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Characteristics of Transportation Mode Selection in Manado Maritime City

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***Abstract*— T The choice of transportation mode is one of the crucial aspects in urban transportation planning and development. Manado City as the economic and administrative center of North Sulawesi has experienced an increase in population and economic activity, which has an impact on transportation demand. This study aims to identify the characteristics of passengers in choosing transportation modes in Manado and to determine the factors that influence the choice of transportation modes. This research uses quantitative research methods. The results of the Structural Equation Modeling (SEM) test show the factors that influence the choice of transportation modes in Manado, namely travel costs, distance travel, and ease of access to modes. The CR value of travel costs to vehicle conditions is 7.456, the CR value of distance traveled to ease of access is 9.682, and the CR value of ease of access to online transportation is 4.654, conventional transportation is 8.282, and private vehicles is 7.365.**

Keywords— Mode Choice, Structural Equation Modeling (SEM), AMOS.

I. INTRODUCTION

Transportation is an integral part of everyday life. The choice of transportation mode is one of the crucial aspects that affect the efficiency and comfort of traveling. Along with the development of cities and population growth, the pattern of selecting transportation modes has also changed (Black, 1981).

Manado City is the capital city of North Sulawesi Province which has an area of 162.55 Km2 with a population of 454,987 people in 2023 where population growth is 0.92%. [1]. As the provincial capital, Manado City boasts significant potential in both tourism and industry, offering numerous business and investment opportunities. Consequently, the establishment of activity centers or land uses such as government administration hubs, residential areas, schools, hospitals, entertainment venues, shopping centers, and tourism accommodations leads to a significant increase in movement generation, which in turn impacts the existing transportation system.

This movement arises from the necessity to access resources or services that are located in different areas. [2]

As a maritime city, Manado has geographical features that make people's activity patterns highly influenced by sea and land access. However, the choice of transportation modes in the city is often hampered by inadequate infrastructure, congestion in urban areas, and lack of efficient public transportation. In addition, the integration of land transportation with seaports and airports still needs to be improved in order to meet the mobility needs of residents and tourists. These challenges affect people's preferences in choosing transportation modes, which are still not fully understood through research. This limited understanding hinders the process of planning and developing a more sustainable transportation system in Manado.

The choice of transportation mode to be used is of course based on the fact that travelers have various considerations in determining the mode of transportation to be used on their trip. [3]. Some considerations that are commonly used by the public when deciding which mode of transportation to use when traveling such as: travel costs, distance traveled, travel time, fares, and others. [4].

By knowing people's behavior in choosing transportation modes to support their trips, various efforts to improve and improve services for users of the modes concerned can be made and more targeted policies can be taken in terms of development of transportation aspects, especially in Manado City. [5]. This is because transportation policies that will be taken or decided by decision makers usually use the results of transportation planning and modeling as a tool in making decisions. [6]

Based on this background, this research presents a novelty by analyzing the characteristics of transportation mode choice in a maritime city like Manado, which is still rarely discussed in transportation studies in Indonesia. This research will examine how the characteristics of transportation users affect the choice of transportation modes in Manado. In addition, this research will analyze the factors that play a role in transportation mode selection decisions using the Structural Equation Modeling (SEM) approach.

The results of this study are expected to provide reference and input for transportation policy makers, as well as provide an overview of the important variables that influence the selection of transportation modes in the

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city. Thus, the main objective of this research is to analyze two things, namely first, the characteristics of transportation users in choosing transportation modes in Manado; and second, the factors that influence the choice of transportation modes using the SEM method.

II. Literature Review

Characteristics of Transportation Mode Selection

Mode selection is a crucial aspect of transportation modeling that directly affects transportation policy in a region. In this case, mode selection does not serve as the first step as well as a determining factor that affects the efficiency and effectiveness of the transportation system. The decision of potential passengers in choosing a mode of transportation is influenced by various factors, including the availability of infrastructure, cost, and ease of accessibility. [7]

Efficient and well-planned transportation can improve community mobility, helping people to carry out their daily activities more smoothly. For example, in dense urban areas, the right choice of transportation mode can reduce congestion and improve quality of life. The availability of different types of transportation modes such as air, water and land gives people the flexibility to choose the means of transport that best suits their needs.

In addition, the selection of transportation modes is also closely related to urban planning. Cities need to provide adequate space for transportation infrastructure, which includes lanes, bus stops, and other supporting facilities. The integration of existing modes of transportation with the city's spatial plan is essential to ensure that people can move efficiently and comfortably. [8] In the development of transportation systems, adjustments to community mobility are key to improving the quality of the system. This requires planning that is not only responsive to current needs but also proactive in dealing with future developments. Therefore, in-depth research on the factors that influence the selection of transportation modes will be very useful for formulating better policies, so that the transportation system can function optimally and contribute to sustainable urban development.

Manado Maritime City

The maritime city of Manado portrays an identity rich in culture and traditions that are closely intertwined with its marine environment. As a city located on the coast, Manado has a strong relationship with marine resources, which affects not only the economy but also the social and cultural aspects of its people. Maritime culture encompasses a wide range of elements, including traditions, practices and knowledge that develop from people's interactions with the sea.

Maritime culture is a reflection of the lives of coastal communities that depend on the sea as a source of livelihood. [9] This is reflected in fisheries, shipping and seafood processing practices that have become an integral part of people's daily lives. The existence of maritime culture is not only limited to economic aspects but also includes social values that prioritize a sense of togetherness and solidarity among fishermen and other coastal communities. On the other hand, the maritime city of Manado is also a place where marine biodiversity can be found, which is a special attraction for tourists. With marine-based tourism, local communities can benefit economically from the natural resources.

Structural Equation Modeling (SEM)

Structural Equation Modeling (SEM) is an analytical approach that helps researchers to understand and analyze complex relationships between variables. In research, SEM offers a comprehensive framework for testing hypotheses involving a variety of interrelated variables, including latent variables that cannot be measured directly. Thus, SEM can serve to test the relationship between independent and dependent variables, but also to explore the relationship between variables in a broader network. [10]

One of the advantages of SEM is its ability to address and manage measurement error that often occurs in data. This is done by taking into account variability and uncertainty in the measurement of variables, so that the results of the analysis become more accurate and reliable. In addition, SEM also aids multi-step analysis, where researchers can evaluate direct and indirect influences between variables, providing a deeper understanding of the dynamics at play.

In the field of transportation, the application of SEM is very relevant, especially to evaluate the factors that influence the selection of transportation modes by users. Using SEM, researchers can identify and quantify the various variables at play, such as travel cost, travel time, ease of access, and vehicle condition. This understanding is crucial for policy makers and transportation planners to formulate appropriate strategies in improving the existing transportation system, ensuring that the available modes of transportation can efficiently meet the needs of the community.

III. Method

This research uses quantitative research methods. The stages of the process to be carried out in this research are depicted in the flow chart in Figure 1 below.

A. Data Collection Technique

The data collection process in this study is through 2 methods, namely: google form and questionnaires distributed directly. [11]

B. Research Variables

This study uses eight variables which are divided into two independent variables and six dependent variables. Variable X or called the independent variable (Independent Variable) is a variable that affects the dependent variable (Dependent Variable), namely variable Y.

Independent Variables / Free Variables (X) consist of:

a. Travel cost (X1), and
b. Distance traveled (X2)

Dependent Variable / Bound Variable (Y) consists of:

a. Vehicle condition (Y1)
b. Ease of getting the mode (Y2)
c. Conventional Transportation (Y3)
d. Online transportation (Y4)

e. Private vehicle (Y5).

Sample Determination

To determine the number of samples in this study, the Slovin formula was used according to Sugiyono (2011), namely:

$$n = \frac{N}{1 + N(e)^2}$$

Description:

N = Sample size/number of respondents N = Population size

E = Presentation of allowance for tolerable sampling error; e = 0.1.

Data Analysis Technique

The data analysis technique used in this research is using the Structural Equation Modeling (SEM) model.

Ghozali (2008) mentioned that "second-generation Structural Equation Modeling (SEM)" is a multivariate analysis technique that allows researchers to test relationships between complex variables, both recursive and non-recursive. This approach provides a holistic view of the entire model, thus allowing a more thorough understanding of the interrelationships between the variables involved. SEM can test together:

a. Measurement Model: the relationship (loading value) between indicators and constructs (latent).
b. Structural Model: the relationship between independent and dependent constructs.

IV. Results and Discussion

A. Respondent Characteristics

a. Characteristics of Respondents Based on Gender
Based on Figure 2, it is known that the majority of respondents in this study are female at 51% while men are only 49%.
b. Characteristics of Respondents Based on Age
Based on Figure 3, it is known that the majority of respondents in this study were between 18-35 years old at 73% and the most minority were respondents aged more than 55 years at 4%.
c. Characteristics of Respondents Based on Occupation
Based on Figure 4, it is known that the majority of respondents in this study have jobs as students at 65% and the least are respondents with jobs as others at 1.9%.

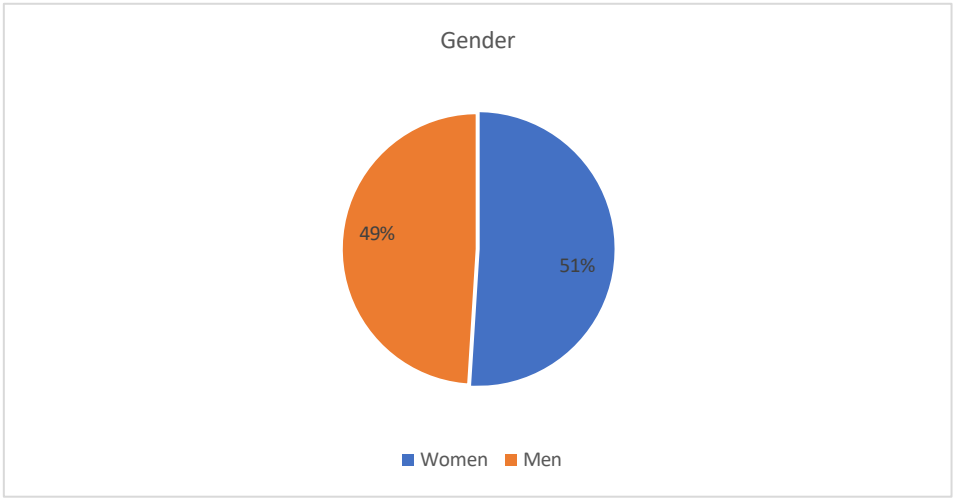

Figure 1. Characteristics of Respondents Based on Gender

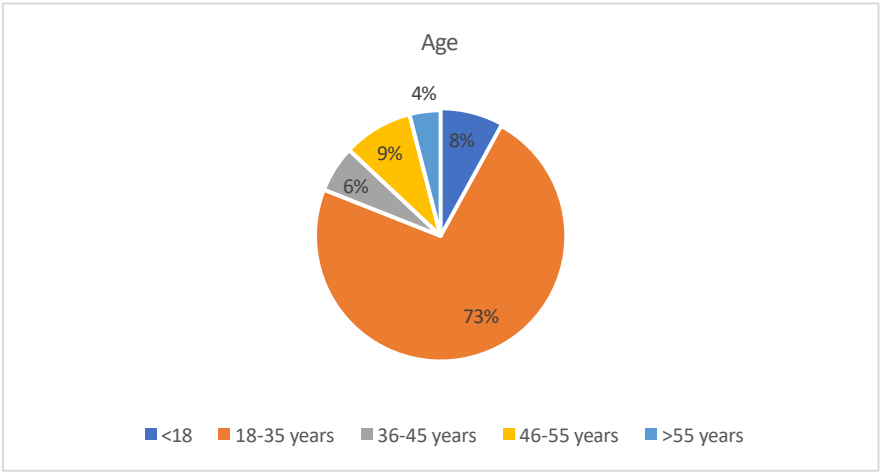

Figure 2. Characteristics of Respondents Based on Age

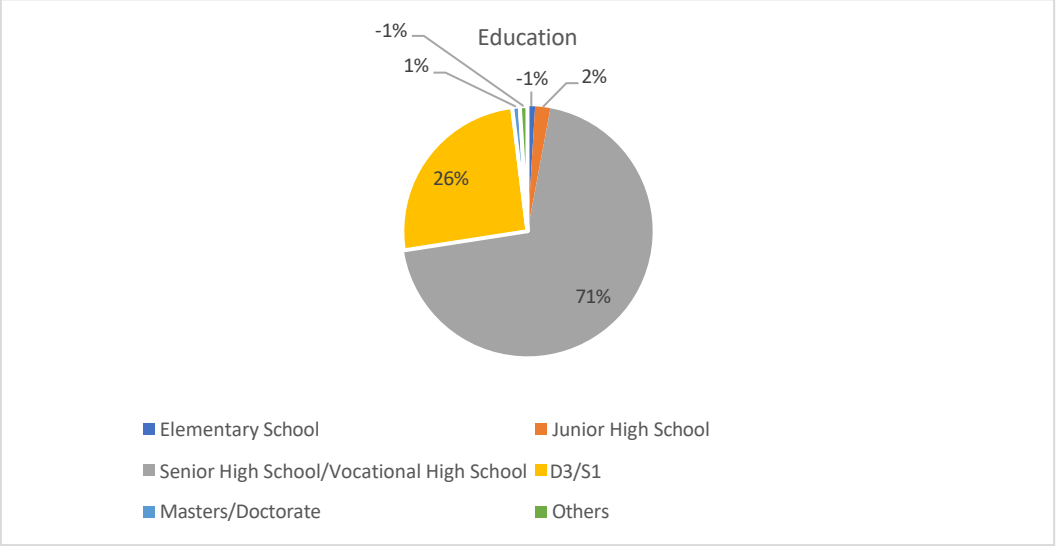

Figure 3. Characteristics of Respondents Based on Last Education

d. Characteristics of Respondents Based on Last Education
Based on Figure 5, it is known that the majority of respondents in this study have the latest education at the high school / vocational high school level of 71% and the least are respondents with S2 / S3 education of 1%.

e. Characteristics of Respondents Based on Income Level
Based on Figure 6, it is known that the majority of respondents in this study do not have income because they are still in the education process / have not yet earned 60% and the least are respondents with an income level of less than Rp1,000,000; (One Million Rupiah) per month at 7%.

f. Characteristics of Respondents Based on Vehicle Ownership
Based on Figure 7, it is known that the majority of respondents in this study own vehicles in the form of motorized vehicles at 47% and the least are respondents with car ownership at 7.6%.

g. Characteristics of Respondents Based on the Mode of Transportation Used
Based on Figure 8, it is known that the majority of respondents in this study stated that they had used all types/modes of transportation at 57% and the least were respondents who used conventional transportation at 2%.

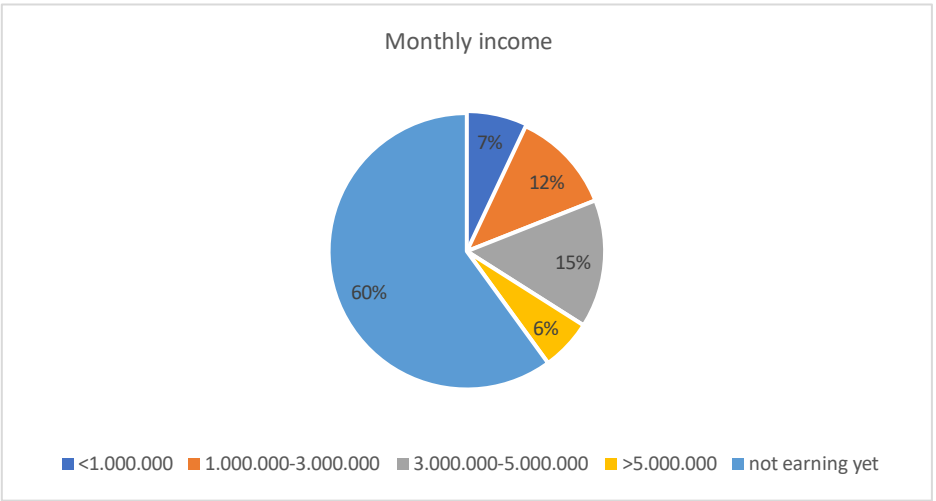

Figure 4: Characteristics of Respondents Based on Income Level

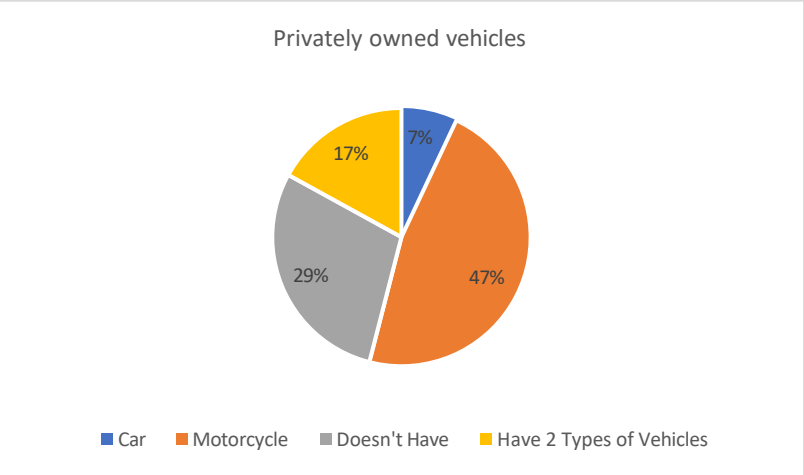

Figure 5: Characteristics of Respondents Based on Vehicle Ownership

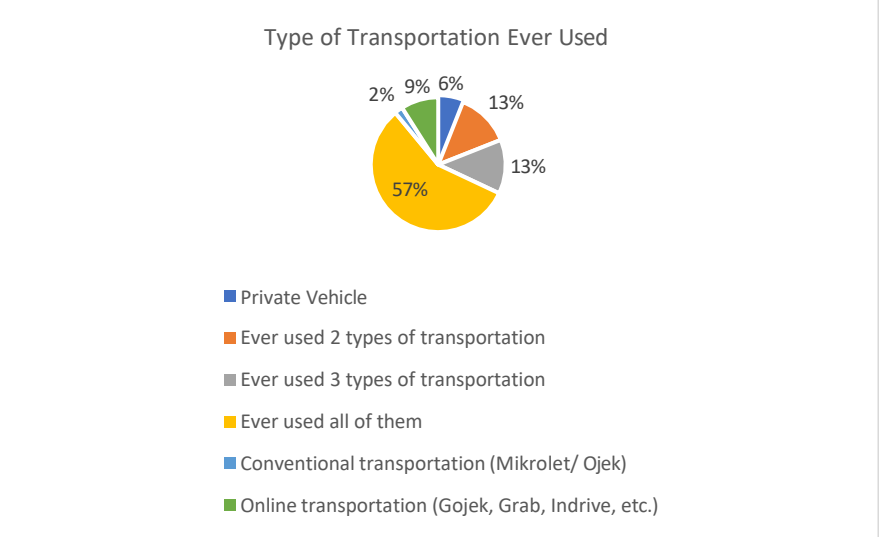

Figure 6. Characteristics of Respondents Based on Type/Mode of Transportation Used

Characteristics of Respondents' Answers

a. Characteristics of Travel Cost Variable Indicator Answers
   Based on Table 1, it is known that Manado people gave a "Very Good" response to the travel cost variable of 85.35%.
b. Characteristics of Travel Distance Variable Indicator Answers
   Based on Table 2, it is known that Manado people gave a "Very Good" response to the travel distance variable of 84.87%.
c. Characteristics of Vehicle Condition Variable Indicator Answers
   Based on Table 3, it is known that the Manado community gave a "Very Good" response to the vehicle condition variable of 86.73%.
d. Characteristics of Variable Indicator Answers Ease of Getting Modes
   Based on Table 4, it is known that the Manado community gave a "Very Good" response to the variable ease of getting the mode of 87.85%.
e. Characteristics of Online Transportation Variable Indicator Answers
   Based on Table 5, it is known that the Manado people gave a "Very Good" response to the online transportation variable of 72.85%.
f. Characteristics of Conventional Transportation Variable Indicator Answers
   Based on Table 6, it is known that the Manado people gave a "Very Good" response to the conventional ojek variable of 86.96%.
g. Characteristics of Private Vehicle Variable Indicator Answers
   Based on Table 7, it is known that Manado people gave a "Very Good" response to the private vehicle variable of 88.44%.

Goodness of Fit (GoF) Test

Based on the SEM analysis output, the fit model can be seen in Table 8. Based on the results in Table 9, it is found that the overall SEM model has a good model (Goodness of Fit). Analysis of data processing results at the full SEM model stage is carried out by conducting suitability tests and statistical tests whose tests are based on the fit model criteria contained in Table 8 Goodness of Fit.

TABLE 1.
CHARACTERISTICS OF TRAVEL COST VARIABLE INDICATOR ANSWERS

Indicator	SS	S	N	TS	STS	Average Score	Respondent Achievement Level (%)	Category
X1.1	71	130	6	2	2	4.26	85.21	Very good
X1.2	57	129	20	2	3	4.11	81.27	Very good
X1.3	91	104	12	1	3	4.32	86.45	Very good
X1.4	88	109	8	3	3	4.31	86.16	Very good
X1.5	92	105	10	0	4	4.33	86.64	Very good
		Mean				4.27	85.35	Very good

Source: Research Data, 2024

TABLE 2.
CHARACTERISTICS OF TRAVEL DISTANCE VARIABLE INDICATOR ANSWERS

Indicator	SS	S	N	TS	STS	Average Score	Respondent Achievement Level (%)	Category
X1.1	106	98	2	2	3	4.43	88.63	Very good
X1.2	57	145	5	2	2	4.20	83.98	Very good
X1.3	84	121	2	2	2	4.34	86.82	Very good
X1.4	85	115	6	3	2	4.32	86.35	Very good
X1.5	31	140	35	4	1	4.93	78.58	Good
		Mean				4.24	84.87	Very good

Source: Research Data, 2024

TABLE 3.
CHARACTERISTICS OF VEHICLE CONDITION VARIABLE INDICATOR ANSWERS

Indicator	SS	S	N	TS	STS	Average Score	Respondent Achievement Level (%)	Category
X1.1	98	104	4	1	4	4.38	87.58	Very good
X1.2	81	122	3	2	3	4.31	86.16	Very good
X1.3	73	126	7	1	4	4.25	84.93	Very good
X1.4	102	103	2	0	4	4.42	88.34	Very good
X1.5	82	125	0	0	4	4.33	86.64	Very good
		Mean				4.34	86.73	Very good

Source: Research Data, 2024

TABLE 4.
CHARACTERISTICS OF VARIABLE INDICATOR ANSWERS EASE OF GETTING MODES

Indicator	SS	S	N	TS	STS	Average Score	Respondent Achievement Level (%)	Category
X1.1	92	109	4	2	4	4.34	86.82	Very good
X1.2	85	121	0	1	4	4.34	86.73	Very good
X1.3	99	105	3	0	4	4.40	87.96	Very good
X1.4	115	90	1	1	4	4.47	89.48	Very good
X1.5	102	103	1	1	4	4.41	88.25	Very good
		Mean				4.39	87.85	Very good

Source: Research Data, 2024

TABLE 5.
CHARACTERISTICS OF ONLINE TRANSPORTATION VARIABLE INDICATOR ANSWERS

Indicator	SS	S	N	TS	STS	Average Score	Respondent Achievement Level (%)	Category
X1.1	29	60	105	17	0	3.48	69.57	Good
X1.2	31	68	100	11	1	3.55	71.09	Good
X1.3	23	77	98	13	0	3.52	70.43	Good
X1.4	26	116	57	2	0	3.88	77.63	Good
X1.5	26	118	61	6	0	3.78	75.55	Good
		Mean				3.64	72.85	Good

Source: Research Data, 2024

TABLE 6.
CHARACTERISTICS OF CONVENTIONAL TRANSPORTATION VARIABLE INDICATOR ANSWERS

Indicator	SS	S	N	TS	STS	Average Score	Respondent Achievement Level (%)	Category
X1.1	103	96	8	1	3	4.40	87.96	Very good
X1.2	80	121	6	0	4	4.29	85.88	Very good
X1.3	103	97	6	2	3	4.20	87.96	Very good
X1.4	97	99	11	1	3	4.36	87.11	Very good
X1.5	82	116	9	1	4	4.29	85.88	Very good
		Mean				4.35	86.96	Very good

Source: Research Data, 2024

TABLE 7.
CHARACTERISTICS OF PRIVATE VEHICLE VARIABLE INDICATOR ANSWERS

Indicator	SS	S	N	TS	STS	Average Score	Respondent Achievement Level (%)	Category
X1.1	99	108	0	0	4	4.41	88.25	Very good
X1.2	69	130	2	8	2	4.21	84.27	Very good
X1.3	102	103	2	1	3	4.42	88.44	Very good
X1.4	76	127	3	2	3	4.28	85.69	Very good
X1.5	127	74	6	1	3	4.52	90.43	Very good
		Mean				4.37	87.41	Very good

Source: Research Data, 204

TABLE 8.
GOODNESS OF FIT (GOF) TESTING

GoF	Cut of Value	Nilai	Kriteria
P	≥0,05	0,057	GoF
RMSEA	≤ 0,08	0,059	GoF
GFI	≥0,80	0,810	GoF
CMIN	≤2,00	1,246	GoF
CFI	≥0,90	0,99130	GoF

Source: Data Processed, Amos (2024)

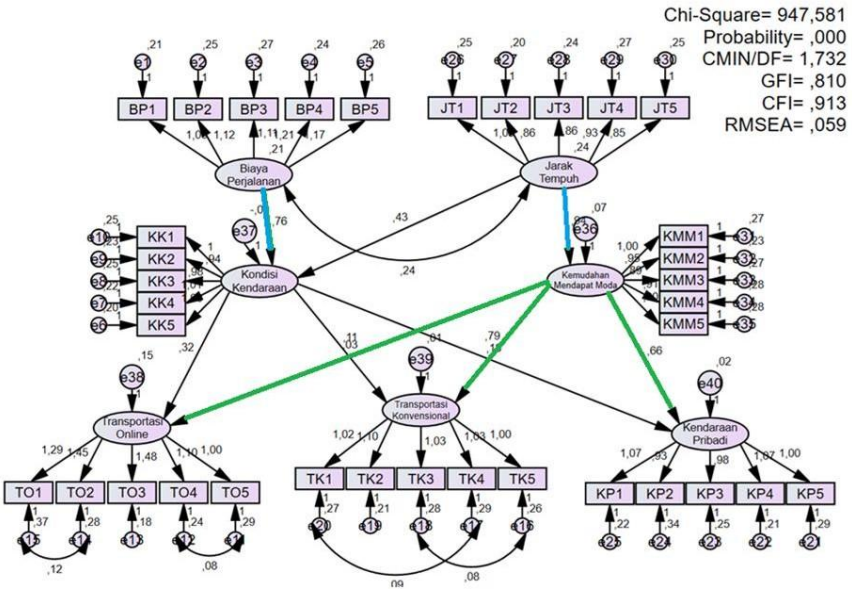

Figure 9. Full SEM Model Analysis of Transportation Mode Selection in Manado
Source: Data Processed, Amos (2024)

Description:
BP = Travel Cost
JT = Distance Traveled
KK = Vehicle condition
KMM = Ease of Obtaining Mode
TO = Online Transportation
TK = Conventional Transportation
KP = Private Vehicle.

The test results using Structural Equation Modeling (SEM) show several important factors that influence the selection of transportation modes in Manado City. First, travel cost proved to be a significant factor. The CR value of 7.456 indicates that the lower the cost of travel, the higher the tendency of users to pay attention to the condition of the vehicle they use. So this value indicates that users, especially cost-sensitive individuals, not only consider the price but also pay attention to the quality and comfort aspects of affordable vehicles.

Furthermore, mileage also has an influence on the choice of transportation mode. The CR value of 9.682 confirms that the shorter the distance to be traveled, the greater the user's preference for more accessible modes of transportation. This means that users in Manado are more likely to choose modes of transportation that can be accessed quickly and practically when their travel distance is not too far, which is generally related to the choice of private transportation or online transportation modes.

Furthermore, ease of access to transportation modes is also proven to be a factor in mode choice decisions. SEM results show that online transportation has an influence with a CR value of 4.654, while conventional transportation and private vehicles show a stronger influence, with CR values of 8.282 and 7.365, respectively. This finding reflects that ease of access is one of the main considerations for Manado people in choosing transportation modes. Despite the growing popularity of online transportation, conventional

transportation and private vehicles remain the top choice as they offer greater ease of access and convenience, especially among users who prefer flexibility.

The results of this analysis reveal that cost, travel distance, and ease of access are the main factors influencing the choice of transportation modes in Manado. Most respondents, dominated by students, tend to choose modes that are affordable and easily accessible. While online transportation is gaining ground in Manado, along with private vehicles, conventional transportation remains an important choice for users due to the ease of access and flexibility it offers.

Therefore, the government and transportation policy makers in Manado need to consider improving the accessibility of public transportation modes as well as ensuring transportation costs remain affordable, especially for younger age groups and those who are not yet on a fixed income. In addition, developing infrastructure to support intermodal integration and improving public transportation conditions can increase mobility efficiency in the city.

V. CONCLUSION

The test results using Structural Equation Modeling (SEM) show that the factors that influence the choice of transportation modes in Manado include travel costs, distance traveled, and ease of access to transportation modes. Travel costs have a CR value of 7.456 on vehicle conditions, indicating that the lower the travel costs, the higher the tendency of users to consider vehicle conditions. Travel distance also has a significant effect, with a CR value of 9.682 on ease of access, indicating that shorter distances tend to increase preferences for more accessible modes of transportation. Ease of access to various types of transportation shows different effects, where online transportation has a CR value of 4.654, conventional transportation 8.282, and private vehicles 7.365. This reflects that ease of access plays an important role in transportation mode selection decisions, with conventional transportation and private vehicles showing a stronger influence than online transportation.

Advice

Based on the research and data analysis, several suggestions can be made:

1. It is necessary to improve services in online transportation modes and conventional transportation both in terms of tariffs, accessibility, comfort and safety levels so that people are more likely to use existing modes of transportation in Manado.
2. There needs to be a policy from the government regarding modes of transportation operating in Manado such as conventional transportation in order to issue regional regulations on two-wheeled transportation as public transportation in Manado because there are many two-wheeled transportation operating in Manado.
3. This research can be used as a reference and is expected to be further developed for further research. It is recommended that the research location be expanded and the object of research be more devoted to students / school children.

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