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STRUCTURAL EQUATION MODELING FOR PATTERN MODA OF TRANSPORTATION ACTIVITIES WEEK END IN MANADO

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ABSTRACT

Everyday human activities require the means of transport to be able to carry out the activities, as well as the availability of goods that humans need to be routed through the transport network. Irregularity in the setting mode of transportation cause problems then arise, especially the classic problems like congestion. Impact due to congestion is resulting in huge losses, both in terms of health and economy. Related to this issue, need to be studied further travel patterns based on daily activities, modes of transportation used, the socio-economic users, conditions of service modes are used, so that can be planned a policy in transport management in the study area proper. Model approach to study the behavior of the respondents in the selection moda for the move is Structural Equation Modeling (SEM). The results showed that the selection moda of transportation during the weekend influenced by economic status, patterns of activity and service satisfaction, activity patterns have the greatest influence on the mode of transportation that is equal to 0.631 the dominant indicator is time for 0.948 and moda of transport motorcycles for 0.948.

Key words: Moda transportation, pattern, activity, service satisfaction, SEM

1. INTRODUCTION

Selection mode can be defined as the proportion of the division or a trip to the manner or moda of travel that is different [1]. Besides the way to travel, modes can also mean conveyance or type of vehicle. In the transportation planning process, various procedures have been developed to reduce or spread the mode selection, which is based on the assumption that the proportion of travel demand served by public transport and private vehicles will depend on the performance of each mode in competition with other moda [2]. Selection mode is the most important models in transportation planning [3]. This is because a key role in public transport in transport policies. No one can deny that public transport modes using the space much more efficiently than private transport [4].

Transportation planning goal is finding a solution to the transportation problem in a way that is most appropriate to use existing resources [5]. Planning for transportation basically is estimated future transport needs to be associated with technical problems of transport, which generally start from a business ensure that existing facilities be powered optimally and aimed to design and build new facilities. The movement is fast, safe, easy and convenient is the will of each individual. However, at the same time there are a number of people who move from and to the same destination. It is caused by various underlying factors such as human factors, economic, infrastructure, administration, and so forth. It is necessary for the study of a model-based moda of transport activity patterns in Manado. Those latent variables will analyzed by Structural Equation Modeling (SEM) [6,7,8,9]

2. METHODOLOGY

The data of this research is the primary data taken directly by giving the questionnaire questions via questionnaire in Manado. The sampling method used simple random sampling [10,11]. Keeping in mind that there are many factors that influence the selection of the mode of transport, so in this study developed the idea that the respondents in the beginning of determining a decision in choosing the mode of transport with regard to achieving the intended location. Questionnaires are prepared to be able to record various travel patterns that occur in the community in a variety of activities such as work, school, and other activities.

Structural Equation Modeling (SEM) is a set of statistical methods that allow testing of a relatively complex set of relationships simultaneously. The complex relationships can be built from one or several dependent variable with one or more independent variables. Each dependent and independent variables can take the form factors (constructs are built of several indicators) [12, 13]. These variables form a single variable that is observed or measured directly in a study. Variables consisted of economic status, patterns of activity, user satisfaction and mode of transportation. Economic status includes six indicators of costs (X1.1), accessibility (X1.2), mode (X1.3), security (X1.4), safety (X1.5) and comfort (X1.6). The pattern of activity there are three types, namely: pattern3- (Home - Work - Stop - Home); pattern9- (Home - Other - Home) and pattern11- (Home - Other - Stop - Home) [14] which includes three indicators that time (X2.1), distance (X2.2) and mode (X2.3). User satisfaction includes 5 indicators of tangibles (X3.1), assurance (X3.2), reliability (X3.3), empathy (X3.4), responsiveness (X3.5). While the moda of transportation includes three indicators, namely private car (Y1.1), motorcycles (Y1.2) and public transport (Y1.3).

In a study using SEM allows a researcher can answer questions that are regressive and dimensional (measuring dimensions of a concept or confirmatory factor analysis [15,16]). Identify the dimensions of a concept or construct (performed by factor analysis), and to measure the effect or the degree of relationship among the factors that have been identified dimensions (performed by multiple regression analysis). SEM models is based on the conceptual framework of social economy, patterns of activity and service satisfaction taken from the literature. The conceptual framework is presented as follows:

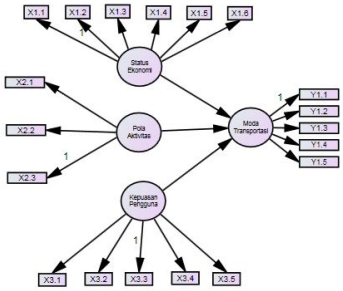

Fig. 1. *Conceptual Framework Moda of Transportation*

3. RESULTS AND DISCUSSION

Validity and Reliability

Validity test is intended to determine whether the questions in the questionnaire are representative and Reliability is a measure of the internal consistency of the indicators of a variable shape that indicates the degree to which each indicator variable that indicates a common formation. Validity and reliability tests performed using confirmatory factor analysis, and the results are presented in Table 1 below.

Table 1. Test Validity and Reliability

Variable	Indicator	Convergent Validity			*Reliability*		
		Loading Factor	p-value	Conclusion	p-value	Conclusion	*Composite Reliability*
Economic Status (X1)	X1.1	0.867	0.000	Valid	0.000	Reliable	0.949
	X1.2	0.856	0.000	Valid	0.000	Reliable	
	X1.3	0.871	0.000	Valid	0.000	Reliable	
	X1.4	0.797	0.000	Valid	0.000	Reliable	
	X1.5	0.898	0.000	Valid	0.000	Reliable	
	X1.6	0.926	0.000	Valid	0.000	Reliable	
Activity Patterns (X2)	X2.1	0.782	0.000	Valid	0.000	Reliable	0.892
	X2.2	0.948	0.000	Valid	0.000	Reliable	
	X2.3	0.835	0.000	Valid	0.000	Reliable	
User Satisfaction (X3)	X3.1	0.620	0.000	Valid	0.000	Reliable	0.903
	X3.2	0.806	0.000	Valid	0.000	Reliable	
	X3.3	0.928	0.000	Valid	0.000	Reliable	
	X3.4	0.900	0.000	Valid	0.000	Reliable	
	X3.5	0.757	0.000	Valid	0.000	Reliable	
Moda of Transportation (Y)	Y1.1	0.906	0.000	Valid	0.000	Reliable	0.951
	Y1.2	0.948	0.000	Valid	0.000	Reliable	
	Y1.3	0.939	0.000	Valid	0.000	Reliable	

Table 1 shows that all values greater loading than 0.5, p-value on the error variance is 0 smaller than α=0.05 and the Composite Reliability value is greater than 0.7, it can be said that all latent variables and their indicators are valid and reliable. Economic status is the biggest indicator of safety (x1.5) for 0.898. The pattern of activity with the biggest indicator is the time (X2.1) of 0.948 and user satisfaction with the biggest indicator of reliability (X3.3) of 0.928. Moda of transport with the biggest indicator is motorcycle (Y1.2) of 0.948.

SEM Moda Transportation Weekend

Normality Test

Normality of the data is a prerequisite for modeling Structural Equation Modeling (SEM). Testing normality emphasis on multivariate data by looking at the value of skewness, kurtosis, and statistically can be seen from the Critical Ratio (CR). If you use a significance level of 5 percent, then the value of CR that is between -1,96 up to 1,96 ($-1{,}96 \leq CR \leq 1{,}96$) said normal distribution of data, both univariate or multivariate [13,15]. The results of testing the normality of data on all study variables CR multivariate value of 1.773 and this value lies outside -1,96 up to 1,96, so that it can be said that the multivariate normal distribution of data.

Singularity Test

Singularity can be seen through the covariance matrix determinant. Determinant value is very small or close to zero indication of the presence of singularity problem, so it can't be used for research. The results of the study provide the value of the sample covariance matrix Determinant of 0.187. This value is not equal to zero so that it can be said that there is no singularity problems in the data analyzed.

Multicollinearity Test

Multicollinearity can be seen through the correlation between exogenous latent variables. The p-value in Covariance greater than (α=0,05) it is said not happen multicollinearity. The results of the study provide a p-value of each latent exogenous variables, namely: (X1 to X2 for 0,117), (X2 to X3 for 0.141), (X1 to X3 for 0.143), so that it can be said that there is a problem of multicollinearity in the data analyzed.

Outlier

Outlier is an observation that appears to the extreme values are uniariate or multivariate that arise due to the combination of its unique characteristics and looks very much from other observations. In the event of a special treatment of outliers can be done at home outlier known how the emergence of the outliers.

Outlier test results in this study are presented in the Mahalanobis d-squared. Mahalanobis value greater than Chi-square table or value p1 < 0,001 said outlier observations. In this study, there are three data outliers, because it is still under 5 percent of the observations, it can be said not happen outliers.

Effect of X1, X2, X3 Against Y1 to Moda Transportation Week End

After testing assumptions, which resulted in a multivariate normal distribution of data, non-singular matrix, multicollinearity does not occur and no outliers, the influence between latent variables can be followed in the analysis of the shape of the path diagram is presented as follows:

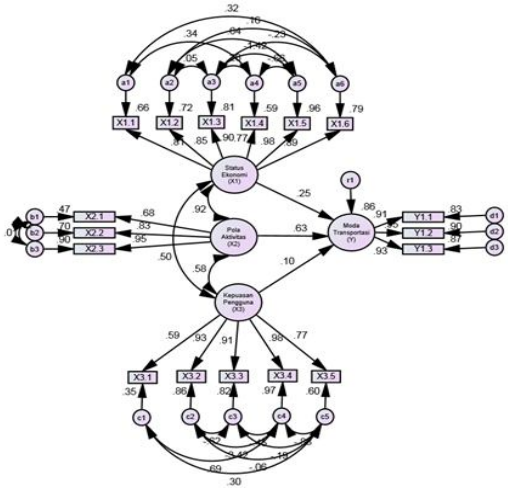

Fig. 2. *Exogenous Relationship Against Endogenous*

The test results over the complete model with the AMOS program is available at the following table:

Table 2. Results of Goodness of Model Fit Moda of Transportation

Criteria	Value Cut – Off	Results Calculation	Information
Chi – Square	Expected to be small	116.842	χ^2 with df = 94 is 117.632 (Good)
Significance Probability	≥ 0,05	0,055	Good
RMSEA	≤ 0,08	0,059	Good
GFI	≥ 0,90	0,937	Good
AGFI	≥ 0,90	0,915	Good
CMIN/DF	≤ 2,00	1,243	Good
TLI	≥ 0,90	0,959	Good
CFI	≥ 0,90	0,963	Good

Based on Table 2, shows that 8 (eight) the criteria used to judge the worth / absence of a model turned out to declare Good and pretty good. It can be said that the model is acceptable, which means there is a match between the model with the data.

Of the appropriate model, it can be interpreted in each path coefficient. Coefficients of these pathways is hypothesized in this study, which can be presented in the following structural equation:

$$Y1 = 0{,}250\ X1 + 0{,}631\ X2 + 0{,}104\ X3$$

Testing the path coefficients in Figure 1 and the equation above in detail are presented in Table 3 below:

Table 3. Results of Path Coefficient Testing Model Moda of transportation

Variable	Coefficient	C.R.	Prob.	Information
Economic status (X1)→ Moda of transportation (Y1)	.250	2.070	.038	Significant
The pattern of activity (X2)→ Moda of transportation (Y1)	.631	4.502	.000	Significant
User Satisfaction (X3)→ Moda of transportation (Y1)	.104	2.234	.025	Significant

Based on Table 3, the interpretation of each path coefficients are as follows:

- X1 is positive and significant effect on Y1. It is seen from the path coefficient is positive for 0,250 C.R. value of 2.070 and obtained a significance probability (p) of 0,038 which is smaller than the significance level (α) determined by 0,05. Thus X1 direct impact on the amount Y1 of 0,250, which means that every hike X1 will raise Y1 by 0,250.
- X2 positive and significant effect on Y1. It is seen from the path coefficient is positive for 0.631 CR value of 4.502 and obtained a significance probability (p) of 0,000 which is smaller than the significance level (α) determined by 0,05. Therefore X2 direct impact on Y1 of 0.631, which means that every increment X2 will raise Y1 of 0,631.
- X3 positive and significant effect on Y1. It is seen from the path coefficient is positive for 0,104 CR value of 2.234 and obtained a significance probability (p) of 0,025 which is smaller than the significance level (α) determined by 0,05. Therefore X3 direct impact on Y1 of 0,104, which means that every increment X3 will raise Y1 of 0,104.

4. CONCLUSION

The results showed that the selection of the moda of transportation during the weekend influenced by economic status, patterns of activity and service satisfaction. The pattern of activity gives the greatest influence on the moda of transportation that is equal to 0.631. The pattern of activity in the week end includes pattern3- (Home - Work - Stop - Home); pattern9- (Home - Other - Home) and pattern11- (Home - Other - Stop - Home) and the dominant indicator is time for 0.948. For the dominant of moda transportation indicator is a motorcycle for 0.948.

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