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The Impact of Suramadu Bridge on Rural Poverty in Kabupaten Bangkalan, East Java, Indonesia

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Abstract

Poverty can be found in a developing country especially in the rural area, including Kabupaten Bangkalan, East Java, Indonesia. One of the reasons is the limited mobility and accessibility. To overcome this problem, the government has built the Suramadu bridge which connects Kabupaten Bangkalan in Madura island with Kota Surabaya in Java Island so that the mobility and accessibility in both areas can be better. This study aims at measuring how big the impact of Suramadu bridge development on rural poverty in Kabupaten Bangkalan, using village potential data in 2007 and 2017 by Badan Pusat Statistik (Central Agency of Statistic). The dependent variable is the amount of poor population and the independent variable consists of physical capital, human capital, natural capital and financial capital which analyzed by using OLS. Suramadu bridge has negative impact on poverty which means after the Suramadu bridge operates, the poverty level in rural area is decreased. Before the Suramadu bridge operates, it was only natural capital that gives impact on poverty while after the Suramadu bridge operates, all of the independent variables give an impact on poverty reduction. The existence of Suramadu bridge can ease the government on issuing the poverty reduction policy in rural area.

Keywords: Poverty, Infrastructure, Village, Regional

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1. Introduction

Poverty can be found in rural area especially in a developing country, including Indonesia (Heineman et at, 2011). In 2017, the number of poor people is around 26,98 million by comparison 10,67 million (39,54%) in town area and 16,31 million (60,45%) in rural area (BPS, 2018). The high number of poverties in rural areas indicates that rural development is not optimal in utilizing the existing resource (Hayami, 2001). This condition becomes worse due to the backwash-effect of rural development so that the existing resource

(human capital, natural capital and financial capital) in rural area distributed to town area (Ke &Fesser, 2010).

The development paradigm is changing for several last decade. The development which emphasized in the town area at first by using macro indicator has changed into specific and regional development. A Trickle-down effect that expected to stimulate rural development did not happen. Town area grows more and develops faster while rural area is unable to catch up. (Rustiadi et al, 2009).

The description of the lack of trickle-down effect can occur in Kabupaten Bangkalan. It is in East Java province which is one of the underdeveloped regions with high poverty rate. Geographically, the location is not far from Kota Surabaya as the capital city, but it is separated by Madura strait along 5 km. in 2004, the Suramadu bridge which connects Kabupaten Bangkalan and Kota Surabaya was built and started to operate in 2009. During the Suramadu bridge operates, the mobility and accessibility in both areas becomes higher.

Many of the research outcome said that transportation infrastructure development has a positive impact on area development. Laird & Venables, (2017) explained that road infrastructure has positive impact on area development through interaction linkage between infrastructure and area development by using theory: (1) the theory which showed infrastructure and area development (2) the theory that emphasizes on infrastructure as an important factor of area development; and (3) equal development which emphasized the role of infrastructure and economic development in the area. The road infrastructure service availability can increase efficiency and household welfare by reducing the household expenditure such as electricity, water, telecommunication, and fuel. Transportation infrastructure has a direct impact on easiness, efficiency, safety, security, health, education, information network development, creating job vacancy and environment. The road infrastructure availability improves the residents' accessibility and mobility to open the business opportunity for residents which made many job vacancies can increase the income and decrease the poverty (Rammelt & Leung, 2017).

On the other hand, the economic impact of beneficial infrastructure is not singular but consists of many factors that are interrelated and related. There are several other factors such as physical capital, natural capital, human capital and financial capital which results in reducing poverty. Education and skills will increase the ability, experience and education level of the resident. A high level of education and skills will reduce the level of resident's poverty (Ogutu & Qoim, 2019). The available access of credit among residents will encourage them to open a business and reduce poverty (Agbola et al, 2017). Clean water source availability for people's lives increases the quality of life and

the existence of superior products indicates the comparative advantage of the village in reducing poverty (Broeck & Maertens, 2017). The use of land for buildings encourages residents to open businesses in villages to reduce poverty (Akotey & Adjasi, 2015). The wide area of rice fields and irrigated ones will increase residents' businesses and reduce poverty levels (Nashwari et al, 2017). The existence of farmers will increase the number of businesses and reduce poverty (Larson et al, 2016).

This research was conducted to measure the impact of the Suramadu bridge on poverty in Kabupaten Bangkalan. Besides, it aims to measure the impact of production factors such as physical capital, natural capital, human capital and financial capital on poverty before and after the Suramadu bridge operates.

2. Literature Review

The World Bank defines infrastructure by the availability of facilities and means of transportation, telecommunications, sanitation and clean water, education, health, irrigation and energy to meet public needs (World Bank, 1994). Road has a role in creating value of goods. Following neoclassical theory, an item has a value under the cost of production or specifically by the cost of labor's sacrifice spending. The road is a tool that can create higher value on an item to meet customer satisfaction. In this case, the road provides value for an item through the process of moving goods from the center of production to the center of consumption. The creation of value for goods by the road makes it an economic valuable tool (Polak & Heertje, 2001).

The road transportation system was built to increase access and mobility of goods/services so that the transfer of basic needs from the source of production to the final consumer went well. The road's capacity development or improvement will cause industries to move near the location of the road and close to each other so that production costs will be lower. Declining production costs are also the reason for agglomeration and trade-off between economic scale and transportation costs. Companies that sell goods on the urban market can minimize costs by moving factory locations further away but larger production capacities or factory locations which is close to markets but smaller production capacities (Anderson & Lakshmanan, 2004).

Purwoto and Kurniawan (2009) explain the benefits of road construction can be measured by increasing mobility and efficiency that occurs among residents. Increasing the quality and quantity of roads will encourage the traffic of people, goods, and services carried out by the residents within the region as well as inter-regional mobility. In the economic context, the existence of the road will increase the productivity of road

transportation which results in cost efficiencies either in the cost of non-production household transportation and production household transportation. Increased cost efficiency means that there are cost savings calculated per unit of production or unit of consumption so that the potential of the region can be exploited by the existence of the road. On the other hand, roads will also give benefit from the increasing income from sectors that supply inputs (labor, capital, and raw materials) in their development. An increase in income also means an increase in people's purchasing power which in turn will have an impact on increasing resident economic activity.

The concepts and definitions of poverty are quite diverse, and the diversity is caused by different data and methodologies, as well as the background of the methodology adopted by experts and institutions, influences in defining the problem socially and economically. The measurement of poverty is compatible with the concepts and definitions carried by each economic institution and country in measuring poverty, as Todaro and Smith (2003), states that the percentage of the poor population can be measured with or without reference to the poverty line. In addition, the measure of poverty, as a difference in opportunities to accumulate social forces which includes: 1) assets such as land, housing, equipment, and health; and 2) financial resources (adequate income and credit), socio-political organizations, and social networks to obtain jobs, goods or services, adequate knowledge and skills, and useful information. The limitations of getting an opportunity to try also influence someone to earn an income to meet the minimum basic needs that must be fulfilled. Low income is also used as a measure of poverty, but social, environmental and even empowerment aspects and the level of participation also contribute to influencing these limitations.

3. Methodology

This study uses a model used by Nashwari et al (2017) which examines the characteristics of poverty at the village and sub-district level in Jambi Province, Indonesia. The difference is the addition of physical capital variables, namely the existence of the Suramadu bridge. The model was analyzed using Ordinary Least Square (OLS) in the conditions before and after the Suramadu bridge operates. Analysis was conducted descriptively on all research variables and econometrically in determining the effect of the independent variables on the dependent variable.

This research was conducted in 281 villages in Kabupaten Bangkalan. The data source uses secondary data from Potential Villages in 2007 which describe conditions before the Suramadu bridge operates and Village Potential in 2017 which describe conditions

after the Suramadu bridge operates. Village Potential is the data released by the Central Statistics Agency which contains the condition of villages in Indonesia which is done every three years.

The dependent variable in this study is the percentage of the number of poor people in the village, which is measured by using the number of affidavit (SKTM) approach issued by the village. There are 14 independent variables used in this study, i.e.: (1) the percentage of the population who work as farmers (%), (2) the percentage of rice field (%) and (3) irrigated rice field (%), (4) the number of non-agricultural businesses in villages such as shops, stalls, micro and small industries (%), (5) percentage of land used as buildings (%), (6) population who migrated abroad as Indonesian workers (%), (7)) the status of the village in access to clean water (dummy, 1 = village is not constrained by the access to clean water), (8) the presence of superior products in the village (dummy, 1 = village has a superior product), (9) the existence of market in the village (dummy, 1 = village has a market), (10) the number of educational facilities in the village consisting of elementary, junior high or equivalent, high school or equivalent and tertiary institutions (%), (11) the existence of skills facilities in the village such as clothing, language, electronics, etc. (dummy, 1 = village has skills facilities), (12) the existence of credit institutions in the village such as Banks and Cooperatives (dummy, 1 = there are credit institutions in the village), (13) the existence of credit program in the village such as people's business credit (*Kredit Usaha Rakyat*), food & energy security credit (*Kredit Ketahanan Pangan dan Energi*), small business credit (*Kredit Usaha Kecil*), etc. (dummy, 1 = there is credit program in the village) and (14) the existence of the Suramadu bridge by making the 2007 poverty variable as an independent variable.

4. Results and Discussion

4.1. Results

Table 1. shows the results of descriptive statistics from the research variables. The average poverty in the village in 2007 was 1,952% and decreased to 1,576% in 2017. The average number of farmers in the village in 2007 was 71,402% and decreased to 67,342% in 2017. The declining number of farmers also occurred in the area of irrigated rice fields and the existing villages, in 2007 the area of rice fields and irrigated rice fields were 37,703% and 6,605%, while in 2017 they were 21,480% and 4,935%.

Non-agricultural businesses in the village in 2007 were 1,449% and increased to 1,526% in 2017. The same condition was occurred in the percentage of the building area

in the village, in 2007 there are 13,271% of the land became buildings and increased to 19,971 % in 2017. Meanwhile, there are 3,173% of villagers migrated abroad in 2007 and increased to 4,019% in 2017.

Most of villages in Bangkalan have difficulty in accessing clean water, especially during the dry season, only 42,321% of villages have guaranteed access to clean water. On the other hand, only 22,378% of villages had superior products in 2007 and increased to 32.345% in 2017. Less than a quarter of villages have markets in the village. Likewise, the existence of skills facilities was only spread out in 14,234% of villages in 2017. In 2007, credit institutions were found in 12,832% of villages and credit programs in 14,215% of villages, while in 2017, credit institutions were found in 17,327% of villages and credit programs is in 37,038% of villages.

Table 1: Descriptive Statistics of Research Variables.

No	Variable	Before Suramadu Operates		After Suramadu Operates	
		Mean	Std Dev	Mean	Std Dev
1	Poverty (%)	1.952	0.816	1.576	0.571
2	Number of Farmers (%)	71.402	23.093	67.342	23.44
3	Rice Field Area (%)	37.703	35.474	21.480	21.32
4	Irrigated Rice Field Area (%)	6.605	14.363	4.935	11.11
5	Non-Agriculture Business (%)	1.449	2.172	1.526	0.498
6	Building Area (%)	13.271	18.791	19.971	17.427
7	Abroad Migration (%)	3.173	4.956	4.019	9.092
8	Clean Water Access (dummy)	42.321	-	42.321	-
9	Superior Product (dummy)	22.378	-	32.345	-
10	Market Access (dummy)	22.123	-	24.124	-
11	Educational Facilities (%)	0.129	0.088	0.128	0.084
12	Skills Facilities (dummy)	9.265	-	14.234	-
13	Credit Institution (dummy)	12.832	-	17.327	-
14	Credit Program (dummy)	14.215	-	37.038	-

Source: Village Potential, 2017, 2007

Table 2. shows the results of the econometric statistics of the influence of the independent variables on poverty in the village. In model before the Suramadu bridge operates, the model has a significant effect on poverty with R^2 of 24.44% or the poverty in the village before Suramadu operates can be explained by the model of 24.44%. Meanwhile, many factors of production in the village do not have a significant effect on poverty. Only the clean water access variable has a negative effect on poverty, it means that villages with guaranteed access to clean water have an impact on the

number of poor people who are getting smaller compared to villages that have difficulty in accessing clean water

In the model after the Suramadu bridge operates, it can be seen that the model has a significant effect on poverty in the village with R^2 of 22.34% or poverty in the village before the operation of the Suramadu bridge can be explained by the model of 22.34% while the rest is influenced by other factors outside the model. The Suramadu Bridge has a negative effect on poverty, this means that the Suramadu Bridge reduces poverty in the village. Suramadu Bridge, which facilitates the access and mobility of goods and services, encourages people to open businesses or make it easier for residents to get to work, followed by increasing income, which in turn reduces poverty levels.

The number of farmers and rice fields has a negative effect on poverty, it means that the more farmers and rice fields in the village, the lower the poverty rate is. Non-agricultural activities from the percentage of building area have a negative effect on poverty in the village, it means that villages with higher non-agricultural activities have lower poverty levels.

Besides, the existence of a superior product in the village has a negative and significant effect on poverty levels among people. The superior products produced by the village reflect the superiority of the village because it is supported by natural conditions or the expertise possessed by its inhabitants. Leading products will trigger the growth of residents' businesses and become a source of income which will reduce poverty in the village.

The existence of skills facilities also has a negative and significant effect on poverty levels. The more presence of skills facilities in the village will improve resident skills, thereby creating opportunities for communities to open businesses, which in turn will increase income and reduce poverty. The existence of credit facilities has a negative and significant effect on poverty levels. People's businesses that require capital are easier with the availability of credit facilities in the village. This condition triggers the residents to do business in the village whether it is new businesses or business development which will reduce poverty among them in turn.

4.2. Discussion

Investment in transportation infrastructure is often done to have an impact on the economic performance of a region. There is a hope that good transportation acts as a catalyst for private sector investment, creates jobs, increases economic activity and grows the local economy. Improved transportation enables time and cost savings

Table 2: The Impact of Suramadu Bridge on Rural Poverty.

No	Variable	Before Suramadu Operates	After Suramadu Operates
1	Suramadu Bridge	-	-0,075* (0,039)
2	Number of Farmers	0,000 (0,002)	-0,003** (0,001)
3	Rice Field Area	0,000 (0,002)	-0,005*** (0,003)
4	Irrigated Rice Field Area	0,002 (0,005)	-0,003 (0,003)
5	Non-Agriculture Business	0,011 (0,024)	0,014 (0,111)
6	Building Area	0,004 (0,003)	-0,008*** (0,002)
7	Abroad Migration	0,004 (0,010)	0,002 (0,003)
8	Clean Water Access	-0,224** (0,110)	-0,029 (0,077)
9	Superior Product	0,141 (0,111)	-0,161* (0,981)
10	Market Access	0,009 (0,117)	-0,114 (0,082)
11	Educational Facilities	-0,051 (0,596)	-0,401 (0,382)
12	Skills Facilities	0,069 (0,187)	-0,166* (0,097)
13	Credit Institution	-0,139 (0,158)	-0,288*** (0,093)
14	Credit Program	0,132 (0,150)	0,010 (0,075)
15	C	1,776*** (0,233)	2,426*** (0,202)
N		281	281
Prob > F		0,0497	0,0000
R^2		0,2444	0,2234

Source: Village Potential, 2017, 2007

Notes: *** p < 1%, ** p < 5%, * p < 10%

for users consisting of individuals and households in their work activities as well as companies that need to move goods, services and employees. Time and cost savings change the flow of traffic which leads to increased flow in some parts of the network and less traffic in other parts. A good transportation can increase proximity, bring economic agents closer and trigger the relocation of economic activity because companies and households respond to new opportunities. Improved transportation enables savings in transportation and communication costs for companies, workers and consumers, which in turn makes transportation cheaper, more reliable and faster, allowing companies to change the way they manage their production (Laird & Venables, 2017).

Proximity and relocation create densities that make economic activity and productivity more effective. It exceeds the direct productivity effect of faster travel because intense economic interactions occur in economically large and dense places. Improved transportation will make affected locations more attractive for investment. The benefits experienced by residents, workers, and companies can cause investment to occur and

change the land use. Transportation can also increase labor supply due to easier travel that occurs and on the other hand, will create demand in some places even if it lost in other places (McFadden & Gorman, 2016; Laird & Venables, 2017). The condition is also expected to occur with the Suramadu bridge which increases access and mobility in Kabupaten Bangkalan to make the poverty level decreases.

The number of farmers has a negative effect on poverty so that more farmers will reduce poverty levels according to research by Larson et al (2016), Hazzel et al (2010) and Bezemer & Headey (2008). The main characteristic of farmers in Kabupaten Bangkalan is the very small land ownership. In 2013 it was noted that the number of agricultural business households with an area of land controlled less than 0.5 hectares was 55.33% so that the efficiency and productivity would be difficult to achieve and also an increase in economic income and welfare would be very difficult to obtain. As a result, the small share of farmer's incomes encourages the farmer to look for other sources of income outside the agricultural sector because the bargaining power of farmers for agricultural products produced is relatively low. Small farmers and farm workers experience a deficit in income from the agricultural sector (income from the agricultural sector alone is not enough to finance their families) so they are forced to look for labor-intensive and less-capital jobs such as small shops, traders, handicrafts, working in services and so on (Nashwari et al, 2017).

The effect of small-scale farming on poverty reduction is more pronounced because it is based on the inverse hypothesis that the relationship between productivity and efficiency results in allocations is higher on small-scale agriculture. An increase in small-scale agricultural income can directly result in poverty reduction and creates a multiplier effect through the consumption relationship of small-scale farmers who are more likely to be poor and spend additional income on locally produced of non-agricultural goods and services thereby it can stimulate the non-rural agricultural economy. This shows that smallholders can allocate resources more efficient and operate with high-efficiency allocations which is suitable to fulfill local and regional markets (Larson et al, 2016).

The influence of farmers' number on poverty is further explained by Mellor & Malik (2017) said that regions with low and medium incomes, overcoming poverty in rural areas are done by accelerating the growth of agricultural production and income from small farmers. The mechanism of reducing poverty occurs by increasing farmers' expenditure to be utilized for the non-agricultural rural sector so that it increases income for the non-agricultural rural population and reduce poverty levels. Small farmers are households that produce agricultural products that are above the poverty line, but they are still not enough to maintain a lifestyle in urban life. The same result is also explained by

Imai et al (2017) who explain that the high growth of the agricultural sector creates more poverty reduction compared to the non-agricultural sector. Also, the development of the agricultural sector is the most effective poverty reduction compared to non-agricultural businesses.

Rice field area has a negative effect on poverty according to the research of Mazumder & Lu (2015) and Nashwari et al (2017). Increasing the area of rice fields will increase the scale of agricultural business that will encourage the growth of resident's businesses that support agricultural activities. Fertile land will increase non-farming because it has more free time (McNally, 2001). Vulnerable agriculture such as rain-fed agriculture and those without productive factors can increase non-agricultural businesses (Knanal & Mishra, 2015).

Building area has a negative effect on poverty level according to the results of research by Akotey & Adjasi (2015) and Nashwari et al (2017). An increase of building area shows the increase in land use for non-agricultural businesses. The increase in building area shows directly an increase in business done by the residents to reduce poverty levels.

Skills facilities have a negative effect on poverty following the results of research by Ogutu & Qoim (2019). The performance of resident's businesses in the village is very much influenced by the level of their skills, the higher the level of resident skills, the more their business increases. A high level of skills will increase the ability of resident to do business. It will also increase the ability to find opportunities and make decisions (McElwee, 2006). Residents in making business decisions will usually seek advice from their family, friends and support groups according to their level of education and skills. The bad and inconsistent advice will limit the decision to do non-agricultural business. Education will improve one's abilities, skills, mental behavior. The existence of skills facilities will increase residents' opportunities to improve their abilities, skills, and mentality better. This will provide greater opportunities for work and reduce poverty (Ogutu & Qoim, 2019).

The existence of credit facilities in the village has a negative effect on poverty level following the results of Dupas & Robinson's research (2013). The availability of credit facilities can increase the access and the use of credit by the public. By the more open access to credit, the public is expected to be able to take advantage of this access and increase their income through lending, especially if it is used for productive activities. Difficult access to credit causes resident must rely on limited savings for investment and small entrepreneurs must rely on profits to continue the business. As a result, income inequality has not diminished, and economic growth has slowed. The role of credit in

the economy can mean creating jobs, whether it is through expansion of production and other business activities or through its influence in encouraging the emergence of new business units. Besides, credit can be directed towards equal distribution of business opportunities, among others through the allocation of credit according to development priorities and economic groups to expand the distribution of development outcomes. In this connection, the government policy adopted in the credit sector is directed to finance economic sectors that have high productivity so that the allocation of funds can be achieved more efficiently. Research conducted by Agbola et al. (2017) states that credit institutions and credit programs play an important role in reducing poverty and increasing living standards in the Philippines so that the efforts need to be made to expand programs to reduce poverty in the Philippines.

5. Conclusion

The existence of the Suramadu bridge increases the influence of production factors in the village in reducing poverty in Kabupaten Bangkalan. The results of this study support many of the previous study's results in which transportation infrastructure can increase mobility and accessibility is a catalyst in reducing poverty. Before the Suramadu bridge operates, the factors of production that could reduce poverty in the village were only access to clean water which illustrates the role of natural capital in rural economic development. Different conditions occur when the Suramadu bridge operates, where physical capital (building area), natural capital (rice field area, superior products), human capital (skills facilities) and financial capital (credit facilities) also play a role in reducing poverty in rural areas.

The implication is that the policy makers must be able to maximize the existence of the Suramadu bridge by making Kabupaten Bangkalan as a supporter of regional growth centers. The center of growth in East Java is in Kota Surabaya, which is on one side of the Suramadu Bridge so that the proximity of the location can make Kabupaten Bangkalan as a provider of housing, trade and tourism facilities. The agricultural sector still has a large role in reducing poverty in rural areas even though the area of rice fields has decreased after the Suramadu bridge operates so that the protection of agricultural land must be increased because the majority of the rural population still works in the agricultural sector.

The increasing presence of non-agricultural businesses does not affect poverty, this is due to the scale of non-agricultural businesses which are small-scale are unable to obtain enough and continuous results for the residents. However, the building area that

represents non-agricultural activities in the form of housing or warehousing plays a role in reducing poverty so that the trade activities on a large scale must be increased. The presence of migrants abroad does not influence poverty, this shows that the money of migrants returning to the village is not distributed for productive business but for the daily needs of the family that left behind.

The superior products owned by the village influence poverty so that it is important to make serious efforts in developing rural superior products. Suramadu Bridge has encouraged people to visit Kabupaten Bangkalan and they need gifts, souvenirs or food that can be provided by residents in Kabupaten Bangkalan. The existence of a market in the village did not influence the poverty reduction because the scale of the business of a small market economy and the limited involved residents were not significant in increasing resident businesses.

The existence of human capital is illustrated by educational and skills facilities where only the existence of skills facilities influences poverty reduction. This shows that the educational facilities in the village are generally basic education that does not play a role in improving skills. Improving residents' skills can be facilitated by the existence of skills facilities to encourage resident in entrepreneurship.

The existence of credit facilities, especially cooperatives, must be used as a means of reducing poverty in rural areas through increasing the number of cooperatives as providers of resident financial capital. The existence of credit program whose purpose is to reduce poverty does not actually affect poverty. This condition is suspected that many credits program are not properly targeted so there are many credits programs are received by the resident who are not eligible to receive them.

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