Spatial modeling on the influence of social network and infrastructure accessibility on the number of poverty alleviation program recipients in Budaya Pampang Village

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Abstract. The poverty rate in Samarinda has not decreased significantly from 2014 until 2019 even though 15 poverty alleviation programs have been implemented by the Government. The insignificant decrease in poverty can be caused by the wrong identification of the causes of poverty. Infrastructure accessibility, social network, and spatial factors are the factors that are rarely identified in the formulation of poverty alleviation strategies. Budaya Pampang has the highest percentage of the population in terms of recipients of poverty alleviation assistance funds, namely 58.9% of the total population in the Village. Therefore, this study was conducted to determine the effect of social network and infrastructure on the number of poverty alleviation assistance funds in Budaya Pampang Village and its surroundings using the spatial regression analysis. Based on the analysis results, it is found that a model stating that 94.7% of poverty in Budaya Pampang Village and its surroundings is influenced by indicators on aspects of the social network and infrastructure accessibility. The relation between the level of social network and poverty is that the higher the level of social network, the lower the level of poverty will be. Meanwhile, the farther a person in accessing infrastructure services, the higher the poverty rate will be.

1. Introduction

According to The Universal Declaration of Human Rights, it is stated that every individual has the right to a decent standard of living[1]. Meanwhile, poverty is a phenomenon that continues to exist in all regions in Indonesia which occurs due to the inability of some people to carry out their lives based on certain conditions.

Samarinda City has a development problem in the form of poverty issues. To reduce the existing poverty rate, the government of Samarinda has made several efforts in the form of strategies and work programs for poverty alleviation. However, the poverty rate in Samarinda has not decreased significantly and is stable at 4% from 2014 until 2019 [2]. According to Integrated Social Welfare Data 2019, Budaya Pampang Village is a village with the largest percentage of the population as recipients of poverty alleviation assistance in Samarinda City, which is 58.9% of the total population in the Village.

In general, it has been known that the availability of the basic infrastructure was one of the main catalysts for decreasing or increasing poverty in areas [3]. The role of infrastructure is to provide an access to health care, access to clean water, access to education, electricity, trade access, and others [4][5]. Therefore, equitable public accessibility in reaching basic infrastructure is necessary to minimize the cost burden and fulfill the basic needs of poor households [4].
Also, some of the opinions stated, there is a link between social networks with poverty alleviation through poor household participation in following community institutions in an area [6]. It can help people escape from the poverty line by providing opportunities, resources, and information that can only be accessed by someone in the available institutions[7]. Social networks in an area need to be identified because people cannot escape from the poverty line independently but rather need to work together with other communities[8].

Social network and community accessibility toward infrastructure, as well as spatial factors, are the factors that can affect the poverty rate in the area. To alleviate the poverty rate it is very necessary to know the main causes of poverty in the community[1]. Therefore, the objective of this study is to determine the effect of social network and infrastructure on the number of poverty alleviation assistance funds in Budaya Pampang Village and its surrounding using the spatial regression method.

2. Methods

2.1. Time and Research Site
Data has been collected from January until March 2019. The research location is in Budaya Pampang Village and its surrounding which consist of 12 neighborhoods with a total area of 32,8 Km². We used Random Sampling to choose who is the poor household that would be the sample for this research.

2.2. Data Collection Method
In this study, data were collected through a primary survey using an interview technique to the research sample. Determination of the number of samples was done by using the Slovin method with an error rate of 5%

\[ n = \frac{247}{1 + 247(0.05)^2} = 153 \]  

Thus, the number of samples used in this study was 153 poor households in 12 Neighborhoods in Budaya Pampang Village and its surroundings through Table 1
### Table 1. Population and sample

| Villages         | Neighborhoods | The Population of Households Receiving Poverty Alleviation Program | Proportion to Number of Samples | Number of Sample Households |
|------------------|---------------|-------------------------------------------------------------------|--------------------------------|-----------------------------|
| Budaya           | 1             | 22                                                                | 9%                             | 14                          |
| Pampang          | 2             | 22                                                                | 9%                             | 14                          |
|                  | 3             | 9                                                                 | 4%                             | 6                           |
|                  | 4             | 28                                                                | 11%                            | 17                          |
|                  | 5             | 30                                                                | 12%                            | 19                          |
|                  | 6             | 35                                                                | 14%                            | 22                          |
| Sempaja Utara    | 25            | 30                                                                | 12%                            | 19                          |
| Lempake          | 46            | 17                                                                | 7%                             | 11                          |
|                  | 47            | 11                                                                | 4%                             | 7                           |
|                  | 48            | 19                                                                | 8%                             | 12                          |
| Tanah Merah      | 22            | 20                                                                | 8%                             | 12                          |
| Sungai Siring    | 9             | 4                                                                 | 2%                             | 4                           |
| **Total**        | **247**       | **247**                                                           | **100%**                       | **153**                     |

2.3. **Research Variables**

The variables used in this study are based on literature reviews and their suitability for the research area as follows:

| Table 2. Research variables |
|-----------------------------|
| **Indicators**               | **Variables**                                                      |
| Poverty Level                | Households receiving poverty alleviation assistance               |
| Rate of Participation Level  | Number of institutional activities                                |
| Community Density Level      | Number of institutional activities                                |
| Centrality Level of Degree   | Number of institutional activities                                |
| Centrality Level of Closeness| Number of institutional activities                                |
| Centrality Level of Betweenness Centrality | Number of institutional activities |
| Electricity Infrastructure   | Distance to the power source                                      |
| Water Infrastructure         | Distance to clean water source                                     |
| Education Infrastructure     | Distance to Elementary School education facility                  |
| Health Infrastructure        | Distance to Community Health Sub-center facility                  |
| Economy Infrastructure       | Distance to market facility                                        |
| Transportation Infrastructure| Distance to the center of tourist activities                      |
|                             | Distance to public transportation                                 |

2.4. **Analysis Method**

The analysis technique used at this stage is in the form of spatial regression analysis which is carried out by using Geoda Software. This analysis is to determine whether there is an effect of social networks and infrastructure accessibility on the poverty rate in Budaya Pampang Village.
The basic input for this analysis is the value of the level of social networks in Budaya Pampang Village and its Surroundings in Table 4, as well as the value of the level of community accessibility to infrastructure in Table 5 and Table 6.

Table 3. Spatial Regression Flow

| Input | Process | Output |
|-------|---------|--------|
| A shapefile for the administrative area of Budaya Pampang Village and its surroundings which has been filled with social network and infrastructure accessibility level variables | 1 Box map Data Exploration | Identify the presence or absence of extreme value data distribution (outliers) |
| | 2 Spatial Weight Determination | Identify the number of neighbors between Neighborhood areas |
| | 3 Spatial autocorrelation test | Correlation grouping of the amount of poverty alleviation between neighboring areas |
| | 4 Spatial Dependency Test | The best alternative estimation of spatial models |
| | 5 Spatial Regression | Form of spatial regression |

Table 4. Level of social network

| Neighborhoods | Rate of Participation | Density | Centrality |
|---------------|----------------------|---------|------------|
|               | Value | Category | Value | Category | Degree Centrality | Closeness Centrality | Betweenness Centrality |
| 1             | 1.35  | Medium   | 0.285 | Low      | 0.28             | 0.22                | 0.05                  |
| 2             | 1.5   | Medium   | 0.47  | Medium   | 0.23             | 0.09                | 0.02                  |
| 3             | 2.5   | High     | 0.8   | High     | 0.73             | 0.75                | 0.46                  |
| 4             | 1.08  | Low      | 0.287 | Low      | 0.22             | 0.31                | 0.18                  |
| 5             | 0.84  | Low      | 0.263 | Low      | 0.21             | 0.14                | 0.04                  |
| 6             | 0.63  | Low      | 0.221 | Low      | 0.05             | 0.15                | 0                     |
| 25            | 1.71  | Medium   | 0.761 | High     | 0.6              | 0.4                 | 0.02                  |
| 46            | 1.36  | Medium   | 0.345 | Medium   | 0.32             | 0.28                | 0.02                  |
| 47            | 1.15  | Low      | 0.26  | Low      | 0.25             | 0.19                | 0.07                  |
| 48            | 1.33  | Medium   | 0.3   | Low      | 0.25             | 0.19                | 0.07                  |
| 22            | 0.88  | Low      | 0.341 | Medium   | 0.24             | 0.22                | 0                     |
| 9             | 1.5   | Medium   | 0.5   | Medium   | 0.45             | 0.37                | 0.01                  |
| Average       | 1.36  | Medium   | 0.40  | Medium   | 0.31             | 0.26                | 0.03                  |

Table 5. Level of community accessibility to infrastructure I (Explanation: class/classification)

| Neighborhoods | Value of Accessibility to Clean Water Infrastructure | Class | Value of Accessibility to Electricity infrastructure | Class | Value of Accessibility to Elementary School Education infrastructure | Class | Value of Accessibility to Junior High School Education infrastructure | Class | Value of Accessibility to Equivalent Educational Institution infrastructure | Class |
|---------------|-----------------------------------------------------|-------|--------------------------------------------------|-------|---------------------------------------------------------------|-------|---------------------------------------------------------------|-------|---------------------------------------------------------------|-------|
| 1             | 12.94                                               | Low   | 13.23                                           | Low   | 445.64                                                         | Low   | 535.70                                                        | Low   | 25.01                                                         | Low   |
| 2             | 13.84                                               | Low   | 13.28                                           | Low   | 141.33                                                         | Low   | 171.02                                                        | Low   | 199.51                                                        | Low   |
| 3             | 10.27                                               | Low   | 10.07                                           | Low   | 67.85                                                         | Low   | 65.59                                                        | Low   | 294.79                                                        | Low   |
| 4             | 10.77                                               | Low   | 10.62                                           | Low   | 488.05                                                        | Low   | 458.97                                                        | Low   | 290.96                                                        | Low   |
| 5             | 286.13                                              | Low   | 911.85                                          | Medium| 2554.68                                                       | Medium| 2803.33                                                       | Medium| 3026.73                                                       | Medium|
| 6             | 1224.72                                             | High  | 4312.74                                         | High  | 5903.83                                                       | High  | 6123.31                                                       | High  | 6553.42                                                       | High  |
| 25            | 272.05                                              | Low   | 194.36                                          | Low   | 3973.30                                                       | High  | 4941.94                                                       | High  | 5065.27                                                       | High  |
| 46            | 10.44                                               | Low   | 10.57                                           | Low   | 812.32                                                        | Low   | 732.13                                                        | Low   | 824.40                                                        | Low   |
| 47            | 10.72                                               | Low   | 11.45                                           | Low   | 1589.61                                                       | Low   | 2722.90                                                       | Medium| 2847.45                                                       | Medium|
| 48            | 12.65                                               | Low   | 12.40                                           | Low   | 1257.26                                                       | Low   | 2741.19                                                       | Medium| 2834.93                                                       | Medium|
| 22            | 10.88                                               | Low   | 11.21                                           | Low   | 2384.64                                                       | Medium| 896.99                                                        | Medium| 142.71                                                        | Low   |
| 9             | 10.01                                               | Low   | 12.47                                           | Low   | 2719.91                                                       | Medium| 410.70                                                        | Low   | 2780.48                                                       | Medium|
| Average       | 157.12                                              | Low   | 460.35                                          | Low   | 1767.39                                                       | Medium| 1683.65                                                       | Medium| 2052.98                                                       | Medium|

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3. Result and Discussion

3.1. Regression analysis

3.1.1. Box map data exploration. Box map is used to determine whether or not there is data distribution with extreme value (outliers) in the dependent variable. If the data has an outlier value, the regression test cannot be performed and it is necessary to re-sort the data. In this study, there are no outlier values and the poverty level in Budaya Pampang Village and its surroundings could be categorized into 4 quartile poverty classifications, namely quartiles 1 to 4 as follows:

a. Quartile 1 consists of Neighborhoods 3 and 9 which have 4 to 9 households receiving poverty alleviation programs.
b. Quartile 2 consists of Neighborhoods 22, 46, 47 and 48 which have 17 to 20 households receiving poverty alleviation programs.
c. Quartile 3 consists of Neighborhoods 1, 2 and 4 which have 22 to 28 households receiving poverty alleviation programs.
d. Quartile 4 consists of Neighborhoods 5, 6 and 25 which have 30 to 35 households receiving poverty alleviation programs.

3.1.2. Spatial weight. Spatial weight is used to explain the existence of a neighbor relation between one area and another so that it can be seen the connectivity between Neighborhoods in Budaya Pampang Village and its surroundings. The minimum number of neighbors formed is 1 Neighborhood and the most are 3 Neighborhood.

3.1.3. Spatial autocorrelation. Spatial autocorrelation is used to determine the spatial influence between the observed values, namely the number of recipients of poverty alleviation assistance. This figure can be illustrated by the LISA (Local Indicator of Spatial) assessment. These outputs, namely the level of significance between regions in influencing the surrounding area to the variables tested and grouping the regions.

Based on the relation between regions to spatial patterns in poverty levels, there are 3 clusters formed, namely Not Significant, High-High, and Low-Low. Not significant means that Neighborhoods 1, 2, 4, 9, 22 and 46 are areas where the level of poverty is randomly distributed and the poverty level is not affected by the surrounding area. Then, for the Low-Low category, it is a Neighborhood area that has a low poverty level value surrounded by surrounding areas which also has a Low value with a significance value of 0.01 for Neighborhood 3, and a significance of 0.05 for Neighborhoods 47 and RT 48.
Besides, for the High-High category, Neighborhoods 5, 6, and 25 are areas that have a High poverty rate surrounded by areas that also have a High poverty rate. Thus, it needs to be the focus of poverty alleviation areas. The results of the spatial autocorrelation can be seen in Figure 2.

Figure 2. Spatial Autocorrelation Map

3.1.4. Spatial dependency test. There are 3 types of model approaches that can be used to estimate the influence of the tested variables in spatial regression, namely the Classical Model, the Lag Spatial Regression Model, and the Error Model. To choose the best model in estimating it, a spatial dependency test must be carried out first by following the provisions of the alternative assessment test for the spatial model which is regarded to be significant if it has a probability level below 0.05.

a. The classic model is chosen if the two Lagrance Multiplier (LM) values are not significant.
b. The Spatial Lag model is chosen if the Lagrance Multiplier (Lag) and Lagrance Multiplier (Error) values are significant.
c. The Spatial Error Model is chosen if the Robust LM (Lag) and Robust LM (Error) values are significant.

Table 7. Result of spatial dependency diagnosis

| Coefficients           | Probability | Remark     |
|------------------------|-------------|------------|
| Moran’s I              | 0.00577     | Significant|
| Robust LM (Lag)        | 0.02579     | Significant|
| Robust LM (Error)      | 0.32329     | Not Significant|
| Lagrance Multiplier (Lag) | 0.00029 | Significant|
| Lagrance Multiplier (Error) | 0.00252 | Significant|

According to the spatial dendency test, the best model to estimate the effect of social network and infrastructure on the number of poverty alleviation assistance funds in Budaya Pampang Village is using the spatial lag.

3.1.5. Spatial Regression Model. The value of R Squared in Table 8 illustrates the percentage level of the model suitability in conducting the influence test between variables. The R Squared obtained is 0.947329, indicating that the influence of the poverty rate in Budaya Pampang Village and its surroundings is 94.7% influenced by social networks and community access to infrastructure. The remaining 5.3% is influenced by other variables that are not included in this regression. There is a Breusch-Pagan Test Probability value which is the value used to detect heteroscedastic, where the residual variance (error) of the data is not constant in all observed data to be tested by using linear regression. In this research we found the Breusch-Pagan Test Probability value is 0.49035 > 0.05 it means there is no heteroscedastic.
Table 8. Result of Spatial Regression

| Variables                                                                 | Coefficient | Probability | Remarks   |
|--------------------------------------------------------------------------|-------------|-------------|-----------|
| Constants                                                                | 2.5855676   | 0.00922     | Significant |
| $X_1$ Rate of Participation                                              | -0.5092018  | 0.00089     | Significant |
| $X_2$ Community density Level                                             | -0.60218387 | 0.00973     | Significant |
| $X_3$ Degree Centrality Level                                            | -0.04921833 | 0.00681     | Significant |
| $X_4$ Closeness Centrality Level                                         | -0.00187162 | 0.00435     | Significant |
| $X_5$ Betweenness Centrality Level                                       | -0.00621271 | 0.00191     | Significant |
| $X_6$ Distance to clean water infrastructure                             | 0.03220482  | 0.00463     | Significant |
| $X_7$ Distance to electricity infrastructure                              | 0.08294019  | 0.00628     | Significant |
| $X_8$ Distance to elementary school education facility                    | 0.00449203  | 0.00785     | Significant |
| $X_9$ Distance to Junior High School Education infrastructure            | 0.00031844  | 0.00066     | Not Significant |
| $X_{10}$ Distance to Equivalent Educational Institution infrastructure    | 0.00009381  | 0.06593     | Not Significant |
| $X_{11}$ Distance to Health Infrastructure for Community Health Sub-center | 0.00010999  | 0.03784     | Significant |
| $X_{12}$ Distance to Market Economy Infrastructure                       | 0.00440125  | 0.06823     | Not Significant |
| $X_{13}$ Distance to center of tourist activity facility                 | 0.00731844  | 0.00046     | Significant |
| $X_{14}$ Distance to Public Transportation Infrastructure                | -0.0193829  | 0.94295     | Not Significant |

From 14 independent variables tested, 10 variables that are significant in influencing the existing poverty level as seen from the probability value less than 0.05. 4 variables that are not significant or have a probability value above 0.05, namely the distance to public transportation, distance to junior high school education facility, equivalent educational institutions for packets A and B, distance to environmental market economic facility, and distance to public transportation services. Next, the coefficient value is a value that describes the magnitude of the influence of the independent variables on the poverty level. From these results, the form of the model made is as follows:

$$Y = 0.356527W + 2.5855676 - 0.5092018X_1 - 0.6021838X_2 - 0.0492183X_3 - 0.0018716X_4 - 0.0062127X_5 + 0.0322048X_6 + 0.0829401X_7 + 0.0044920X_8 + 0.0001099X_{11} + 0.0073184X_{13}$$

Based on the model above, there is a constant value of 2.5855676 which means that if all independent variables are ignored or not increasing, the poverty rate is 2.5855676. The $W$ value is the value that appears when there is a spatial autocorrelation event that occurs in the observation area. The $W$ value of 0.356527 means that the poverty rate in a Neighborhood is influenced by the poverty rate around it which is 0.356527 multiplied by the number of neighbors. From that model we could explain about the influence of social networks infrastructure accessibility on poverty.

3.2. The influence of social networks on poverty

According to the previous research, to deal with poverty, alleviation must use the approach of a social network between villagers that may open more possibilities to move out from poverty towards local and extra local resources mobility, especially information resource [9]. It is matched on the result of the analysis of the rate of participation, density and centrality as a part of social networks significantly affecting poverty in Budaya Pampang Village. In detail we could see that neighborhood 3 which has a high rate of participation value with an average of 1 household participating in 3 institutions and has a high-density which villagers can reach the flow of communication by 80% having 9 poor households. Meanwhile, neighborhood 6 has a low rate of participation value with an average of 1 household participating in 0-1 institution and has a low-density which villagers can reach the flow of communication by 6% having 35 poor households.
According to the observation on Budaya Pampang Village, the rate of participation and density level is related to the opportunity of accessing information and program alleviation that directed to people in the community such as community self-development to obtain new information such as agricultural production techniques and handicraft material as well as other soft skill training conducted by related agencies by collaborating through existing institutions. It is mediated with information on job opportunities, such as information on the existence of job fairs, bazaars, data collection for working capital assistance whose information and funding are transferred through data from institutional members.

The value of centrality also influenced the poverty in Budaya Pampang Village which is shown by the significant value of Degree Centrality, Closeness Centrality, and Betweenness Centrality. It means that the more central actors connected through existing institutional activities in the area, the more decreasing the poverty rate will happen because a central figure could act as an intermediary between the government and villagers by collecting data, socializing, and delivering suggestions and input regarding the implementation of policies in improving the economy for the poor. By optimizing the Central actors it could distribute information and communication access efficiently.

3.3. The Influence of Infrastructure Accessibility on Poverty
From 9 variables of infrastructure accessibility tested with spatial regression, 5 variables significantly influenced the number of recipients of poverty alleviation programs in Budaya Pampang Village and its surroundings. According to the previous research, the development of physical infrastructure should take into consideration the distance from poor households toward the infrastructure, which may require mobilization and additional costs for accessing basic infrastructure[10]. It is correlated with this research that distance from poor households toward basic infrastructures such as clean water infrastructure, electricity infrastructure, elementary school facilities, and Community Health Sub-center significantly influenced the poverty in Budaya Pampang Village.

It is shown on the result of the analysis that neighborhoods 6 and 25 which tend to be classified as an area which has high distances to access all basic infrastructure have a high number of poor households, namely 30 until 35 poor households. This high distance could make household need additional costs to access the infrastructure such as require mobilization and for buying clean waters, subscribe to a taxi bike vehicles for going to elementary school facilities and Community Health Sub-center, purchasing a generator for electricity also they cannot carry out productive activities at night because they are not served by the electricity network. It is different when compared to areas that have low accessibility toward infrastructure, they do not need additional cost for mobilization toward accessing elementary school facilities and Community Health Sub-center; it tends to be done by foot. They also could carry out productive activities at night because they are already served by electricity.

In this research, the distance toward the tourist center significantly influenced the poverty in Budaya Pampang Village. This result corresponds with previous research that states the distance to the tourist center indirectly can affect the level of poverty through opportunities to open business fields[11]. Based on observation households in neighborhood 3 with average low accessibility to the tourist center of 65.28 meters tend to carry out business activities by taking advantage of the location of houses that are around tourist traffic lanes. The business is carried out in the form of opening a shop selling souvenirs and carving wood, as well as a grocery store. It is mediated with other regions that do not have the same opportunity because there are no activities that can attract someone to interact through their area. If it is related to poverty data, it can be seen that Neighborhood 3 has 9 poor households which is a very small number when compared to the surrounding area.

4. Conclusions
It is recorded that 94.7% of the poverty rate in Budaya Pampang Village and its surroundings is influenced by social networks and infrastructure accessibility. This form explains that the higher the level of social networks that consist of rate of participation, density, and centrality in an area, the lower the poverty level will be. Also, the higher the distance that a community needs toward infrastructure of clean water, electricity, elementary schools, Community Health Sub-centers, and tourist centers, the higher the poverty rate will be. Through spatial modeling, a cluster of areas with high poverty is
formed which is influenced by the level of poverty in the vicinity, namely Neighborhood 5, 6 and 25 so that poverty alleviation needs to be carried out in an integrated approach with the main focus on areas identified as having a spatial relationship with the high poverty.

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