Regional Development and Community Welfare in Langkat Regency in the Perspective of Road Network Development and Freight Management

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Abstract — **This study aims to analyze the effect of road network development and freight transportation management on regional development and community welfare in Langkat Regency. The study population was drivers of motor vehicles transporting goods in Langkat Regency. The number of samples taken was 305 respondents with probability sampling technique. The data analysis technique used is Structural Equation Modeling (SEM). The results showed that the variable road network development did not directly affect the welfare of the community but the development of the road network indirectly affected the welfare of the community through the development of the area in Langkat Regency. The management of goods transportation has a positive and significant effect on the welfare of the community, both directly and indirectly through regional development in Langkat Regency. Regional development directly affects the welfare of the community in Langkat Regency.**

Keywords — **Road network development, Goods transportation management, regional development, community welfare.**

I. INTRODUCTION

According to Bunch (1991) the existence of important groups as a form of community organizing and mutually agreed rules, because of three things, namely: (1) many problems can only be solved by an institution formed jointly; (2) groups can provide the continuity to continuously develop the business of group members; and (3) groups can organize communities to be able to compete with outsiders.

In regional development, there are three interrelated components in supporting the development of an area, namely (1) population resources, (2) economic activities, and (3) transportation systems. All activities of importing raw materials, marketing production, providing labor brought from residential areas to industrial areas and vice versa, require a transportation system that guarantees security, safety, speed and affordability by the purchasing power of the people of Meyer (1984). A good transportation system will have an impact on good accessibility as well.

High accessibility from the original location to the destination of transportation of goods is characterized by high connectivity and mobility where the distance is shorter, shorter travel times and affordable transportation costs (Hurst, 1974), (Dennis, 1998).

Accessibility is a measure of ease (time, cost, or effort) in moving between places or regions in a system. The benefits derived from improved access to two parts, namely: (1) direct benefits; easier access to various facilities in relation to the provision of services by these facilities, and (2) secondary benefits; includes saving time, effort and transportation costs. In relation to secondary benefits, three things will be obtained if there is an increase in accessibility, namely: (1) time savings, (2) reduction in transportation business; the size of the hauling business is expressed in tonnes / km, greater freight capacity with longer distances, and (3) efficiency of movement and savings in transportation costs. Service facilities that are more accessible, will make people or the community can further improve their standard of living (Hurst, 1974) and (Dennis, 1998).

Road infrastructure development is often seen as a solution to the problem of

overcoming the availability of road capacity and accessibility. To improve the accessibility of land use that will be connected by the transportation network system, investment in the construction of the transportation network system is made. Accessibility (Black, 1981) is a measure of comfort or convenience regarding the way land use locations interacts with each other and 'easy' or 'hard' a location is achieved through a transportation network system. Opinion (Hurst, 1974), (Dennis, 1998) in stating the benefits derived from improving access to two parts, namely: (1) direct benefits; easier access to various facilities in relation to the provision of services by these facilities, and (2) secondary benefits; includes saving time, effort and transportation costs.

According to Bowersox (1981), the definition of transportation is the movement of goods or passengers from one location to another, with products that are moved or moved to locations that are needed or desired. Papacostas (1987) defines transportation as a system consisting of certain facilities along with flows and control systems that enable people or goods to move from one place to another efficiently at any time to support human activities.

Road construction that is crossed by freight vehicles must be able to withstand the axle pressure of the vehicle against the road. Quality road infrastructure facilitates the distribution of goods and services that causes increased accessibility and mobility of goods and services, which can further improve the welfare of the community, and be able to increase the competitiveness of a country (Araby, 2002).

Research of Bosede, et al. (2013); Ivanova and Masar (2013), and Srinavasu and Rao (2013) also use the transportation infrastructure variable but are not detailed using the road transport infrastructure variable. Terefe Research (2012), Skorobogatova and Merlino (2016), used the road infrastructure variable but did not use the freight transportation variable.

Karamihas and Sayers (1998) state that pavement roughness can negatively impact various functional and operational characteristics of the road because: (1) it causes stress in the vehicle structure; (2) reduce user comfort; (3) increase the dynamic load of the road surface by vehicle wheels so as to accelerate damage and fatigue in road structures; (4) increase user inconvenience and reduce the amount of effective vehicle load. Therefore, for roads to be able to accommodate the needs of movement with certain service levels, road supervision and maintenance needs to be done.

The quality of goods transportation services is strived for: speed, safety, adequacy, frequency, regularity, responsibility, acceptable cost or affordable price) (Schumer, 1968). However, the existence of the road network alone is not enough to support the economic growth of a region, the condition of the road network system must also be taken into account. The better the condition of the road network system in an area, the better the connectivity level, which means the easier the relationship between regions is established. The higher the level of connectivity, it can be seen from the shorter travel distance and the route of choice to travel to destinations, increasing direct travel to the destination and easier to reach / access (Victoria Transport Policy Institute, TDM Encyclopedia, 2009).

Transport output and investment in transportation infrastructure in Nigeria have significantly contributed positively to growth, which shows a strong and statistically significant impact. Experience from Nigeria shows that this is necessary to design economic policies that will improve transportation infrastructure and to increase investment in the sector of sustainable economic growth. It is necessary to reduce the cause of ablution in the road network by opening a water and rail transportation network (Akanbi Bosede, Bamidele Abalaba, Dunni Afolabi, 2013).

The impact of road infrastructure development on economic growth and Slovak economic competitiveness is focused on the quality of the road network on certain highways and laying roads (Ivanova and Masar, 2013). The density and quality of road infrastructure, which primarily determines the competitiveness of the country. This study also addresses issues of expenditure and funding sources relating to road infrastructure in the Slovak Republic, the competitiveness of road infrastructure and the flow of foreign direct investment (FDI) to the Slovak Republic. In addition, look at road infrastructure in relation to gross domestic product (GDP) and foreign direct investment. The methodology uses the time series method and the correlation method when analyzing the impact of road infrastructure development on economic growth and increasing Slovak economic competitiveness. There is a correlation between GDP development and road infrastructure expenditure on the one hand and the flow of foreign direct investment to the Slovak economy and competitiveness on the other.

A study of the Multimodal Goods Transportation System Policy to Reduce Road Damage Due to Overloading in the Province of Nanggroe Aceh Darussalam shows that: 1) crossings between regencies / cities across East Aceh have the greatest volume of goods movement compared to south west and middle cross, due to the population and the GRDP is relatively higher and the road conditions are relatively better, and the orientation of movement to Medan city and vice versa, 2) overloaded truck is very influential on the road damage power, road damage is directly proportional to the percentage of overload when compared to the corresponding load according to the amount permit load, 3) it is recommended to divert freight transportation by other modes that can carry more goods in one transport for distances of more than 300 km, 4) revitalization of the railroad gets priority compared to the new road plan (Saleh, 2009).

Skorobogatova and Merlino (2016) highlight the role of the transportation industry in Latvian economic development, describe the concept of transportation infrastructure as an important part of the country's transportation system, and estimate international approaches that work for measuring the performance of transportation infrastructure development. This article focuses on the need for the development of a methodology to measure the performance of transportation infrastructure, which must be applied systematically and which will be generally beneficial to all those who are responsible for making decisions relating to transportation. This study concludes that transportation is a priority in the development of the Latvian economy. Adequate infrastructure is a basic prerequisite for the country's transportation system. Transportation substantially has direct and indirect effects on economic efficiency and economic growth. Transportation infrastructure is very important for the country's economic growth. There is a relationship between the quality of transportation infrastructure and the country's macroeconomic performance. Analysis of trends in GDP and transportation sector development indicators confirms the relationship between economic development growth and the transportation industry.

Infrastructure plays an important role in economic growth and thus contributes to reducing economic inequality, poverty. Greater access from the poor to education and health services, water and sanitation, road networks and electricity is needed to bring equitable development. That is an important prerequisite for sustainable economic and social development. Transport infrastructure investments (roads, railways, ports and civil aviation), irrigation, watersheds, hydroelectric works, scientific research and training, markets and warehousing, communication and informatics, education, health and family welfare play a strategic but indirect role in the development process, but makes a significant contribution to growth by increasing the productivity of land, labor

and capital factors in the production process. Educational facilities greatly affect the quality of life of people. This study establishes the relationship between infrastructure and economic growth using growth theories with empirical evidence. This concludes that infrastructure has a significant positive effect on economic growth and poverty reduction (Srinavasu and Rao, 2013).

The main road sector investment program that has been taking place in Ethiopia since 1997 resulted in a significant increase in road accessibility. As a low-income country without railroad and water transportation system, road transportation is the most important for the economy of Ethiopia. The purpose of this study is to empirically assess the effects of public investment programs on the welfare of rural households in Ethiopia. The study combined panel data on rural households in Ethiopia with provincial level panel data on road density to estimate the impact of roads on poverty and consumption. The results showed poverty decreased with increasing accessibility of rural roads. Studies also show that good road connectivity not only lowers the poverty line but also significantly increases consumption growth rates. Overall productivity of farm households has increased significantly with the level of road access (Terefe, 2012).

Vytautas Snieska and Ineta Simkunaite (2009) conducted a study on the correlation between growth and infrastructure in Latvia and Estonia giving the same results. Road length and telecommunications are positively correlated with economic growth and sanitation has an inverse correlation with economic growth. Empirical tests prove that the relationship between infrastructure variables and economic growth in Lithuania and Latvia has differences even though these countries are associated with the same group of countries.

II. RESEARCH METHODOLOGY

A. Determination of Research Samples

The study was conducted on 3 (three) roads in the province of North Sumatra in the regency of Langkat. The study population was residents of Langkat Regency who worked as drivers of freight vehicles. Determination of the number of samples at each survey location on each road using the Slovin formula as follows.

TABLE I
NUMBER OF POPULATION AND RESEARCH RESPONDENT SAMPLES

No.	Development Area / Roads	Transportation Type	Average Population Per days Volume (Unit)	%	Sample
1	**Langkat Hulu Area**				
	Kuala - Selesai Road	2 axes	225	17.50	53
		3 axes	52	4.04	12
		Combination	9	0.70	2
	Namu Ukur - Batas Kota Binjai Road	2 axes	81	6.30	19
		3 axes	1	0.08	-
		Combination	-	0.00	-
	Mancang – Kwala Begumit Road	2 axes	138	10.73	33
		3 axes	30	2.33	7
		Combination	3	0.23	1
2	**Langkat Hilir Area**				
	Padang Tuaang – Tanjung Pura Road	2 axes	198	15.40	47
		3 axes	22	1.71	5
		Combination	8	0.62	2
	Secanggang – Stabat Road	2 axes	117	9.10	28
		3 axes	10	0.78	2
		Combination	-	0.00	-
	Pantai Cermin –Kampung Lalang Tanjung Pura Road	2 axes	70	5.44	17
		3 axes	-	0.00	-
		Combination	-	0.00	-
3	**Teluk Haru Area**				
	Pangkalan Susu – Simpang Pangkalan Susu Road	2 axes	116	9.02	28
		3 axes	16	1.24	4
		Combination	5	0.39	1
	Pematang Jaya – Batas Aceh Tamiang Road	2 axes	51	3.97	12
		3 axes	4	0.31	1
		Combination	-	0.00	-
	Skoci – Simpang Bukit Mas Road	2 axes	111	8.63	26
		3 axes	16	1.24	4
		Combination	3	0.23	1
	Total		**1,286**	**100**	**305**

Source: 2019 Survey Results

B. Data Analysis Technique

Data analysis techniques using Structural Equation Modeling (SEM) where SEM is a statistical modeling technique that is very cross-sectional, linear and general. Included in this SEM is factor analysis (factor analysis), path analysis (path analysis) and regression (regression).

Some of the assumptions and steps of model testing carried out in SEM are:

a. The recommended number of samples is at least 200; meet the test for normality, linearity, outlier.

b. Confirmatory Factor Analysis (CFA) testing in this study is needed to determine whether the indicators are representative or not, in forming each latent variable

c. Measurement model is a part of SEM model which consists of latent variables (constructs) and several manifest variables (indicators). The purpose of testing is to find out how precisely manifest variables can explain existing latent variables. Test the suitability of the model through a review of various criteria for goodness of fit (GoF). If the GoF criteria have not been met then a modification of the model is carried out so that later the required model will be obtained and better.

III.   FINDING AND DISCUSSION

A. Evaluation of SEM Assumptions

Evaluation of multivariate outliers using Mahalanobis Distance is to show the distance of an observation from the average of all variables in a multidimensional space (Hair et all, 1995; Norusis, 1994; Tabacnick & Fidel, 1996. To calculate the Mahanolobis Distance based on chi-square values on free degrees of (20 indicators) at the level of p <0.001 is χ^2 (20.0.001) = 45.318 (based on the distribution table χ^2) From the results of data processing it is known that 6 (six) samples found outliers because the Mahalanobis distance is greater than 45.318. Therefore, to avoid data abnormalities in this study, the six observations should be excluded from the sample so that the remaining sample size is 299 samples (still meeting the minimum sample of SEM, 200 samples). Indications of multicollinearity and singularity can be seen through the determinant values of covariance matrices that are really small, or close to zero. From the results of data processing the value of the Determinant of sample covariance matrix = 409666688,948

From the results of data processing it can be seen the determinant value of the sample covariance matrix is far from zero. Thus it can be said that the research data used do not have multicollinearity and singularity.

B. Confirmatory Factor Analysis

CFA testing in this study is needed to determine whether the indicators are representative or not, in forming each latent variable. From the results of the CFA analysis, it is known that the CFA model for latent variables of the road network (X1), the organization of freight transport (X2), regional development (Y1) and public welfare (Y2) shows that all indicators are declared valid and trusted to measure all research variables.

TABLE II
OUTPUT ANALYSIS OF CFA RESEARCH VARIABLES

No.	Variable	Indicators	Estimate	Result
1.	Road Network (X1)	Ease (X11)	,770	valid
		Road Design (X12)	,690	valid
		Road Construction Quality (X13)	,835	valid
		Road Maintenance (X14)	,933	valid
		Road Class Designation (X15)	,659	valid
		Signs and Marks (X16)	,897	valid
2.	Organizing Freight Transport (X2)	Government Development (X21)	,590	valid
		Tax and Retribution (X23)	,613	valid
		Vehicle Type (X24)	,979	valid
		Driving Equipments (X25)	,975	valid
		The Procedure for Transporting Goods (X26)	,647	valid
		Goods Freight Control (X29)	,846	valid
3.	Regional Development (Y1)	Economic Aspects (Y11)	,748	valid
		Social and Cultural Aspects (Y12)	,957	valid
		Institutional Aspects (Y13)	,871	valid
4.	Community Welfare (Y2)	Revenue (Y21)	,789	valid
		Business and Employment Opportunities (Y22)	,780	valid
		Education (Y23)	,836	valid
		Safe and Comfortable (Y24)	,418	valid
		Health (Y25)	,741	valid

C. Analysis Results of the Research Model Feasibility Test

Based on the results of the model that has been made and the fulfillment of a number of assumptions, the next step is to test the model or measurement model. Measurement model is a part of SEM model, which consists of latent variables (constructs) and several manifest variables (indicators). The purpose of testing is to find out how precisely manifest variables can explain existing latent variables.
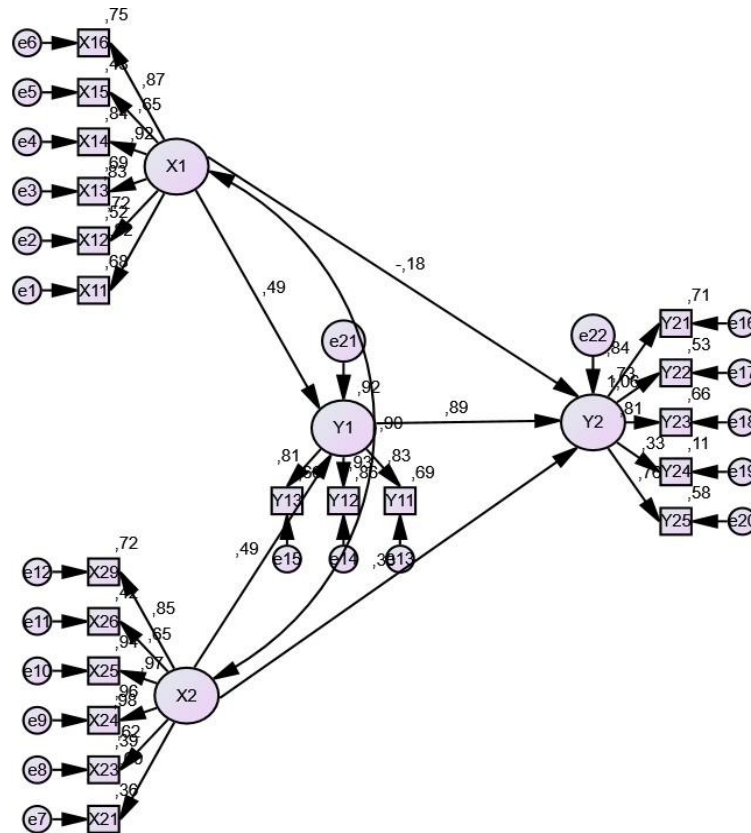

Fig 1. Measurement Model Before Modification

TABLE III
FEASIBILITY TESTING INDEX SEM MODEL BEFORE MODIFICATION

Goodness of Fit Index	Cut off Value	Analysis Result	Model Evaluation
$\chi 2$ - Chi - square	Small	1176.173	Not Feasible
Probability	>0.05	0.000	Not Feasible
RMSEA	<0.08	0.142	Not Feasible
GFI	>0.90	0.699	Not Feasible
AGFI	>0.90	0,614	Not Feasible
TLI	>0.90	0.820	Not Feasible
CFI	>0.90	0.844	Not Feasible

From the table above it can be seen that the criteria for assessing the feasibility of the SEM model consisting of $\chi 2$ - Chi-square, probability, RMSEA, GFI, AGFI, TLI and CFI are all not good. Where all the values from the analysis are far from the

stated value. For this reason, the model must be modified so that later the required model will be obtained and better.
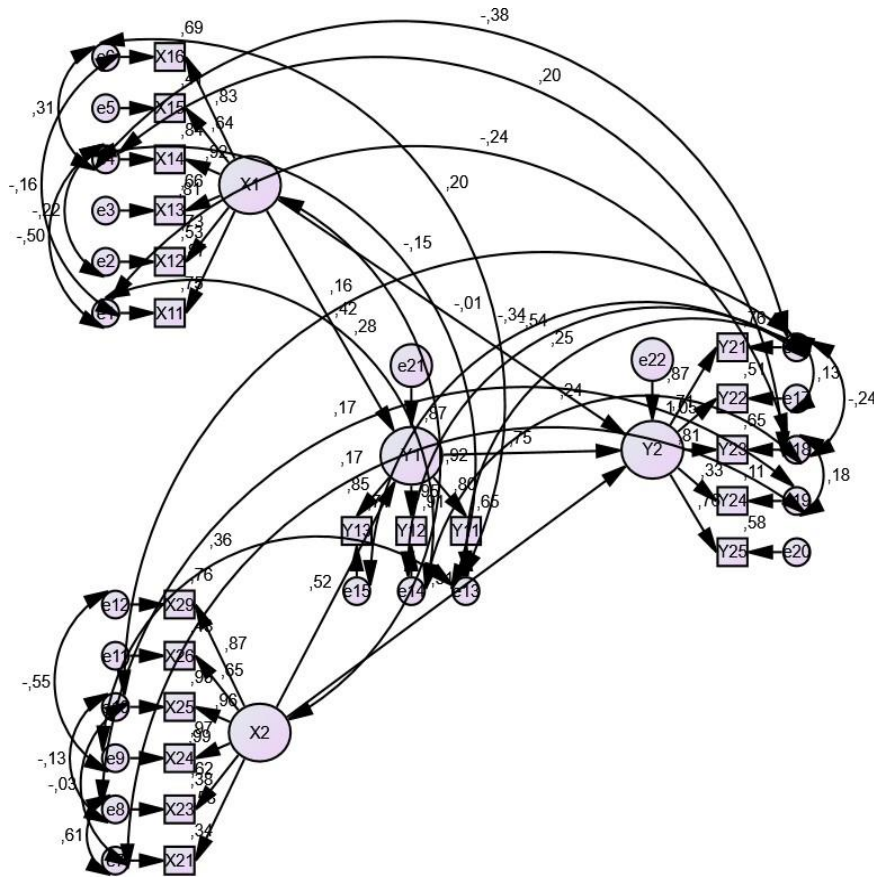

Fig 2. SEM Model After Modification

TABLE IV
FEASIBILITY TESTING INDEX SEM MODEL AFTER MODIFICATION

Goodness of Fit Index	Cut off Value	Result Analysis	Model Evaluation
χ 2 - Chi - square	Small	482.774	Good
Probability	>0.05	0.010	Marginal
RMSEA	<0.08	0.078	Good
GFI	>0.90	0.868	Marginal
AGFI	>0.90	0.808	Marginal
TLI	>0.90	0.927	Good
CFI	>0.90	0.947	Good

From the table above it can be seen that the criteria for assessing the feasibility of the SEM model consisting of χ 2 - Chi-square, probability, RMSEA, GFI, AGFI, TLI and CFI generally show that the model is fit with the data because overall it is deemed

to meet GOF criteria and the next can be continued in the next data processing. Furthermore, the calculation of the coefficient of influence through regression weight will be calculated which will be used as a basis for analyzing the significance and magnitude of influence between research variables.

TABLE V
REGRESSION WEIGHT AND STANDARDIZED REGRESSION WEIGHT

Relationship Between Variables	C.R	P	Estimate	Result
Regional Development - Road Network	4.087	0.000	0.425	Significant
Regional Development - Organizing Freight Transport	5.353	0.000	0.524	Significant
Community Welfare - Regional Development	6.898	0.000	0.748	Significant
Community Welfare - Organizing Freight Transport	3.315	0.000	0.305	Significant
Community Welfare - Road Network	-0.146	0.884	-0.013	Significant

Based on the results of regression weight can be seen the results of the significance of the influence of road network variables (X1) and the implementation of freight transportation (X2) on the development of the Langkat Regency (Y1) and road network variables (X1), the implementation of freight transportation (X2), and regional development (Y1)) to the welfare of the people of Langkat Regency (Y1) partially directly and indirectly, namely:

1. SEM analysis results show the coefficient of the road network path (X1) to the development of Langkat District (Y1) of 0.425 with a value of C.R 4.087> 2.0 and prob. 0,000 <0.05 indicates a positive and significant influence of the road network (X1) on the development of Langkat District (Y1). The coefficient of implementing freight transportation (X2) to the development of Langkat Regency (Y1) is 0.524 with a value of C.R 5.353> 2.0 and prob. 0,000 <0.05 indicates a positive and significant effect of the implementation of freight transportation (X2) on the development of Langkat Regency (Y1). The estimated value of Squared Multiple Correlations (estimate = 0.867) shows that the regional development variable (Y1) can be explained using the road network variable (X1) and the implementation of freight transportation (X2) of 86.7%.

2. SEM analysis results show the coefficient of the road network path (X1) to the welfare of the people of Langkat District (Y2) of -0.013 with a value of C.R -0.146 <2.0 and prob. 0.884> 0.05 shows there is no direct influence of the road network (X1) on the welfare of the people of Langkat District (Y2). The coefficient of organizing the transportation of goods (X2) to the welfare of the people of Langkat Regency (Y2) is 0.305 with a value of C.R 3.315> 2.0 and prob. 0,000 <0.05 indicates a positive and significant direct effect on the implementation of freight transportation (X2) on the welfare of the people of Langkat Regency (Y2). The coefficient of regional development (Y1) to the welfare of the people of Langkat Regency (Y2) was 0.748 with a value of C.R 6.8985> 2.0 and prob. 0,000 <0.05 indicates that there is a positive and significant direct effect of regional development (Y1) on the welfare of the people of Langkat District (Y2).

3. SEM analysis results show the indirect effect of the road network (X1) on the welfare of the community (Y2) through the development of the Langkat District (Y1) can be calculated by the product of the road network path coefficient (X1) to the regional development (Y1) with the development path coefficient region

(Y1) to the welfare of the people of Langkat Regency (Y2) in the amount of $0.425 \times 0.748 = 0.318$

4. SEM analysis results show the indirect effect of the implementation of freight transportation (X2) on the welfare of the community (Y2) through the development of the Langkat District (Y1) can be calculated by the product of the path of the freight transportation route (X2) to the regional development (Y1) with the coefficient the path of regional development (Y1) to the welfare of the people of Langkat Regency (Y2) is $0.524 \times 0.748 = 0.392$.

This research proves that the road network and the implementation of freight transportation have a positive and significant effect on the development of the Langkat Regency. The results of this study support the existing theoretical statements as explained in the Infrastructure system and transportation facilities as basic infrastructure (basic infrastructure) are prerequisites for the occurrence of regional economic movement, where the support and driving system of transportation infrastructure plays a role in the efficiency and effectiveness of regional economic activities. The breakdown in the regional transportation system will hamper investment mobility and economic activities of the community. Transportation in regional development is the main support that enables a region to develop. Transportation activities provide positive benefits judged from economic aspects, social aspects and political aspects. Transportation functions as the promotion sector and the servicing sector for regional and economic development.

This research also proves that regional development influences the welfare of the people of Langkat Regency, that regional development is an act of regional development or developing regions or areas in the context of efforts to improve the level of welfare of the community or promote and improve and improve something that already exists. Basically, regional development means increasing the value of a region's benefits to the people of a certain area to be able to accommodate more residents, with an average level of community welfare improving, in addition to showing more facilities / infrastructure, goods or services available and business activities an increasing society, both in terms of type, intensity, service and quality.

This research also proves that the road network and the implementation of freight transportation have a positive and significant effect on the welfare of the people of Langkat Regency through regional development. Transportation can advance economic and community welfare through the creation of accessibility and mobility where the accessibility function is to open less developed regions and the mobility function to spur developed regions. The availability of road infrastructure has a very strong relationship with the level of regional development, which among others is characterized by the rate of economic growth and social welfare.

This research proves that the implementation of freight transportation has a direct influence on the welfare of the community based on the direct benefits that can be felt by the community through the implementation of freight transportation. Transportation is an activity that creates or adds to use. The uses created by transportation activities are place utility and time utility. Creating a place, related to transportation activities that move goods from one place to another. By moving an item from the production area, the use of the item is higher, because many consumers who are more consumers who can afford to pay a higher price that is what is called the place value need it. Transportation has the potential to have a direct positive effect on the poor. Transportation has an important role in reducing poverty. Reducing the number of poor people can be done by increasing income and reducing expenditure

per population. Development of transportation facilities directly opens business opportunities and employment opportunities for the welfare of the community.

Based on the findings in this study, so that the development of the area and the welfare of the people of Langkat Regency will improve the improvement of the road network, the organization of goods transportation, economic infrastructure and facilities and community institutions through:

1. Construction of a network of freight transportation that connects the location of origin of the transportation of goods within the regency and is connected to seaports, railway stations and toll road development.

2. Improving the design and quality of existing road network construction, maintaining timely and appropriate quality of roads, determining the class of roads through socialization and expressed with road class signs, meeting the needs of traffic signs and road markings.

3. Increasing the organization of goods transportation through government guidance, eradicating illegal levies, adjusting the type of goods transport motorized vehicle to the type and capacity of the cargo, fulfilling the equipment of drivers and motorized vehicles for transporting goods, fulfilling the provisions on procedures for the transportation and loading and unloading of goods, completing infrastructure and means of supervision cargo of goods.

4. Increasing the types, quantities and conditions of economic infrastructure and facilities through the development of industrial and regional commodity processing factories to become finished goods such as: agricultural production of food crops, plantations, livestock, and fisheries.

5. Strengthening the role of financial institutions and the community's economy

IV. CONCLUSION AND RECOMMENDATIONS

The results of this study prove that the road network does not have a direct significant effect on community welfare, but the road network has a significant and positive effect on the welfare of the people of Langkat Regency through the development of the region. Construction of a freight transportation network that connects the generation site (origin) and the pull (destination) of transportation of goods within the regency and is connected to the Pangkalan Susu seaport, between the regency development areas (Langkat Hulu, Langkat Hilir and Teluk Aru), the location of the train station and the development of the Stabat - Binjai - Medan toll road. The results of this study prove that the implementation of freight transportation has a significant and positive effect on the welfare of the community partially directly and through regional development can be a reference for the Government of Langkat Regency to improve the implementation of freight transportation by increasing: government guidance on the implementation of freight transportation, supervision of the fulfillment of driving equipment, supervision cargo, guidance and supervision of allotment of vehicles and procedures for transportation, improvement of tax and retribution services, and eradication of illegal levies on the implementation of freight transportation. The results of this study prove that the development of the region has a significant and positive effect on the welfare of the community, which can be a reference for the Langkat District Government to improve the development of the Langkat Regency by increasing: the types, numbers and conditions of economic, socio-cultural and financial institutions and community economic and institutional infrastructure. The need for special research related to the construction of goods terminals and their supporting facilities to support the implementation of freight

transportation in Langkat Regency. Considering that there are still indicators not yet summarized in this study, it is very possible for researchers to further complement other indicators so that this research becomes more perfect and continues to be new in the accessibility and connectivity of the road network, and the implementation of freight transportation.

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