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Study of Logistic Transportation Based on The Movement of Agricultural Commodities in Aceh Province

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ABSTRACTS

Transportation is still a problem in every region in Indonesia, including in Aceh Province. As the node of sea transportation, ports have an increasingly large role in economic development in line with the increasing importance of ports in logistical activities. This study aims to examine logistics transportation based on the movement of agricultural commodities in Aceh Province. The research method uses descriptive quantitative methods with a secondary data analysis approach. The data used in this study are data of the movement of goods and data on agricultural products in Aceh Province. The data analysis approach used linear regression and was validated through the coefficient of determination and correlation test as well as the t-test and ANOVA test. Based on the results of analysis and statistical validation, it can be seen that agricultural products have a positive and significant linear relationship with the generation of movement of goods in Aceh Province.

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1. INTRODUCTION

Transportation is still one of the problems in every region/city in Indonesia, from the uneven growth in the number of private vehicles with the increase in road length, to traffic congestion (Sinarimbo, 2005; Merk, O andNotteboom, T, 2015; Monios, Jand Wilmsmeier, G , 2012). One area that has transportation problems is Aceh Province (Muhammad Nasyir,2017). Aceh Province is the westernmost province in Indonesia. Aceh Province is located between 01 ° 58 '37.2 "- 06 ° 04' 33.6" North Latitude and 94 ° 57 '57.6 "- 98 ° 17' 13.2" East Longitude with an average height of 125 meters above the sea level. To the north and east it is bordered by the Malacca Strait, to the south with the Province of North Sumatra and to the west with the Indian Ocean. The area of Aceh Province is 5,677,081 ha and in 2013 Aceh Province consisted of 18 districts and 5 cities, 289 sub-districts, 779 mukims and 6,474 villages. According to data in 2016, the population of Aceh Province was recorded at 5,096,248 people with a population growth rate of 1.94 percent (BPS Aceh, 2017).

Aceh Province has a strategic geographical location that has made this province a gateway for trade and culture traffic that has connected East and West for centuries (Sulistiyono, 2013). Based on the survey data of the origin of national transportation destinations, nationally almost 90% of the movement of goods is carried out by land (road) transportation, 7% by sea transportation, and the rest by other transportation (such as trains, airplanes, and river and ferry transportation) (Reis, 2013). The lack of attention to the movement of goods by sea and railtransportation is mainly due to the lack of availability of infrastructure and facilities as well as lack of systems and regulations, so that the movement of goods by road is still a more efficient option (Sofyan M Saleh, 2010; Acciaro, M, and McKinnon, A, 2013; de Borger, B and De Bruyne, D , 2011).

The movement of goods can be divided into 33 commodity groups according to the Decree of the Minister of Transportation KM 71 of 2005 concerning "Transportation of Goods/Cargo between Domestic Seaports." The movement of goods that occurs in Aceh Province consists of 16 commodity groups, including: salt, fruit, agricultural grains, other grains, CPO, coal, cooking oil, general cargo of non-food, general cargo of food, coffee, vegetables, rice, fish, logs, meat and livestock. Rice and agricultural grains are the main commodities produced in agriculture. Land use in Aceh Province, particularly in the 2016 rice harvest area, was 429,485.9 hectares, consisting of a harvest area of 420,770.9 hectares of paddy rice and 8,715 hectares of field rice (BPS, 2017). In addition, there is also a harvest area of 70,024.2 hectares of corn, 14,559.2 hectares of soybeans, 1,823.4 hectares of peanuts, 1,897.7 hectares of cassava, 526.9 hectares of sweet potatoes and 1,153.9 hectares of green beans.

In order to distribute the movement of these goods, adequate transportation is needed including road transportation, rail transportation, sea transportation and air transportation (Haial, A., Benabbou, L., & Berrado, A., 2021; De Luca S., 2014). Ports as the node of sea transportation have a bigger role in economic development in line with the increasing importance of ports in logistical activities, especially intermodal and multimodal transportation (Bryan et al., 2007; Cascetta E., Pagliara F, 2013). Good logistics performance will have implications for the low cost of transportation of goods, thereby increasing the competitiveness of the economy (Marchetti & Wanke et al., 2010; Kelly J, et.al., 2020). Ports in Aceh Province are classified as small and medium ports on a national scale (Fan, L, Wilson, WW and Dahl, B, 2012; Herdian, T., 2017) . Until now, Aceh Province has only had five active ports out of eleven ports that have served export and import activities in recent years.

Based on data from the Department of Transportation, Information Communication and Telematics (Dishub.acehprov.go.id, 2013), 11 of these ports are located in Aceh Province which is included in the Sumatra Economic Corridor in the Master Plan for the Acceleration ofIndonesian Development Planning. Public ports operated in Aceh Province such as Sabang, Malahayati, Lhok-seumawe, and Kuala Langsa are in the international trade route of the Malacca Strait, so that these ports are strategically located for export-import activities.

Based on the description above, this study aims to examine the study of logistics transportation, in particular the number of ship visits based on the movement of agricultural commodities in Aceh Province. This research is expected to be a reference for those who need to make decisions on the movement of goods through ports in Aceh Province, so as to improve the economy in Aceh Province and its surroundings.

2. METHODS

The method that are being used is descriptive quantitative research method with secondary data analysis approach. Secondary data analysis was carried out by utilizing secondary data as the main source of research. The research locations are focused on 12 districts/cities in Aceh Province that have ports, namely: Aceh Besar Districts, Sabang City, Aceh Singkil Districts, Simeulue Districts, Aceh Jaya Districts, Southwest Aceh Districts, East Aceh Districts, Langsa City, Banda Aceh City, North Aceh Districts, West Aceh Districts and South Aceh Districts.

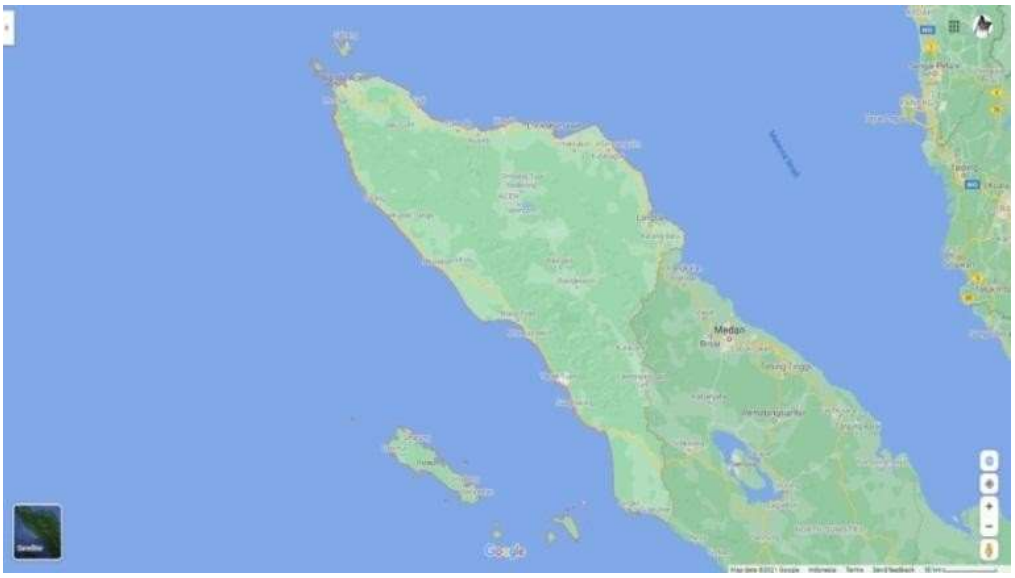

Figure 1. Map of Aceh Province

Secondary data in this study were obtained from related agencies or institutions which were then reprocessed systematically and objectively. The types of secondary data used in this study are presented in the following table.

Table 1. Secondary Data

No.	Data Types	Data Source	Years
1	Generation of Goods Movement Data	Kementerian Perhubungan	2016
2	Ship Visit Data, Rice HarvestArea and Green Bean Harvested Area	Badan Pusat Statistik Provinsi Aceh	2016

After the secondary data is collected and reprocessed, then linear regression analysis is carried out between the number of ship visits to the generation of goods movement in Aceh Province. Linear regression analysis was conducted to determine the relationship between the dependent variable (Y) and the independent variable (X) in the form of an equation function (Ofyar Z.T. 2008). Linear regression analysis between the number of ship visits, rice harvested area and green bean harvested area as well as the generation of goods movement can be stated in the following equation:

$$Y = a + b_1 X_1 + b_2 X_2 + b_3 X_3 \quad (1)$$

where:

Y = The number of generated movement of goods
X = Number of ship visits, rice harvested area and green bean harvested area
a = Constant of the regression line intercept on the y-axis
b = Regression line coefficient

Validation of an equation function is carried out to test the level of confidence. The statistical tests used in the linear regression equation include the coefficient of determination and the correlation test to determine the "strength" of the relationshipbetween variables, as well as the t-test and ANOVA test to determine the significance of the slope on the regression line. By using constants and coefficients from the regression equation, the coefficient of determination can be expressed as follows (Sutrisno, 2018).

$$^2 = \frac{(\quad \Sigma + (\Sigma -)^2 ( )}{\Sigma)^2 - (^2)} \quad (2)$$

where:

r^2 = Coefficient of determination
n = Number of regions under review

$\sum$ = Total value of the variable y
$\sum$ = The number of times the x and y values

$\bar{}$ = The average of the y variable

The correlation test between variables X and Y is the root of the coefficient of determination with the following formula:

$$= \pm \sqrt{^2} \quad (3)$$

where:

r = Coefficient Correlation

The t-test is done by comparing the value of the test ratio (t-value) with the t-table value in the t distribution table. If the value of t-value is in the area of acceptance, variable X does not affect variable Y linearly, whereas if it is in the area of rejection, variable X affects variable Y linearly. While the ANOVA test is also carried out by comparing the value of the test ratio (F-value) with the F-table value in the distribution table F. If the F-value is in the acceptance area, variable X does not affect variable Y linearly, whereas if it is in the rejectionarea, variable X affects variable Y linearly. The level of importance used for the t-test and ANOVA test was 0.05.

3. RESULTS AND DISCUSSION

Data on the movement of goods from the results of a survey conducted by the Ministry of Transportation in 2016 can be presented in the form of an origin-destination matrix and desire line graphs. The origin-destination matrix for the movement of agricultural commodities which includes rice and agricultural grains is shown in the following table.

Table 2. Origin-destination matrix for agricultural commodity movements

Zone	1	2	3	4	5	6	7	8	9	10	11	12	Generation (ton / month)
1	597	676	2274	828	960	1522	2187	858	419	126	300	191	10938
2	693	227	762	187	167 4	1470	1350	302	403	48	225	193	7534
3	112 4	905	3867	205 4	157 6	2677	4011	1812 0	473	128 4	535	370	36996
4	115 6	255	2342	147	413	659	968	840	191	106	147	93	7317
5	172	342	207	57	212	473	508	124	183	16	88	152	2534
6	153 6	144 2	2218	475	814	2082	8081	876	397 4	146	416	443	22503
7	193 1	295 5	3143	154 8	264 0	6727	3466	2877	409 8	483	101 9	929	31816
8	0	0	5	0	0	0	1	0	0	0	0	0	6
9	70	67	110	23	130	670	310	44	41	7	22	26	1520
10	0	0	0	0	0	0	0	0	0	0	0	0	0
11	196	143	286	69	116	269	292	117	83	18	81	82	1752
12	21	20	32	7	68	48	44	13	17	3	14	12	299
Attraction (ton / month)	749 6	703 2	1524 6	539 5	860 3	1659 7	2121 8	2417 1	988 2	223 7	284 7	249 1	123215

Details: 1. Aceh Barat, 2. Aceh Barat Daya, 3. Aceh Besar, 4. Aceh Jaya, 5. Aceh Selatan, 6. Aceh Timur, 7. Aceh Utara, 8. Banda Aceh, 9. Langsa, 10. Sabang, 11. Simeulue, 12. Aceh Singkil.

Based on the origin-destination matrix for agricultural commodity movements presented in Table 2, the magnitude of agricultural commodity movements can also be presented in the form of desire lines. Desire lines are lines that connect between zone centers on a map with different line thicknesses according to the magnitude of the movement. In Figure 2. it can be seen that the flow of goods movement from Aceh Besar District is the densest, as much as 36996 tons/month.

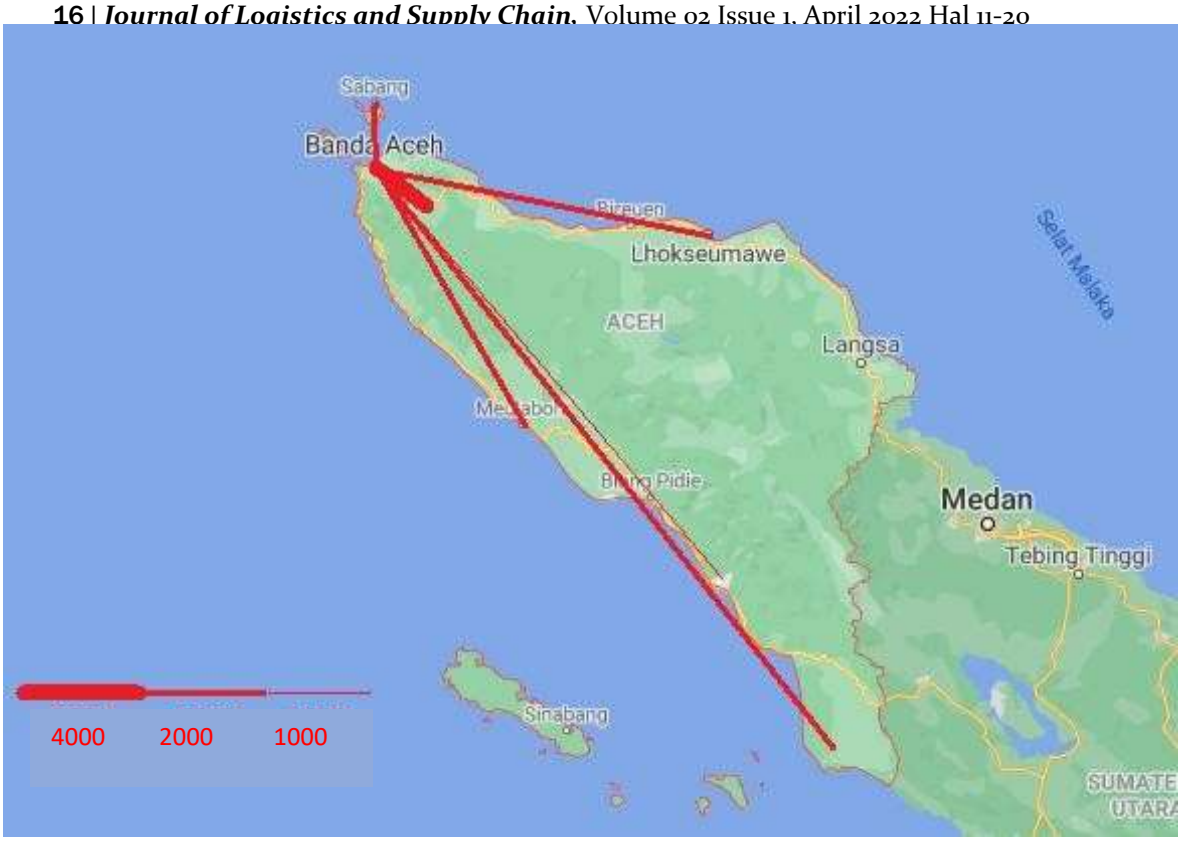

Figure 2. *Desire Line for the Movement of Goods in Aceh Province*

3.1. Linear Regression Analysis

The data for generating movement of goods and number of ship visits, rice harvested area and green bean harvested area for several areas reviewed in 2016 are shown in the following table.

Table 2. Data generating movement of goods and number of ship visits, rice harvested area and green bean harvested area

No	Zone	Commodity Agricultural Grains (tonnes/month)	Rice (tonnes/ month)	Awakening (tonnes/ month)	Rice Harvested Area (ha)	Green Beans Harvested Area (ha)	Number of Ship Visits (unit)
1	Aceh Barat	7068	3870	10938	24946,4	1	252
2	Daya	4986	2548	7534	13043	0	46
3	Aceh Besar	22821	14175	36996	39129,7	153,3	2582
4	Aceh Jaya	4773	2544	7317	18672,9	12	75
5	Aceh Selatan	87	2447	2534	14625	39	206
6	Aceh Timur	13789	8714	22503	36668,7	15	13
7	Aceh Utara	14039	17777	31816	61721,2	46,5	284
8	Banda Aceh	0	6	6	72,1	0	0
9	Langsa	994	526	1520	3096,9	0	8
10	Sabang	0	0	0	0	3	2017
11	Simeulue	1121	631	1752	7394,7	0	465
12	Aceh Singkil	203	96	299	1268,6	2	530

The results of linear regression analysis in brief can be seen in the following table.

Tabel 3. Regression Analysis Results

	Coefficients	*Standard Error*	*t Stat*	*t-table*	*P-value*
Intercept	-1898,63	1657,85	-1,15	1,86	0,29
Rice Harvested Area (ha)	0,51	0,07	6,98		0,0001
Green Beans Harvested Area (ha)	81,97	43,29	1,89		0,09
Number of Ship Visits (Unit)	1,61	1,87	0,86		0,41

The results of the linear regression analysis in the table above produce the following regression equation:

$$Y = -1898,63 + 0,51\ X_1 + 81,97\ X_2 + 1,61\ X_3 \quad (4)$$

From the above equation it can be concluded that:

1. A constant value of -1898.63 provides information that if the three independent variables (X) do not change, the generation of movement of goods in Aceh Province is -1898.63.
2. The variable X1, which is the harvested area for rice, has a coefficient value of 0.51 indicating that if there is a change in the harvested area of rice by 1 unit, the generation of movement of goods will change by 0.51.
3. The variable X2 which is the harvested area for green beans has a coefficient value of 81.97, indicating that if there is a change in the harvested area of green beans by 1 unit, the generation of movement of goods will experience a change of 81.97.
4. The variable X3 which is the number of ship visits has a coefficient value of 1.61 indicating that if there is a change in the number of ship visits by 1 unit, the movement of goods will experience a change of 1.61.
5. In the table above, it is known that the coefficient sign of the variable equation X1, X2, X3 is positive (+), it can be concluded that the greater the rice harvest area, the green bean harvested area and the number of ship visits, it will increase the generation of movement of goods (Y) .

3.2. Determinant Coefficient Test

The determinant coefficient test was carried out to determine the ability of the independent variables to explain the variation in the dependent variable. The following is a table of the results of the calculation of the coefficient of determination.

Table 4. Result of Determination Coefficient Analysis

Regression Statistics	
Multiple R	0,98
R Square	0,95
Adjusted R Square	0,93
Standard Error	3383,27
Observations	12

The value of r^2 in the results of the analysis above is 95.0% which means that the independent variables of rice harvested area, green bean harvested area and number of ship visits are able to explain changes in the generation of movement of goods in Aceh Province and the rest is explained by variables not in the model of 5.0%.

3.3. Correlation Test

Correlation is used to measure the strength of the relationship between 2 variables and also to be able to determine the form of the relationship between the 2 variables and the quantitative results. The strength of the relationship between the 2 variables referred to here is whether the relationship is close, weak, or not close, while the form of the relationship is whether the form of the correlation is the positive linear or negative linear. A good correlation between the variables X and Y is indicated by the value of the relationship between 0.5 - 1.0. The results of the correlation test that have been carried out are shownin Table 5.

Tabel 5. Correlation Analysis Results

	Generation Movement	*Harvested Area Rice (ha)*	*Harvested Area Green Beans (ha)*	*Number of Visits Ship (Unit)*
Generation Movement	1			
Rice Harvested Area (ha)	0,92	1		
Green Beans Harvested Area (ha)	0,77	0,56	1	
Number of Ship Visits (Unit)	0,36	0,09	0,68	1

From this table, it can be seen that the correlation value between variables Y and X_1 is 0.92 and Y and X_2 is 0.77, so that the correlation value is ≥ 0.5, it is known that thegeneration of movement of goods to the harvested area of rice and the harvested area of green beans has a strong relationship. tightly. Whereas for the correlation value betweenthe variables Y and X3 is 0.36 <0.5, it is known that the generation of movement of goods to the number of ship visits has a strong/close relationship. In addition, the three variables X have positive correlation (+), which means that the form of the relationship between the independent and dependent variables is positive linear.

3.4. t-Test

The t-test or partial test is intended to test the effect of each explanatory variable individually on the response variable. Based on the results of the linear regression analysis recorded in Table 3, it can be concluded that:

1) Rice harvested area (x_1) has a t-value of 6.98, greater than than t-table of 1.86 and a probability of 0.0001 < 0.05, it can be said that rice production has a positive and significant effect on the movement of rice and grain commodities agriculture.
2) The harvested area for green beans (x_2) has a t-value of 1.89, which is greater than t-table of 1.86 and a probability of 0.09 <0.05, so it can be said that rice production has a positive and significant effect on the generation of movement of rice and agricultural grain commodities.

3) The number of ship visits (x3) has a t-count value of 0.86 which is smaller than the t-table of 1.86 and a probability of 0.41 <0.05, it can be said that rice production has no significant effect on the movement of rice and agricultural grain commodities.

3.5. ANOVA Test

ANOVA test or simultaneous test aims to reflect the effect of the independent variables together on the generation of movement of goods in Aceh Province, the results of the calculation are briefly shown in the table below.

Table 6. ANOVA Test Analysis Results

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	1772443463,79	590814487,9	51,62	1,41E-05
Residual	8	91572051,13	11446506,39		
Total	11	1864015514,92			

The F_{count} value in the table above is 51.62 and a significant value is 1.41E-05 <0.05, which indicates that the overall rice harvested area, green bean harvested area and number of ship visits have an effect on the generation of movement of goods in Aceh Province.

4. CONCLUSION

Based on the results of a logistic transportation study based on the movement of agricultural commodities in Aceh Province that has been carried out, it can be concluded that the rice harvested area, green bean harvested area and number of ship visits have a positive and significant linear relationship to the generation of movement of goods in Aceh Province.

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