Environmental Management Model for Road Maintenance Operation Involving Community Participation

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Abstract. Public expectations of Central Java, which is very high on demand fulfillment, especially road infrastructure as outlined in the number of complaints and community expectations tweet, Short Mail Massage (SMS), e-mail and public reports from various media, Highways Department of Central Java province requires development model of environmental management in the implementation of a routine way by involving the community in order to fulfill the conditions of a representative, may serve road users safely and comfortably. This study used survey method with SEM analysis and SWOT with Latent Independent Variable (X), namely, Public Participation in the regulation, development, construction and supervision of road (PSM); Public behavior in the utilization of the road (PMJ) Provincial Road Service (PJP); Safety in the Provincial Road (KJP); Integrated Management System (SMT) and latent dependent variable (Y) routine maintenance of the provincial road that is integrated with the environmental management system and involve the participation of the community (MML). The result showed the implementation of routine maintenance of road conditions in Central Java province has yet to implement an environmental management by involving the community; Therefore developed environmental management model with the results of H1: Community Participation (PSM) has positive influence on the Model of Environmental Management (MML); H2: Behavior Society in Jalan Utilization (PMJ) positive effect on Model Environmental Management (MML); H3: Provincial Road Service (PJP) positive effect on Model Environmental Management (MML); H4: Safety in the Provincial Road (KJP) positive effect on Model Environmental Management (MML); H5: Integrated Management System (SMT) has positive influence on the Model of Environmental Management (MML). From the analysis obtained formulation model describing the relationship / influence of the independent variables PSM, PMJ, PJP, KJP, and SMT on the dependent variable MML as follows: MML = 0.13 + 0.09 PSM PJP PMJ + 0.09 + 0.19 + 0.48 KJP SMT + e

1. Introduction

The provincial road organization program in Central Java included road regulation, building, and supervision was organized by the Central Java Province’s Office of Highways. Road Organization prioritizes the periodical maintenance, treatment, and examination of road to maintain road service level corresponding to the specified minimum standard service. The availability of funds, human resource, tools and changing legislation became an interesting challenge to be developed more in order to improve

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the performance of road [1]. The Central Java Province’s Office of Highways as a government institution with main duty and function of managing the road in the improvement, periodical maintenance and routine maintenance program. It has been described that in 2015, the road dealt with by the Office of Highways is 2,565.621 Km in length, 85.09% (2,183.15 Km) with routine maintenance and 14.91% with rehabilitation, periodical maintenance and improvement programs. The bridge dealt with is 26,086.0 M, 97.37 % with routine maintenance program and 2.63 % with rehabilitation, and bridge replacement program [2]. The Javanese people’s expectation is very high to the fulfillment of need particularly for road infrastructures included in many of their complaints and expectation in tweeter, short mail message (SMS), e-mail, and community’s report in various mass media; Dinas Bina Marga (Office of Highways) of Central Java Province requires the development of environment management in road routine organization by involving the community participation in the form of fulfilling the representative road condition, that can cater to the road users securely and comfortably [3].

The implementation of road maintenance is highly affected by weather, geographic, and land condition in individual internodes. Recalling that nearly all internodes of provincial road undertake routine maintenance, in which an environmental protection is needed in individual internodes physically, sustainable culture should be created in organization and society, and moral values and mutual trust among the elements of organization in the Central Java’s Office of Highways should be implanted, the good environment management should be applied [4].

2. Experimental
This research employed survey method, that was, the research method would use data to generalize the population of research and the data needed in this research included primary and secondary data. This research started by specifying a model based on the theory. Individual variables in the model were conceptualized as the latent ones and measured with some indicators. Some indicators were developed for individual models. The factor analysis was used to determine the indicators to be used to measure the relevant latent variables and represented by some factors [5,6].

The collected and qualified data with adequate validity and reliability was analyzed using the tabulation calculation system corresponding to individual variables used in this research. Data processing was carried out using Structural Equation Model (SEM) based on Variance and Component-Based SEM with Smart PLS software [7].

3. Results and Discussion
The research variable is the measurable abstract concept (observed variable). However, there is also the immeasurable abstract concept (unobserved variable). This dissertation research is intended to examine the multidimensionality of construct consisting of six variables.

3.1 Latent Independent Variable
a. The first latent independent variable is Community Participation in governing, building, developing and supervising road (PSM) (X1), constituting the variable affecting other variable, and in this research, the latent independent variable consisting of 5 indicator variables (X1-1, X1-2, X1-3, X1-4, X1-5): X1-1 is the Level of Community participation in the activities in road area; X1-2 is the form of Community participation in the activities in road area, X1-3 is the Community’s need for road function, X1-4 is the community’s readiness in active participation; and X1-5 is local wisdom.

b. The second latent independent variable is Community behavior in utilizing road (PMJ) (X2), constituting the variable affecting other variables, and in this research the latent independent variable consisting of 5 indicator variables (X2-1, X2-2, X2-3, X2-4, X2-5): X2-1 is the Community’s knowledge on legislation pertaining to road, X2-2 is the Community’s compliance with the legislation pertaining to road, X2-3 is the Discipline of maintaining the road performance, X2-4 is the Community’s compliance with the payment of road retribution, and X2-5 is the care about the problems pertaining to the road surrounding.
c. The third latent independent variable is the Provincial Road Service (PJP) (X3) is the variable affecting other variables, and in this research the latent independent variable consisting of 5 indicator variables X3-1, X3-2, X3-3, X3-4, X3-5): X3-1 is The development of provincial road maintenance, X3-2 is the implementation of routinely provincial road maintenance, X3-3 is the supervision over provincial road maintenance, X3-4 is the quick handling of provincial road damage, and X3-5 is the evaluation on the sustainable implementation.
d. The fourth latent independent variable is work safety in Provincial road (KJP) (X4), constituting the variable affecting other variable, and in this research the latent independent variable consisting of 5 indicator variables (X4-1, X4-2, X4-3, X4-4, X4-5): X4-1 is the readiness of work security cost, X4-2 is the management plan in work safety, X4-3 is the availability of personnel in supporting work safety, X4-4 is the availability of work safety-supporting tool, and X4-5 is the follow-up of work safety program.
e. The fifth latent independent variable is an Integrated Management Sistem (SMT) (X5), constituting the variable affecting other variable, and in this research the latent independent variable consisting of 5 indicator variables (X5-1, X5-2, X5-3, X5-4, X5-5): X5-1 is the study of planning, X5-2 is the study of implementation, X5-3 is the study of examination and evaluation, X5-4 is the study of improvement measure, and X5-5 is the study of SKPD’s commitment.

3.2 Latent Dependent Variable (Y)
The variable affected by other research in this research was a routinely provincial road maintenance, integrated into an environment management system and involving community participation.

3.3 Convergent Validity Test
This convergent validity test was intended to test whether or not the indicators used is fairly valid and representative in measuring its construct. The criteria used in this validity test:
   a. P value < 0.05
   b. Loading factor > 0.7 (valid);
   c. Loading factor = 0.4 s/d < 0.7 (remaining to be maintained as long as it does not raise the AVE value and the composite value is reliable above its threshold);
   d. Loading factor < 0.4 (the indicator should be dropped out of the model).

From the SEM PLS analysis, the factor loading value result was obtained of 0.4 for each of the variables, so that those indicators are fairly relevant in measuring PSM, PMJ, PJP, KJP, SMT and MML

3.4 Discriminant Validity Test
This validity test was intended to examine whether or not the indicators used are fairly valid in contributing to $R^2$. The criteria used in this validity test are: root value AVE > correlation value between constructs in the same column:
   a. Root value of AVE for PSM variable: 0.642 > correlation values between constructs in the same column.
   b. Root value of AVE for PMJ variable: 0.668 > correlation values between constructs in the same column.
   c. Root value of AVE for PJP variable: 0.688 > correlation values between constructs in the same column.
   d. Root value of AVE for KJP variable: 0.683 > correlational values between constructs in the same column.
   e. Root value of AVE for SMT variable: 0.717 > correlational values between constructs in the same column.
   f. Root value of AVE for MML variable: 0.703 > correlation values between constructs in the same column.

Thus the indicators of variable belong to valid category in discriminant way.
3.5 Construct Reliability Test
This test is intended to test the reliability of the instrument/indicator creating a construct. The criteria used in this test are:

a. Composite reliability > 0.7
b. Cronbach’s alpha > 0.7

The composite reliability and cronbach’s alpha values can be seen in the Table 1.

| Latent Variable Coefficient | Composite reliability coefficients | Cronbach’s alpha coefficients |
|-----------------------------|----------------------------------|-------------------------------|
| PSM                         | 0.844                            | 0.786                         |
| PMJ                         | 0.863                            | 0.816                         |
| PJP                         | 0.863                            | 0.814                         |
| KJP                         | 0.897                            | 0.872                         |
| SMT                         | 0.927                            | 0.914                         |
| MML                         | 0.886                            | 0.853                         |

From the table above, it can be interpreted as follows:

a. The composite reliability values for PSM, PMJ, PJP, KJP, SMT and MML constructs are: 0.863; 0.863; 0.897; 0.927 and 0.886, respectively, all of which are higher than 0.7;
b. The cronbach’s alpha values for PSM, PMJ, PJP, KJP, SMT and MML constructs are: 0.816; 0.814; 0.872; 0.914 and 0.853, respectively, all of which are higher than 0.7. Thus it can be concluded that all variables in this research ((PSM, PMJ, PJP, KJP, SMT and MML) are reliable.

3.6 Hypothesis Testing
The hypothesis to be tested includes:

a. H1: Community Participation (PSM) affects positively the Environment Management Model (MML)
b. H2: Community behavior in utilizing road (PMJ) affects positively the Environment Management Model (MML)
c. H3: Provincial Road Service (PJP) affects positively the Environment Management Model (MML)
d. H4: Work Safety in Provincial Road (KJP) affects positively the Environment Management Model (MML)
e. H5: Integrated Management System (SMT) affects positively the Environment Management Model (MML)

From the analysis using SEM-PLS 3.0, the path analysis diagram is obtained as follows:
Figure 1. Path diagram (without parameter value)

Figure 2. SEM Analysis Completed (with its variable values)

Model Fit Indices and P Value
APC=0.194. P<0.001
From the chart and model fit indices and value, it can be interpreted as follows:

a) Model and coefficient values contained in the chart is fit (APC = 0.194 with \( p < 0.001 \), ARS = 0.68 and \( p < 0.001 \) and AVIF = 2.299 < 5);
b) Predictor variable variation (PSM, PMJ, PJP, KJP, SMT) explains the 68% of criterion variable variation MML, including in the criterion of explaining overall (large);
c) Hypothesis 1 stating that PSM affects positively MML is supported (\( p=0.01< 0.05 \ ))
d) Hypothesis 2 stating that PMJ affects positively MML is supported (\( p=0.02< 0.05 \ ))
e) Hypothesis 3 stating that PJP affects positively MML is supported (\( p=0.02< 0.05 \ ))
f) Hypothesis 4 stating that KJP affects positively MML is supported (\( p=0.01< 0.05 \ ))
g) Hypothesis 5 stating that SMT affects positively MML is supported (\( p=0.01< 0.05 \ ))

4. Conclusion

1. There is an environment management model in organizing the routinely provincial maintenance by involving community participation obtained using SEM analysis.
2. From the analysis, the model formulation is obtained describing the relationship/effect of independent variables, including PSM, PMJ, PJP, KJP, and SMT on the dependent one, MML, as explained below:

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MML = 0.13 \text{PSM} + 0.07 \text{PMJ} + 0.09 \text{PJP} + 0.19 \text{KJP} + 0.48 \text{SMT} + e
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