compulsory education program. So the productive age up to 45 years are able to work. However, at present, it is quite difficult to reduce the population again which is 3.2 percent of the population.

Geographical factors are also an obstacle for the government in eradicating illiteracy in Indonesia. Illiterate people live in remote and difficult to reach villages. The illiterate people who live in the village are also not easy to find. Thus, the Ministry of Education and Culture of the Republic of Indonesia carries out illiteracy eradication using a block or cluster system, namely by concentrating programs in illiterate densely populated areas. The Ministry of Education and Culture also implements a post-illiteracy program. These programs include independent business literacy education and multicultural education. Independent business literacy education is oriented towards literacy maintenance with a focus on independent business skills.

In addition, the School Reading Gardens, libraries are also used to retain new reading residents. Because reading is a skill and must always be trained. Especially for those who are over 45 years old. If it has been taught, but there is absolutely no text that is communicated by their sight. There is no television, running text and others. This does not help them remember what he has learned, so there is the potential for illiteracy again.

Conclusion

Based on the description in the discussion and findings above, the availability of sanitation water and electricity has a positive effect on literacy in 501 districts and cities spread throughout Indonesia. The existence of water in daily life activities has a very crucial role in all corners of Indonesia. So far, sanitation water is provided and managed by local government companies at low prices so that all households can access it. Result of research proved that sanitation improves mental health of individuals, so that better mental health increase literacy rate.

This case in Indonesia, water is not only a basic need but also has a powerful function to support literacy in every region in Indonesia. The value and benefits of water are not only powerful for literacy program but also have a very large multiplier effect, so sanitation water is a key component for people's life.

The results of this study prove that electricity improves literacy. The availability of electricity makes lighting in the house every day. Thus, people tend to be eager to learn and especially basic learning. Through this process, the literacy rate is increased than before electricity.

Until 2020, due to several geographical and scattered factors, regional remoteness, poverty, and culture. It is difficult for the government to reduce the number of illiterate people to below 3.2 percent of the population. Therefore, we propose this model to support literacy programs in Indonesian territory. With this econometric model, we hope to form an enabling circumstance through sanitation and electricity.

References


**Acknowledgements**

The researchers would like to thank to Office of Research and Publication (ORP) of Faculty of Economics and Business Universitas Pelita Harapan, Karawaci, Tangerang Indonesia for financially supporting the research and community development.
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