Analysis of Factors Affecting the Effectiveness of Road Maintenance in Pidie Regency

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Abstract

Land transportation infrastructure as a medium of accessibility for various community needs that have an important role in economic growth, socio-cultural, political, and other factors of a region or area. In order for road infrastructure to function optimally in improving these factors, several important aspects need to be considered, including having user safety and comfort, environmentally friendly. Land transportation infrastructure is not only a means of mobility but also a tool to achieve better social and economic welfare for the entire community. Given the strategic role of land transportation infrastructure, namely roads, it is very necessary to have security and comfort values so that the efficiency and effectiveness of the infrastructure are indicators to be evaluated. The effectiveness and efficiency of roads are greatly influenced by many factors including road conditions and age, land use, social, economic and policy. community and related parties. The purpose of this study is to analyze the dominant factors that influence the effectiveness of road maintenance in Pidie district. This study uses a qualitative approach to analyze data obtained from respondents which are primary data and the use of SPSS as an analysis tool so that it becomes numerical. The results obtained for the instrument items used are reliable and trustworthy, this is based on the Cronbach's Alpha (CA) value obtained in the range of 0.50 to 0.70. Based on the results and discussions obtained, it can be concluded that all proposed instrument items provide a significant contribution to determining the effectiveness of road maintenance decisions in Pidie Regency with the highest influence instrument factors being economic instruments and road conditions. The coefficient value obtained for the two factors is 5.571 for the economic instrument and followed in second place, namely the road condition instrument item with a coefficient of 3.603.

Keywords: *Effectiveness, Road Maintenance, Dominant Factor.*

1. Introduction

Highways are land transportation infrastructure that have a very important role in the transportation sector, especially the continuity of the distribution of goods and services and the most effective and cheapest population migration. The existence of highways is very necessary to support economic growth, agriculture, society, culture and other sectors [1], [2]. Road infrastructure is essential to enable the efficient movement of people, goods and services, while increasing access to land and facilitating various commercial and social activities [3], . However, over time, road damage cannot be avoided either due to the service life being reached, the influence of high traffic volumes, traffic loads exceeding the permit capacity, poor drainage, or lack of maintenance [4], [5], [6]. The damage to the road has various negative impacts on road users, including lack of comfort for drivers, increased traffic accidents, increased travel time, and other factors including difficulty of access for people with disabilities [7], [8], [9], [10]. In addition to the influence of several negative factors, road damage has a significant impact on disrupting the community's economy as a means of accessibility in carrying out daily activities and the distribution of goods and other transportation services [11], [12]. District roads are transportation infrastructure that connects the district center which is the center of the economy of a region with central points of production, especially agricultural commodities, livestock and other strategic needs such as transportation of natural resources for construction purposes [7], [13]. Likewise, Pidie Regency is located in the lowlands which is dominated by rice fields surrounded by sub-district towns so that it requires a relatively large and long road network. Geographical conditions and the large number of road networks have the potential for lack of maintenance and care so that roads are damaged more quickly. This condition is exacerbated by the limited allocation of funds for road maintenance and care, so that an appropriate strategy is needed for the effectiveness and efficiency of the use of the regional revenue and expenditure

budget for road maintenance and care activities. sources of funds, like many regions in Indonesia, have a need for a quality road network to support local economic growth, community accessibility and distribution of goods. Damaged roads not only have an impact on the low performance of traffic movements as a means of mobility and access to markets and other public facilities so that they can affect the stimulus of the regional economy. In addition, road damage can affect the exchange of information, goods, and services between regions for isolated areas other than land transportation or separate areas [14], [15]. Therefore, road construction is intended for human activities as actors of mobility or carriers of information, of course, in carrying out movement requires safety and comfort and these values are closely related to the traffic environment, road conditions, traffic arrangements and side obstacles.

Based on the problems caused by damaged roads, urgent and important needs in efforts to improve road performance as a means of mobility for various community needs in Pidie Regency want to analyze the factors that influence the effectiveness and efficiency of road maintenance in the Pidie Regency area. In this analysis, considering various factors that influence policy decisions on road maintenance management that are interrelated with each other including economic factors, policies, road conditions, land use, traffic volume, and other factors in the form of local wisdom such as community participation, education levels and other social values [16]. Of the various factors that influence decisions on maintenance in an area, the most dominant and significant are only two main factors, namely economic factors and policy factors [17], [18]. Economic factors have a significant influence on road maintenance decision making, this is related to the costs and benefits of road maintenance itself. The availability of sufficient funds for road maintenance in an area or region is not accompanied by the benefits and objectives to be achieved for economic growth, so it is impossible for the policy to be implemented. Economic factors and policies are two dominant aspects that must be considered, followed by road conditions and their functional classification. To achieve effectiveness in road maintenance, it is important for decision makers to consider all of these factors holistically in policy planning and implementation. Given that Pidie Regency has unique geographical, social and economic characteristics, it requires an appropriate and adaptive approach so that an effective maintenance policy strategy with local conditions does not cause problems at the community level as beneficiaries. Seeing how important the role of road infrastructure is in supporting the sustainability of the transportation system and other aspects of life, the existence of road infrastructure must always be maintained in optimum condition by carrying out routine maintenance and maintenance so that it remains within its planned age [19].

The implementation of a road maintenance system in Pidie Regency has an important role in maintaining road conditions so that they continue to function optimally in serving traffic, so that traffic safety is guaranteed and road services are improved [14]. This is the background to the research to compile the implementation of road maintenance so that fast handling priorities are obtained so as to minimize serious damage to asphalt pavement work. This study aims to examine the effectiveness of road maintenance by identifying factors that influence the causes of road damage using the perceptions of respondents in Pidie Regency and analyzing the role of each causal factor in road maintenance policy decisions in the region.

2. Research Method

This study was designed to determine the level of effectiveness of road maintenance in Pidie Regency with a qualitative and quantitative approach. The qualitative approach is used to help explore the perceptions and experiences of the community and related parties, while the quantitative approach is used to analyze numerical data [20], [21]. Given that this study is included in the descriptive category, which aims to describe and analyze the factors that influence the effectiveness of road maintenance in Pidie Regency.

The population of sample data which is the source of information for the analysis is planned from various groups of several individuals with predetermined qualities and characteristics including planning consultants, implementing contractors, user communities and construction service development institutions. The number of questionnaire data distributed is quite large, but after verification to meet the criteria obtained, each group of individuals varies greatly so that the total population of data obtained is 65 respondents. In addition to the questionnaire data, direct interview data and field observations are also used as sources of information in the form of experiences and views to obtain a more comprehensive picture of the effectiveness of road maintenance policy decisions. The distribution of questionnaire data and respondent interviews and field observations were selected randomly in areas adjacent to the research location. Based on the collected data, an analysis was carried out by reducing qualitative data so that it can be presented in a table according to groups and individuals. From the tabulation results, the percentage of respondents according to category was obtained to ensure data validity so that data analysis can be carried out using the Statistical Package for the Social Sciences 24.0 (SPSS 24.0).

3. Results and Discussion

Several results were obtained Based on the data analysis results on the dominant factors causing road damage that affect the effectiveness of road maintenance in Pidie Regency using SPSS 24.0. The results obtained are presented in tables and descriptive narratives.

3.1. Identification of Factors

According to the data analysis results from SPSS 24.0, a very varied level of consistency was obtained for the test variables used to determine the dominant factors causing road damage in determining the effectiveness of road maintenance in Pidie district. Of the six (6) proposed indicators in the form of dominant factors causing road damage, the consistent value is stated in the form of Cronbach's Alpha (CA) and obtained in the range of 0.50 to 0.70 so that the data can be noted with a moderate level of reliability and in the category is still consistent enough to be used. The dominant factors and level of consistency of the proposed variables with the CA value obtained are shown in Table 1.

Table 1. Results of dominant factors and consistency levels

Variable	Value	Cronbach's Alpha	Description
Road Condition (X1)	> 0,6	0,709	Reliable
Road Age (X2)	> 0,6	0,717	Reliable

Land Use (X3)	> 0,6	0,708	Reliable
Social (X4)	> 0,6	0,699	Reliable
Economic (X5)	> 0,6	0,691	Reliable
Policy (Y)	> 0,6	0,691	Reliable

According to the findings presented in Table 1 above, the dominant factors causing road damage to the effectiveness of road maintenance decision-making in Pidie Regency with a CA greater than 0.70 are the age and condition of the road and land use. The three dominant factors causing road damage are more consistent than other factors, namely social, economic, and policy, with relatively lower CA values but still in the reliable category.

This is grounded in the concept of indicator items, where a higher CA value is stated to be more dominant and influential if applied as a policy reason to determine the effectiveness of road maintenance based on the age of the road. This can be explained by the fact that the age of the road is related to the condition of decreasing elasticity values so that the stiffness of the pavement increases, which can cause small cracks that cause discomfort to road users. Likewise, road conditions can also affect the determination of the effectiveness of road maintenance. Uncomfortable road conditions, such as wavy unevenness, can also be used to determine the effectiveness of road maintenance. Still, this condition is relatively weak in argumentation due to budget constraints. With this condition, based on the results of the consistency test on the proposed indicator items, it can be stated that the road age factor is the first order in determining the effectiveness of maintenance decisions in Pidie Regency.

As for the reliability test to support the extent to which the measuring instrument can be trusted or relied upon. This can be seen if the measuring instrument is used repeatedly to measure the same symptoms and the measurement results are relatively constant, then the measuring instrument is reliable. Thus, reliability shows the consistency of the research measuring instrument by measuring the same symptoms. Table 4.2 shows the results of the comfort instrument item analysis by looking at the Rtable and Recount values obtained by all instrument items in the reliable category.

Table 4. 2 Results of comfort instrument items

Variable	R_{Table}	$R_{Calculated}$	Description
Road Condition (X1)	>0,244	0,446	Reliable
Road Age (X2)	>0,244	0,637	Reliable
Land Use (X3)	>0,244	0,462	Reliable
Social (X4)	>0,244	0,518	Reliable
Economic (X5)	>0,244	0,555	Reliable
Policy (Y)	>0,244	0,650	Reliable

All comfort instrument items can be stated to be in a reliable and accurate category. Likewise, all instrument items have been recalculated to a value greater than the Rtable value according to the degrees of freedom and the specified significance level, so all instrument items are declared valid. Based on the analysis of the comparison between the results of Rtable and Rhitung, the most reliable indicators for decisions on the effectiveness of road maintenance in Pidie Regency are policy and economic indicators. Policy indicators are the main reason for determining decisions on the effectiveness of road maintenance in Pidie Regency. They are relatively less relevant or less precise, although this opinion is in line with the statement of Robinson & Rusbintardjo. However, suppose the policy indicator is collaborated with economic policy. In that case, the policy indicator is used to determine the effectiveness of road maintenance in Pidie Regency with the ultimate goal of increasing an area's economy. The economic factor based on this analysis with $R_{calculated}$ is ranked second most dominant in determining the effectiveness of road maintenance in the Regency. This can be explained by the fact that economic indicators are the main reason for determining the effectiveness of road maintenance in Pidie Regency due to increased accessibility, high traffic movement, and comfort so that the distribution of goods and passengers, as well as information, can influence the increase in the economy of a region, especially industrial areas and other areas related to commodity sources.

3.2. Contribution factors

To identify and evaluate each factor's contribution to the road maintenance policy decision in Pidie Regency, a multiple linear regression test is used, where each indicator obtains unstandardized coefficients. This value indicates the magnitude of the direct impact of changes on the Y value, which is the dependent variable. The coefficients of each factor that influences the effectiveness of road maintenance decisions are shown in Table 2, with varying unstandardized coefficient values.

Table 2. Recapitulation of instrument item factor contributions

Model	Unstandardized Coefficients
Constanta	0.312
Road Condition	3.603
Road Age	1.504
Land use	0.985
Social	0.658

Economic	5.571

According to the results presented in Table 2 above, it can be stated that each coefficient of the factors causing road damage that affect the effectiveness of road maintenance in Pidie Regency varies greatly. The coefficient value is a form of direct contribution to the effectiveness of the decision. The form of impact on the effectiveness of the decision is proposed in the form of the following equation:

$$Y = 0.312 + 3.603X_1 + 1.504X_2 + 0.985X_3 + 0.658X_4 + 5.571X_5 + e \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(1)$$

The magnitude of the regression coefficient provides information about the intensity of each influence on the Y variable, which is the level of effectiveness of road maintenance decisions in Pidie Regency. Based on the proposed equation, it can be stated that the coefficient that has a significant influence on the efficacy of road maintenance decisions is the economic instrument item where the coefficient value obtained from the results of this analysis is 5.571 and followed in second place is the road condition instrument item with a coefficient of 3.603.

Based on the analysis of determining the contribution of each factor to the decision to evaluate the effectiveness of road maintenance in Pidie Regency, the economic instrument items in the equation model have a very high impact on influencing the value of the decision on the effectiveness of maintenance in Pidie Regency. This condition is very suitable to be applied considering that high economic growth has an impact on increasing the original regional income of an area.

Based on the results obtained as an equation for the level of effectiveness of road maintenance activity decisions in Pidie Regency, the result has been involved with integrating all factors so that the road maintenance strategy is more effective in achieving the expected goals. The effectiveness of road maintenance in Pidie Regency, although influenced by a combination of several main variables and other variables such as budget, time, human resources, coordination between stakeholders, and appropriate implementation methods, can be carried out without causing negative impacts on planned targets, especially for passenger and goods accessibility.

4. Conclusion

Based on the results and discussion of the effectiveness of maintenance in Pidie Regency, several conclusions and suggestions can be drawn:
1. All instrument items proposed to evaluate the determination of road maintenance effectiveness decisions in Pidie Regency are reliable and trustworthy.
2. According to the outcomes of the multiple linear regression conducted on all proposed instrument items, it can be stated that the most dominant factors influencing the determination of road maintenance effectiveness decisions in Pidie Regency are economic factors and road conditions.
3. The occurrence of differences in dominant factors influencing the determination of road maintenance effectiveness decisions between the results of this study and other studies is estimated by elements of local wisdom and culture.

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