Analysis Of Trip Production and Attraction Model In Serang District

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ABSTRACT

Serang Regency is located on the northwestern of Java Island in Banten Province, with an annual population growth rate of 1,31%. The main economic sectors in this region are industry, plantations, and agriculture. Based on Central Bureau of Statistics report from 2015 to 2019, approximately 70% of Serang Regency's total land area is devoted to rice fields, horticultural, plantations, and fisheries, representing the predominant land use in the region. Population growth due to migration and natural growth will result in an increase in the number of trips required by residents for their activities thus affecting the pattern of movements in the area. The purpose of this research is to identify factors that influence and to obtain a model of the generation and attraction in Serang Regency. The analysis used is multiple linear regression analysis with the type 1 stepwise method. Dependent variables used in this research are trip generation and attraction in Serang Regency, and there are 11 independent variables selected based on geographical, demographic, socioeconomic, land use, and transportation infrastructure parameters. The results showed that the factor of the total area of paddy fields (ha) (X10) and the variable number of schools (X4) have the most significant influence on trip generation of movements in Serang Regency with the selected model Y1 = 7113,807 – 1,505X10 + 93,999X4 with a value of R^2 = 0,812. Meanwhile, the factor that most influences attraction is the plantation area (ha) factor (X11) with the selected model Y2 = 10427,988 – 4,428X11 with a value R^2 = 0,828.

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1. INTRODUCTION

Serang Regency is located at the northwestern tip of Java Island, in Banten Province, which consists of 28 sub-districts. Serang Regency has potential as a tourism destination in Banten Province. Serang Regency has the potential as a tourism city in Banten Province. The population growth of Serang Regency which continues to increase every year raises the need for better transportation facilities to overcome increasingly complex traffic problems. With the increasing ownership of motorized vehicles by the population, traffic problems are a major concern. The amount of movement required by residents to perform various activities over time will result in challenges in land use and transportation planning in this area. If the high population density grows uncontrollably, it can result in traffic disruptions [1]. he process of movement or movement of people or goods from one place to another is called transportation [2], [3]. Transportation is also a network system that connects one activity space with another activity space, which includes activities to move people or goods from one place to another [4]. This process reflects how humans play a role in the growth of a city. The main objective of the transportation system is to provide transportation services that are safe, fast, smooth, comfortable, and contribute to equitable growth and stability as a driver, driver, and support for national development, as well as to strengthen relations between nations [5].

The movement that occurs between two places, namely from the place where goods/services are needed to the place where goods/services are available, is the solution to the issue of fulfilling needs. This is a situation where a need is not met at the location where it arises but can be fulfilled elsewhere [6]. The movement generation model is a modeling stage that estimates the number of movements originating from a zone and the number of movements attracted to a zone, the amount of movement generation generated by households at a certain time interval [4]. Trip generation refers to the number of trips that occur within a unit of time within a land use zone [7]. The generation and attraction of movements that occur today to determine the movements that occur in the future.

Transportation system is an interaction that involves various elements such as goods, passengers, facilities, and infrastructure in the movement and physical transfer of people or goods, whether with or without the use of vehicles, in the context of the natural environment or human engineering [8]. Transportation planning is a process that begins with identifying potential movements and ends with creating adequate access to activities. One of the most well-known transportation planning models is the Four Step Model, which consists of four stages that analyze different components sequentially.

Land use involves human activities, and each type of land use results in a certain number of trips. Land use is formed by three main elements: humans, activities, and locations that interact with each other [9]. Urban transportation systems involve various activities such as work, education, recreation, shopping, and visits that occur in different types of land use areas such as offices, factories, stores, and homes. This mapping of land use is often referred to as land use planning. To meet these needs, individuals travel between different land use areas by utilizing transportation network systems, such as walking or using public transportation like buses [4].

In the research conducted on Jaksa Agung Soeprapto Street in the city of Gorontalo [6], the results of the pull that affects in one particular area in one city and only uses one parameter, but has not discussed the factors that affect the generation and attraction of movement by using the regression model of the Serang Regency Origin-Destination Matrix data with units of people / day as the value of the generation and attraction of movement. So, the purpose of this research is to determine the factors that influence the generation and attraction of movement between sub-district zones based on geographical parameters, population, socioeconomics, land use and transportation facilities and infrastructure parameters and to obtain the selected model for trip generation and attraction of movement between sub-district zones in Serang Regency.

2. METHODS

The most popular method for determining transportation planning models is the Four Step Model, which consists of four stages. To obtain the best linear regression model, various methods can be used, including stepwise method 1, stepwise method 2, and trial-and-error method [4]. The method used in this research is stepwise method 1. This model is a combination of several components that need to be analyzed separately and sequentially. This method begins by inputting independent variables into the model and then adding other independent variables while considering the possibility of removing the previously entered independent variables. The first independent variable may become insignificant after the second independent variable is added, and if that happens, the first variable is eliminated. This process continues as additional independent variables are added until there are no more independent variables that can be added or eliminated [10], [11].

The following are the steps in performing linear regression analysis using the stepwise 1 method [12]:

a. Determine the independent variables to be included in the model based on geographical parameters, population, socioeconomics, land use and transportation facilities and infrastructure.
b. Conduct a linearity test on the selected independent variables to be included in the model.
c. Conducting multiple linear regression analysis with all selected independent variables.
d. Performing multiple linear regression analysis by reducing one by one the selected independent variables from the one with the smallest correlation to the dependent variable so that no more independent variables can be removed from the model.
e. Conducting a correlation test between independent variables and independent variables, and a correlation test between independent variables and the dependent variable.
f. Eliminating independent variables that have a high correlation between other independent variables.
g. Selecting the best model by taking into account the coefficient of determination as well as the constant value and the regression coefficient

3. RESULTS AND DISCUSSION

The results of the analysis that has been carried out by conducting the Stepwise type 1 method include statistical tests, namely the validity test and reliability test, correlation test, linearity test, and regression analysis using the Stepwise type 1 method. The results show what factors influence the generation and attraction of movements in Serang Regency, the following is a discussion of the analysis carried out.

3.1 Characteristics of the Study Area

Serang Regency, Banten Province which is located between 05°50' - 6°21' South latitude and between 105°0'-106°22' East longitude, with an area of 1469,66 square kilometers and consists of 29 sub-districts and 326 villages [13]. According to the Banten Province Central Bureau of Statistics report data in 2018, Serang Regency has a population of 1,493,591 people with an annual population growth rate of 1,31%. The economic sector in Serang Regency is in the plantation and agriculture industry sectors. While the processing, tourism, construction, and fisheries sectors rank fourth which results in a decreasing percentage value and shifts towards the agricultural sector.

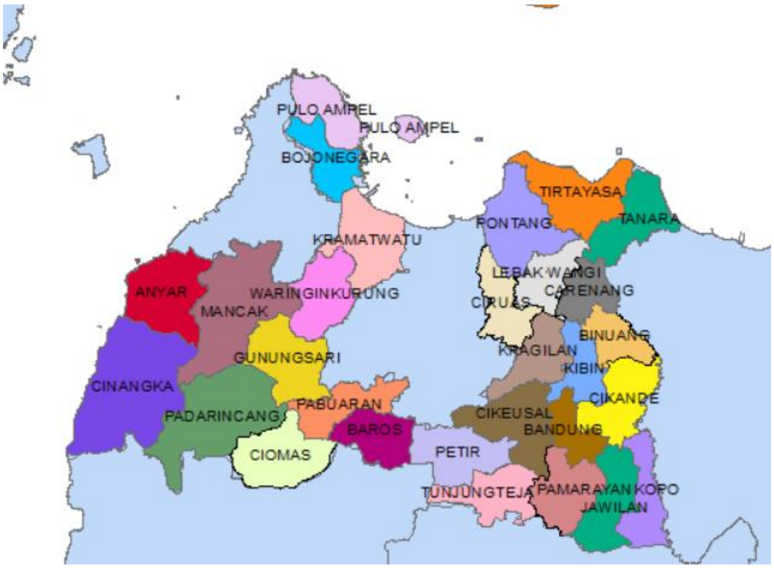

Figure 1. Serang District location map

3.2 Variable Used

In this study two types of variables were used, namely the independent variable X (independent variable), and the dependent variable Y (dependent variable).

Table 1. Variables Used

Variable			
Y1	Trip Production	X6	Number of Industries
Y2	Trip Attraction	X7	Total Manpower
X1	An Area (ha)	X8	Number of Hotels and Tourism
X2	Total Population	X9	Ekonomic Facilities
X3	Number of Places of Worship	X10	Rice Field Area (ha)
X4	Number of Schools	X11	Garden Land Area (ha)
X5	Number of Hospitals		

Table 1 shows that the dependent variable in this study is the value of movement generation and attraction in Serang Regency in 2018. The value is obtained from the origin destination matrix information. The destination origin matrix is a two-dimensional matrix that contains information about the magnitude of zone movements within a certain area [4]. This independent variable is selected based on logic that has a relationship with the dependent variable. The determination of independent variables in this study is by looking at several parameters, namely geographical parameters, population, socioeconomics, land use and transportation facilities and infrastructure.

3.3 Statistic Test

Data analysis in this research was carried out by carrying out statistical tests, namely validity and reliability tests, correlation tests, linearity tests, and regression analysis Stepwise type 1 method.

3.3.1 Linearity Test

The purpose of carrying out a linearity test is to find out whether the independent variable and the dependent variable have a linear relationship or not. This test is a prerequisite for analysis if the research to be analyzed uses simple linear regression analysis or multiple linear regression [14].

Table 2. Output of linearity tests of selected independent variables in trip production modeling

No		Variable	Sig Deviation from Linearity	Decision
1	X1	An Area (ha)	0.425	Linear
2	X2	Total Population	0.378	Linear
3	X3	Number of Places of Worship	0.741	Linear
4	X4	Number of Schools	0.068	Linear
5	X5	Number of Hospitals	0.852	Linear
6	X6	Number of Industries	0.794	Linear
7	X7	Total Manpower	0.658	Linear
8	X8	Number of Hotels and Tourism	0.138	Linear
9	X9	Ekonomic Facilities	0.635	Linear
10	X10	Rice Field Area (ha)	0.187	Linear
11	X11	Garden Land Area (ha)	0.189	Linear

In table 2 the results of the linearity test conducted on all independent variables of generation have a sig deviation from linearity value greater than 0,05 [15]. So, it can be concluded that between the independent variable and the dependent variable, the generation has a linear relationship, which means that the independent variable affects the dependent variable and linear regression analysis can be used.

Table 3. Output of linearity tests of selected independent variables in attraction modeling

No		Variable	Sig Deviation from Linearity	Decision
1	X1	An Area (ha)	0.914	Linear
2	X2	Total Population	0.914	Linear
3	X3	Number of Places of Worship	0.715	Linear
4	X4	Number of Schools	0.641	Linear
5	X5	Number of Hospitals	0.532	Linear
6	X6	Number of Industries	0.870	Linear
7	X7	Total Manpower	0.931	Linear
8	X8	Number of Hotels and Tourism	0.894	Linear
9	X9	Ekonomic Facilities	0.852	Linear
10	X10	Rice Field Area (ha)	0.073	Linear
11	X11	Garden Land Area (ha)	0.189	Linear

In table 3 the results of the linearity test conducted on all independent variables of attraction have a sig deviation from linearity value greater than 0,05 o it can be concluded that between the independent variables and the dependent variable of attraction have a linear relationship, which means that the independent variable affects the dependent variable and linear regression analysis can be used.

3.3.2 Validity Test

The validity test is carried out to determine the accuracy of an instrument in measuring what should be measured. A measuring instrument can be called valid if the instrument used to measure can indeed measure what should be measured precisely [16].

Table 4. Validity test results

Variable		rcount	rtable	Explanation
Trip Production	Y1	0.375	0.374	Valid
Trip Attraction	Y2	0.389	0.374	Valid
An Area (ha)	X1	0.386	0.374	Valid
Total Population	X2	0.922	0.374	Valid
Number of Places of Worship	X3	0.370	0.374	Valid
Number of Schools	X4	0.611	0.374	Valid
Number of Hospitals	X5	0.823	0.374	Valid
Number of Industries	X6	0.374	0.374	Valid
Total Manpower	X7	0.679	0.374	Valid
Number of Hotels and Tourism	X8	0.395	0.374	Valid
Ekonomic Facilities	X9	0.372	0.374	Valid
Rice Field Area (ha)	X10	0.376	0.374	Valid
Garden Land Area (ha)	X11	0.398	0.374	Valid

Based on table 4 shows that the provisions in deciding whether the variables in this study are valid or not are to compare the value of r count with r table. If r count > r table, then these variables are valid. The calculated r value is obtained from the analysis by comparing the variable value with the total value of the variables used [17]. or the value of r table obtained from the table r product moment with a significance level of 5% and the amount of data as much as 28, the value of r table is 0,374.

3.3.3 Reliability Test

To determine the consistency of the measuring instrument, a reliability test is carried out. The method usually used is the Cronbach Alpha method. In the reliability test, the items included in the test are valid items only, therefore this test is carried out after the validity test [18].

Reliability Statistics

Cronbach's Alpha	N of Items
.733	13

Figure 2. Reliability test results

Figure 2 is the result of the reliability test carried out, to determine whether the instrument used is reliable or not is to look at the Cronbach's Alpha value if the Cronbach's Alpha value is more than 0.6 then the instrument is said to be reliable [18]. The Cronbach Alpha value obtained is 0,733 > 0,*6.*

3.3.4 Correlation Test

There are statistical requirements that need to be met in each analysis model, namely that there must be no strong correlation between the independent variables, while the independent variable and the dependent variable must be correlated [19].

Table 5. Correlation test results

Variable		X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11
An Area (ha)	X1	1										
Total Population	X2	-0.051	1									
Number of Places of Worship	X3	0.121	.449*	1								
Number of Schools	X4	0.105	.744**	.605**	1							
Number of Hospitals	X5	-0.231	.829**	0.171	.409*	1						
Number of Industries	X6	-0.058	0.145	0.160	0.057	0.061	1					
Total Manpower	X7	-0.152	0.358	-0.018	0.003	.504**	0.031	1				
Number of Hotels and Tourism	X8	0.261	0.329	0.180	0.287	0.289	0.166	0.275	1			
Ekonomic Facilities	X9	-0.152	0.233	0.275	.446*	0.203	0.109	-0.080	0.323	1		
Rice Field Area (ha)	X10	-.515**	-0.113	-0.281	-0.234	0.105	-0.231	0.005	-0.231	0.122	1	
Garden Land Area (ha)	X11	-0.037	0.182	0.061	0.176	0.060	0.255	0.084	-0.109	-0.191	0.040	1

Based on table 5 the results of the correlation test between the independent variable and the independent variable and between the independent variable and the dependent variable are obtained. The result of this test is the correlation coefficient (r), this coefficient is valued between -1 and 1, if the value obtained is close to 1 or -1 then the relationship is getting closer while if the value is close to 0 then the relationship is getting weaker. As explained above that fellow independent variables should not have a strong correlation, if there are independent variables that are strongly correlated, there must be variables that are eliminated or not included in the model, for the independent variables selected to be included in the model are variables that have a higher correlation with the dependent variable. Strongly correlated independent variables are those that have a correlation coefficient (r) of more than 0,50 [18].

Table 6. Selected independent variables for the trip production model

NO	Variable		r
1	Rice Field Area (ha)	X10	-0.856
2	Number of Schools	X4	0.474
3	Garden Land Area (ha)	X11	0.187
4	Number of Hotels and Tourism	X8	0.126
5	Total Manpower	X7	-0.084

Based on Table 6 which is the selected independent variables for the generation model, the selected variables were chosen because the Hotel and tourism variable (X8) was automatically selected to be included in the generation model because it is not correlated with other independent variables. The variable of paddy field area (ha) (X10) is correlated with area (ha) (X1), the variable of paddy field area (ha) (X10) is selected to be included in the generation model because it has a higher r value than other variables. Meanwhile, the variable area (ha) (X1) is automatically eliminated and does not need to be re-examined for correlation with other variables. The variable (X3) correlates with variables (X2) and (X4). The independent variable selected to be included in the attraction model is variable (X4) because it has the highest correlation value with the dependent variable of attraction compared to other variables. Meanwhile, variables (X3) and (X2) are automatically eliminated and do not need to be re-examined for correlation with other variables. The variable number of industries (X6) is correlated with the variable plantation area (X11). The variable plantation area (X11) was selected to be included in the generation model because it has a higher r value than other variables. Meanwhile, the variable number of industries

(X6) is automatically eliminated and does not need to be re-examined for correlation with other variables. The variable number of workers (people) (X7) is correlated with the variable health facilities (X5). The variable number of workers (people) (X7) was selected to be included in the generation model because it has a higher r value than other variables. Meanwhile, the health facility variable (X5) is automatically eliminated and does not need to be re-examined for correlation with other variables.

Table 7. Selected independent variables for the attraction model

NO	Variable		r
1	Garden Land Area (ha)	X11	-0.91
2	Total Population	X2	-0.296
3	Rice Field Area (ha)	X10	-0.191
4	Ekonomic Facilities	X9	0.152
5	Total Manpower	X7	-0.141
6	An Area (ha)	X1	0.101
7	Number of Industries	X6	-0.100
8	Number of Hotels and Tourism	X8	0.083

Based on Table 7 the selected independent variables for the attraction model include the variable area (ha) (X1), the number of industries (X6), hotels and tourism (X8) and the area of plantations (X11) because it is not correlated with other independent variables, the variable is selected to be included in the attraction model. The variable (X2) is correlated with variables (X3), (X4), and (X5). The independent variable selected to be included in the attraction model is variable (X2) because the variable has the highest correlation value to the dependent variable of attraction compared to other variables. Meanwhile, variables (X3), (X4), and (X5) are automatically eliminated and do not need to be re-examined for correlation with other variables. Variable (X10) is correlated with variable (X4). The independent variable selected to be included in the attraction model is variable (X10) because variable (X4) has been eliminated at the previous stage and does not need to be re-examined for correlation with other variables. Therefore, variable (X10) was selected to be included in the attraction model. Variable (X7) is correlated with variable (X5) which has been eliminated in the second stage. Therefore, variable (X7) is selected to be included in the attraction model. The economic facility variable (X9) which is only correlated with the number of schools (X4) is automatically selected to be included in the attraction model because the number of cooperatives (X4) has been eliminated in the previous stage.

3.3.5 Type 1 Stepwise Analysis

Stepwise analysis was conducted after the selected independent variables were included in the generation model and the attraction model. The stepwise method is done by entering all the selected independent variables into the model, then eliminating them one by one based on their correlation value to the dependent variable [11].

Table 8. Trip production modeling analysis stepwise method type 1

No	Variable	Step 1	Step 2	Step 3	Step 4	Step 5
1	Intersep (c)	7610.909	7457.255	7473.807	7113.264	12086.662
2	X10	-1.602	-1.602	-1.536	-1.505	-1.634
3	X4	99.141	100.960	89.789	93.999	
4	X11	-0.598	-0.531	-0.380		
5	X8	-34.819	-38.260			
6	X7	-0.021				
R2		0.838	0.836	0.813	0.812	0.733
F-stast		23.803	30.570	36.257	56.169	74.090
Sig F-stat		.000b	.000b	.000b	.000b	.000b

In table 8 there are 5 models of trip production were obtained by entering the selected independent variables in table 6. Then at the first model stage, all selected independent variables were entered, then removed one by one based on the independent variable that had the least correlation with the dependent variable. This elimination process is carried out until only one independent variable is left in the model. The next step is to determine which model is selected to determine which model is selected, the model needs to see the significance value on the F-stat and the significance value on the t-count.

The selected generation model uses the type 1 stepwise method which is the generation model at stage 4 of the analysis. The reason that makes stage 4 the selected model compared to other stage models is because only this model has the following criteria:

a. The significance value in F-stat < 0,05.
b. The significance value of the t-count < 0,05.
c. The intercept value (regression constant) is smaller than other stages,
d. The sign of the regression coefficient (+/-) is as expected,
e. Has an R^2 value that is categorized as strong, namely more than 0,67 [20].

Table 9. Trip attraction model

Model	Y1= 7113,807 - 1,505X10 + 93,999X4
R^2	0,812
Significance F-stat	0,000
Significance t-count X10	0,000
Significance t-count X4	0,000

Table 9 shows the selected movement generation model where the most influential variables are the variable of Agricultural Area (ha) (X10) and the variable of the number of schools (X4). The following is the interpretation of the selected generation model:

a. Has a regression constant of 7113,807 which states that if the value of the variable area of rice fields (ha) (X10) and the variable number of schools (X4) is zero then the generation will still occur at 7113,807.
b. Has a regression coefficient value of the area of rice fields (ha) (X10) of -1,505 which states that every time there is an increase in the area of rice fields by 1 ha, there will be a decrease in the amount of movement generation by 1,505.

c. Having a regression coefficient value of the number of schools (X4) of 93,999 states that every time there is an increase in the number of schools by 1 school, there will be an increase in the number of movement generation by 98,999.
d. Having an R^2 value of 0,812 indicates that the independent variable can explain the dependent variable by 81,2%, the rest is explained by variables that are not included in the model.
e. Having an F-stat significance value of 0,000 (<0,05) indicates that the independent variables simultaneously have a significant effect on the dependent variable and the estimated model is feasible.
f. Having a t-stat significance value of the variable area of paddy fields (ha) (X10) of 0,000 (<-0,05) and the variable number of schools (X4) of 0,003 (<-0,05) indicates that these variables have a significant effect on the dependent variable at α 5%.

The selection of the variable of Agricultural Area (ha) (X10) and the variable of the number of schools (X4) as variables that influence generation in Serang Regency is related to the actual situation of Serang Regency, namely land use, which can be said to be related because Serang Regency is an area that is prominent for its agricultural activities as its livelihood.

Table 10. Trip attraction modeling analysis stepwise method type 1

No	Variable	Step							
		1	2	3	4	5	6	7	8
1	Intersep (c)	13657.091	13770.254	14307.777	14580.841	14735.824	14724.28	13492.677	10427.988
2	X10	-4.455	-4.427	-4.259	-4.28	-4.275	-4.317	-4.309	-4.428
3	X5	-0.041	-0.049	-0.038	-0.035	-0.047	-0.044	-0.06	
4	X12	-1.126	-0.937	-1.399	-1.424	-1.286	-1.234		
5	X2	1.33	0.572	1.295	0.921	1.185			
6	X15	-0.014	-0.024	-0.034	-0.043				
7	X7	0.224	0.166	0.153					
8	X11	1.433	1.404						
9	X1	-26.356							
10	X6	-0,437							
R2		0.882	0.88	0.868	0.865	0.862	0.861	0.846	0.828
F-stast		18.748	22.033	24.08	29.362	37.459	51.526	71.306	130.229
Sig F-stat		.000b	.000b	.000b	.000b	.000b	.000b	.000b	.000b

Based on table 10 there are 8 models of attraction generation obtained by entering the independent variables contained in table 7. In the first model stage, all the selected independent variables are included, then excluded one by one based on the independent variable that has the smallest correlation with the dependent variable. This elimination process is carried out until only one independent variable is left in the model. The next step is to determine which model is selected to determine which model is selected, the model needs to see the significance value in the F-stat and the significance value in the t-count.

The selected attraction model uses the stepwise method type 1 which is the generation model at stage 8 of the analysis. The reason that makes stage 8 the selected model compared to other stage models is because only this model has the following criteria:
a. The significance value in F-stat < 0,05.
b. The significance value of the t-count < 0,05.
c. The intercept value (regression constant) is smaller than other stages,

d. The sign of the regression coefficient (+/-) is as expected,
e. Has an R^2 value that is categorized as strong, namely more than 0,67 [20].

Table 11. Trip attraction model

Model	Y2= 10427,988 - 4,428X11
R^2	0,828
Significance F-stat	0,000
Significance t-count	0,000

Table 11 is the selected attraction model where the variable is the variable that most influences the attraction of movement in Serang Regency, namely the Plantation Area (ha) variable (X11). The following is the interpretation of the selected attraction model:

a. Has a regression constant of 10427,988 which states that if the value of the plantation area (ha) variable (X11) is zero then the attraction will still occur at 10427,988 which is influenced by other variables that are not included in the model.
b. Having a regression coefficient value of plantation area (ha) (X11) of -4,428 states that every time there is an increase in plantation area by 1 ha, there will be a decrease in the number of attraction movements by 4,428.
c. Having an R^2 value of 0,828 indicates that the independent variable can explain the dependent variable (movement attraction) by 82,8%, the rest is explained by variables that are not included in the model.
d. Having an F-stat significance value of 0,000 (< 0,05) indicates that the independent variables simultaneously have a significant effect on the dependent variable and the estimated model is feasible.
e. Having a t-count significance value of the plantation area (ha) variable (X11) of 0,000 (<-0,05) yang indicates that the variable has a significant effect on the dependent variable α 5%.

The selection of the variable, namely the Plantation Area (ha) variable (X11). as a variable that influences the attraction in Serang Regency is related to the actual situation in Serang Regency, namely that in Serang Regency there are several plantation areas which provide an attraction for people to make movements towards Serang Regency.

4. CONCLUSION

The factors that influence the generation of movement in Serang Regency are the number of schools (X4), the number of workers (X7), hotels and tourism (X8), the area of rice fields (ha) (X10) and the area of plantations (ha) (X11). The selected model for movement generation between sub-district zones in Serang Regency is Y1= 7113,807 - 1,505X10 + 93,999X4 with an value $R^2 = 0{,}812$. The factors that influence the movement attraction in Serang Regency are area (ha) (X1), population (people) (X2), number of industries (X6), number of workers (X7), hotels and tourism (X8), economic facilities (X9), area of paddy fields (ha) (X10) and area of plantations (ha) (X11). The selected model for the movement pulls between sub-district zones in Serang Regency is Y2 = 10427,988 - 4,428X11 with X11 a value of $R^2 = 0{,}828$.

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