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ANALYSIS OF THE SELECTION OF RIVER TRANSPORTATION MODES THAT ARE INTEGRATED WITH LAND TRANSPORTATION IN THE CITY OF BANJARMASIN

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Abstract

The city of Banjarmasin, as the center of economic growth in South Kalimantan, faces significant challenges in terms of mobility. The development of river public transportation is one of the alternatives to overcome urban transportation problems. This study has significance in providing a holistic view of the factors that need to be considered in the selection of river transportation modes that are integrated with land transportation. The study was conducted in the areas of North Alalak Village and Sungai Lulut Village. The data processing method in this study involves testing the completeness of primary and secondary data to describe field conditions, then analyzing the preferences for choosing transportation modes using the AHP method which includes steps such as defining problems, creating hierarchical structures, conducting pairs comparisons, calculating eigenvalues and testing consistency, while the data analysis stage includes the calculation of consistency ratios, consistency vector, average of entries (Zmax) and Consistency Index (CI) to determine the final preference of each alternative. The analysis of priority weights between criteria is calculated to find out the order of the most influential criteria in selecting transportation modes. The results of the study can provide guidance for decision-making at the level of governments, transport companies and communities in developing and adopting more efficient transport systems. This research is expected to be useful for the author to expand insights, for the government and operators as input in the development of integrated transportation, and for the general public as a reference for more efficient modes of transportation.

Keywords: Mode Selection, Analytical Hierarchy Process, Multinomial Logit Model

INTRODUCTION

The city of Banjarmasin, as the center of economic growth in South Kalimantan, faces significant challenges in terms of mobility. This growth has an impact on traffic density and poses challenges to the city's transportation system. According to data from the Banjarmasin City Transportation Office, daily traffic on a number of main roads has increased significantly in recent years. Traffic congestion on several major roads has become a major problem affecting the quality of life of the population and transportation efficiency. In addition, population density data shows that urban areas in Banjarmasin City have increased by 15% in the last five years (BPS Kota Banjarmasin, 2023). The growing mobility challenge emphasizes the need for sustainable transportation solutions.

Banjarmasin is known as the City of a Thousand Rivers. Life by the river has become a common thing for the people of Banjarmasin. Public transportation in Banjarmasin is not only served by land transportation but also river transportation, such as jukung (boats) and kelotok (motorized boats). River transportation in the early development of transportation in Banjarmasin has an important role as a dominant vehicle used by the community, both for daily travel purposes and for commercial purposes (Aprilla et al., 2023; Aziz et al., 2023; Dwina et al., 2022; Mutiani et al., 2022; Sidharta et al., 2020). Public interest in using river transportation in its development is decreasing compared to the use of land transportation. The decline can be seen from the decreasing number of river transportation in 2009 from 416 to 82 in 2014. There was a decrease in the use of river transportation with the intention of

working by 25%, the intention of school by 8.9%, and the intention of spending decreased by 10.5% (Sari, 2008).

The role of river transportation has advantages that are worth considering (Abbas et al., 2020, 2021, 2022; Sugiati et al., 2022; Syafari et al., 2024). Based on the cost aspect, infrastructure development is cheaper, because rivers and antasan (canals that were generally made during the Dutch occupation) in Banjarmasin have formed a network and have a sufficient width. The river network in Banjarmasin connects residential areas to activity centers. The river has a fairly large width such as the Martapura River approximately 150 m, the Kuin and Kerokan Rivers between 25 m and 40 m with a depth of between 2.4 m and 4 m. The river is wide and of sufficient depth makes it possible to increase the volume of river traffic. Socio-culturally, this river transportation is more familiar with people's lives, especially people who live along the banks of the Barito and Martapura rivers. The facts show that the superiority of river transportation is not accompanied by follow-up to maintain its sustainability. The condition of river public transportation has not been developed from year to year.

The decline in passenger interest is partly due to service aspects, such as lack of safety guarantees (Valutytė, 2020), weather and wave disturbances (Gössling et al., 2023), passenger comfort that is perceived to be lacking (Yuan et al., 2021), as well as the shape/design of river transportation and facilities that do not facilitate accessibility of movement. The condition of the existing pier that cannot be adjusted to the phenomenon of the tides of the river makes it difficult for passengers to get on/off the boat at low tide. The discomfort of river transportation conditions is increasingly felt for users who are less accustomed to using river transportation, both when loading and in their vehicles.

The city of Banjarmasin as one of the cities located in the river area, has great potential to develop river transportation as an efficient and sustainable alternative. Transportation sustainability is a key aspect in facing the challenges of urbanization and increased mobility. Despite having great potential, public interest in using river transportation is still limited. Several factors such as lack of integration with land transportation and limited route availability are the main obstacles.

The river transportation used must meet the requirements for ship airworthiness as affirmed in Government Regulation Number 20 of 2010 concerning Water Transportation (Article 52 paragraph 2). Furthermore, river transportation according to Law of the Republic of Indonesia Number 17 of 2008 concerning Shipping should pay attention to all aspects of people's lives and be directed to facilitate the flow of mass movement of people and/or goods through waters safely, safely, quickly, smoothly, orderly and orderly, comfortable, and useful, at a cost that is affordable to people's purchasing power (Article 5 paragraph 6). This is in line with the aims and objectives of the National Transportation System (Sistranas) as a guideline for regulating and developing transportation in order to achieve effective and efficient implementation of national transportation. Sistranas requires that river transportation can ensure safety, high accessibility, integrated, sufficient capacity, orderly, smooth and fast, easy to reach, punctual, convenient, affordable rates, orderly, safe, low pollution levels, low public burden, and have high utility in a unified national transportation network.

Another problem occurs in road transportation. The rapid growth of vehicles that is not balanced with the increase in road capacity poses classic problems in transportation, such as slowdowns or congestion, especially in urban centers. Transportation costs are increasing, while building a new road network requires huge costs. The development of river public transportation is one of the alternatives to overcome urban transportation problems. The development is in line with the Banjarmasin City Government's program to revive river transportation as a daily public transportation. Efforts to achieve the program can be seen from the steps to repair/normalize rivers/antagonism by the Banjarmasin City Government.

The existence of a wide and many river networks parallel to the road network is an advantage in supporting this program. River transportation should be able to make an even greater contribution and can synergize with the urban transportation order in Banjarmasin.

Integration between river transportation and land transportation is considered a potential solution to increase public interest. However, the decision-making process related to the selection of integrated river transportation modes requires a careful and informed approach. Although the potential of river transportation has been recognized, there has been no specific research that comprehensively applies methods in the context of selecting river transportation modes that are integrated with land transportation in the city of Banjarmasin. Therefore, this research is directed to fill this knowledge gap and provide a more in-depth view. This study has significance in providing a holistic view of the factors that need to be considered in the selection of integrated river transportation modes. The results of the study can provide guidance for decision-making at the level of governments, transport companies and communities in developing and adopting more efficient transport systems.

This study was conducted with the aim of analyzing factors that affect interest in using river transportation modes that are integrated with land transportation. This research is expected to be useful for the author to expand insights, for the government and operators as input in the development of integrated transportation, and for the general public as a reference for more efficient modes of transportation.

RESEARCH METHOD

The research used the quantitative approach. This research was conducted in the areas of North Alalak Village and Sungai Lulut Village, Banjarmasin City. The primary data collected in this study is data obtained directly from respondents through surveys based on the analytical hierarchy process and stated preference techniques. The survey was conducted from June 1, 2024 to June 2, 2024. Respondents were randomly taken to people who traveled in the direction of North Alalak to Sungai Lulut or vice versa, Banjarmasin City. Secondary data is data obtained from related agencies in the form of road network data, river networks, maps of land transportation routes, matrices of origin of people's travel destinations in the city of Banjarmasin.

In this study, the researcher determined the number of samples used with the value *of e* = 5% as follows:

$$n = \frac{N}{1 + N \times (e)^2} = \frac{1032}{1 + (1032 \times (5\%)^2)} = \frac{1032}{1 + 2{,}58} = \frac{1032}{3{,}58} = 288{,}268 = 289$$

Based on calculations with the Slovin *formula*, the number of samples used in this study is 288,268 which is rounded to 289 samples. Thus the number of samples in this study is 289 samples.

The data processing method in this study involves testing the completeness of primary and secondary data to describe field conditions, then analyzing the preferences for choosing transportation modes in Banjarmasin City using the AHP method which includes steps such as defining problems, creating hierarchical structures, conducting pairs comparisons, calculating eigenvalues and testing consistency, while the data analysis stage includes the calculation of consistency ratios, consistency vector, average of entries (Zmax), Consistency Index (CI), and Consistency Ratio (CR) to determine the final preference of each alternative.

RESULT AND DISCUSSION

The results of the data calculation of all respondents whose consistency ratio results meet the requirements ≤ 0.1, then the results are averaged so that a ranking or priority weight can be obtained for each research element as follows:

Priority Weight Analysis Between Criteria

The analysis of priority weights between criteria is calculated to find out the order of the most influential criteria in the selection of transportation modes. The priority weight between the criteria was obtained from the answers of respondents or users of transportation modes.

Table 1. Ranking of Priority Weights Between Criteria

Criteria	eVP	eVP %
Travel Time	0.27	27%
Cost	0.27	27%
Security	0.10	10%
Comfort	0.10	10%
Trip Frequency	0.18	18%
Travel Purpose	0.08	8%

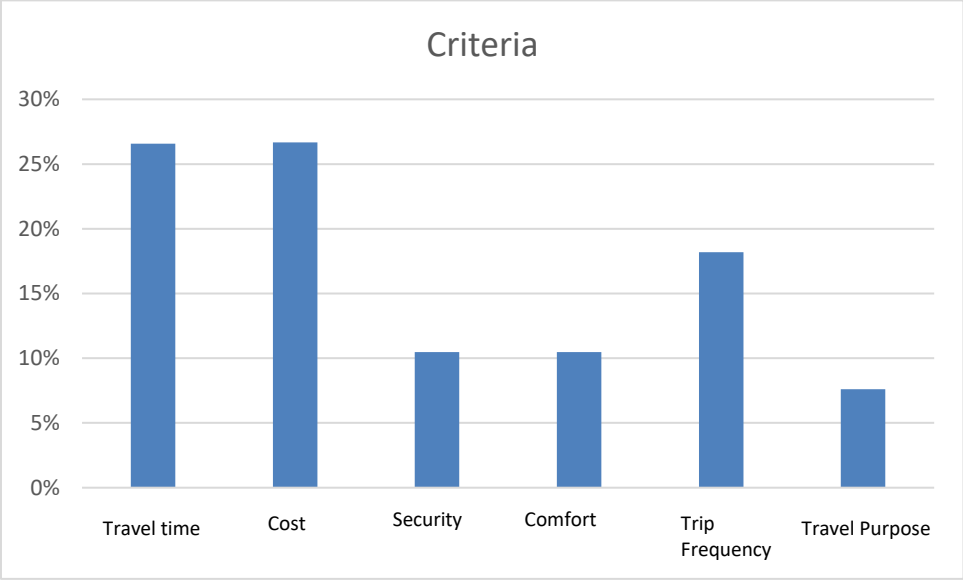

Figure 2. Chart of Percentage of Priority Weights Between Criteria

From the table and figure above, it is known that the order of priority weights that most influence on the selection of transportation modes of Sungai Lulut and North Alalak in Banjarmasin City is the first order of travel time and cost factors with a weight of 27%, followed by the travel frequency factor of 18%, the comfort factor of 10%, the safety factor of 10%, and finally the travel intention factor with a weight of 8%.

Analysis of Priority Weights Between Alternative Mode

The analysis of the priority weight between alternative modes can be obtained from the calculation of all existing variables and the value or conclusion in the selection of transportation modes can be obtained.

Table 1. Ranking of Priority Weights Between Alternative Mode

Mode	eVP	eVP %
Motorbike	0.41	41.3%
Car	0.31	30.7%

Land Transportation	0.18	18.5%
Land Transportation + River Transportation	0.10	9.6%

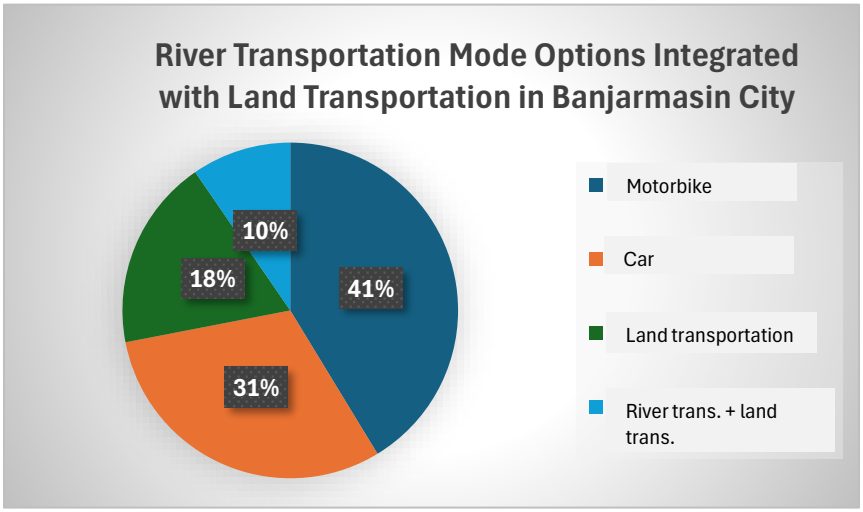

Figure 3. Priority Weight Percentage Diagram Between Alternative Moda

Based on the Table and Diagram above, it is obtained that when these travelers travel from the Lulut and North Alalak Rivers, as many as 41% will choose the mode of motorcycle transportation, 31% will choose the mode of car transportation, 18% of land transportation and those who choose the mode of land transportation + river transportation as much as 10%.

CONCLUSION

The study reveals that transportation users in North Alalak – Sungai Lulut are mostly over 40, with high school/vocational school education and private workers. Most trips take less than 30 minutes, with commute intent to work being the most common. The most frequent trips are two times per week, with safety and comfort rated as very good. Motorcycles are the most widely used mode of transportation, followed by cars and land transportation. The top priorities in choosing a mode of transportation between Sungai Lulut and North Alalak are travel time and cost factors (27%), travel frequency (18%), comfort (10%), safety (10%), and travel intent (8%). The research recommends simplifying questionnaires and calculating Vehicle Operating Costs (BOK) to determine suitable fares. Future research could focus on understanding transportation user behavior and improving transportation systems, particularly among younger populations.

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