

The Analysis of Problem Solving Priority of Semi Paratransit Services in Developing Countries

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Abstract— The development of public transport in developing countries is inversely compared to the developed countries. The problem of low quality of service, lack of information, accidents, comfort, and pollution is a threat to the sustainability of public transport. Management of semi-paratransit transport individually, not in a legal entity making it unable to compete with the ease ownership of private vehicles as well as the development of online public transportation. In this research, we focused on evaluating the priority of solving the semi-paratransit transport problem in improving its sustainability in developing countries, so that the fundamental problems faced by the semi-paratransit transport and get the patterns of problem-solving. The evaluation method is designed by specifying the criteria and sub-criteria in detail. Population data, road networks, routes, the number of semi-paratransit transport, and survey data are determined and collected based on the framework of research needs. The data analysis was discussed by the analytical hierarchy process method. The results show the priority of solving problems from stakeholders, users, drivers, and managers of semi-paratransit transport with various criteria and sub-criteria. Development of public transportation can be done by building political will and action commitment and by the understanding of the existing problems.

Index Terms—Developing Countries, problem-solving, semi-paratransit, public transport.

I. INTRODUCTION

The mobility challenges of the developing world are considerably different than in wealthier, advanced countries [1]. Public transport management in developing countries hasn't delivered an optimal output. The management of public transport is full of problems, including low quality and choice, many accidents due to low driver discipline, insufficient funds to renew and repair vehicles, the arrangement of up and down the passengers by thugs, lack of security (lots of pickpockets), complexity and rigidity existing rules, ineffective management and administrative structure, private vehicle ownership that cannot be regulated in a unity [2]. In developed countries, public transport has met the standards and convenience. In developing countries, public

networking systems are far from adequate services. The unavailability of comprehensive transportation planning includes facilities, infrastructure, financing, and human resources development, the very limited number and the lack of public transportation currently adds to the problems of public transportation.

Semi-paratransit transport is a common public transport in small and medium cities in the study area. Lately, the semi-paratransit transport is diminished in its existence due to the rapid development of smart mobile applications in transportation such as ridesharing/carpooling/vanpooling [3]. Real-time ridesharing has the potential to make a difference by offering a new mode of transportation that dynamically matches drivers and riders, and automatically distributes the cost reduction of the commute between them while reducing security and safety concern [3]. On the other hand, the current conventional semi-paratransit transport is stagnant, do not develop properly, has a low quality of services, less safety, less comfortable, not environmentally friendly and less competitive.

The public transport is a livelihood project and basic public service that the government should provide and give priority on finance support [4]. But, nowadays, the government and related offices in the study area seem powerless to develop the semi-paratransit public transport. There are no policy and financial support that take a side of the semi-paratransit transport. The phenomenon is widespread that there is a lack of financial investment leads to operational difficulties, low wages, unstable workforce, and unsustainable development of public transport enterprises [4]. The low quality of semi-paratransit services lead to the rapid increase in car ownership and follow with the problem of traffic congestion and environmental pollution. The government and the semi-paratransit operators in the study area is still short of the science-based indicator system and methodology to evaluate the public transport. Public transport authorities and operators have no principles to follow when executing the public transport priority strategy [5].

In terms of safety and comfort, semi-paratransit drivers have a low driving discipline that leads to congestion and accident [2]. The driver must chase their income based on the number of passengers in one day. If they get more passengers, they will get more income and vice versa. This condition makes the driver drive their vehicle with unstable speed and stop at the irregular side of the road.

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The inappropriate policy system, management, operation of semi-paratransit public transport and indiscipline driver makes inconvenience for passengers. The load factor of semi-paratransit transport is not in a good number. The passengers who use semi-paratransit transport daily are captive users, who have no other choice to transport from one place to another.

The study and analysis of semi-paratransit development in systemic and comprehensive approach are urgently needed. The evaluation of semi-paratransit sector based on their problems in detail will increase the sustainability of semi-paratransit transport. This research proposed a framework to build up some criteria and sub-criteria from government and related offices, semi-paratransit operators, semi-paratransit drivers, and semi-paratransit passengers perceptions completely to find the basic problems and its problem-solving priority. This research takes a case study in Magelang, Java Island, Indonesia.

II. SEMI-PARATRANSIT EVALUATION INDICATORS

Dragu et al [6] conducted a study to identify indicators that could be used to assess the quality of public transport. The assessment of the quality of public transport services is based on the set of criteria that represent the views of passengers of those who use the service [6].

Quality is the best and most comprehensive indicator which measures the performance of the transport system [6]. Quality standards are based on an assessment cycle which includes four distinct points of view: expected quality, perceived quality, desired quality and achieved quality [6].

[7] explained that to evaluate the urban public transportation, they used an index system that should be built obeying the principles such as conciseness, objectivity, scientificity, and practicability.

In this study, we develop the main criteria and its sub criteria based on several literature reviews that can be defined in table 1, 2, 3, 4. Table 1 describes main criteria and sub-criteria to evaluate semi-paratransit transport from government and related offices perception, table 2 describes from semi-paratransit perceptions, table 3 describes from semi-paratransit driver perceptions, table 4 describes from semi-paratransit passenger perceptions.

TABLE I
CRITERIA AND SUB-CRITERIA FROM GOVERNMENT AND RELATED OFFICES PERCEPTIONS

Main Criteria	Sub Criteria
Knowledge	1. A comparative study to the advanced city with sophisticated semi-paratransit transport 2. Give political motivation 3. Participate in international or national forum
Awareness	1. Awareness and desires to develop semi-paratransit transport 2. Technical assistance 3. Boost the national or international financial support
Attitude	1. Publish the political attitude and action plan 2. Spread those action plan to mass media
Action	1. Integrate sustainable transport policy in planning and implementation 2. Seek for national or international appreciation opportunities

	3. Public transport infrastructure development 4. Minimum service standard development
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TABLE II
CRITERIA AND SUB-CRITERIA FROM SEMI-PARATRANSIT OPERATORS

Main Criteria	Sub Criteria
Service	1. High satisfaction index from passengers 2. Low complaints 3. Semi-paratransit repair and driver management review regularly 4. Semi-paratransit ownership system (individually to a professional company)
Accessibility	1. High arrival frequency during peak hour 2. Arrival information service
Reliability	1. On time arrival 2. Clearly and orderly semi-paratransit arrival information
Comfort	1. Full of passengers at peak hour 2. The target number of passenger fulfilment a day 3. Air conditioner availability 4. Clean and tidy
Security and Safety	1. Security support facilities availability 2. Zero accidents 3. A low rate of crime
Effects on the Environment	1. Environmental friendly vehicle 2. The amount of fuel used

TABLE III
CRITERIA AND SUB-CRITERIA FROM SEMI-PARATRANSIT DRIVERS

Main Criteria	Sub Criteria
Service	1. Hospitable driver 2. Passenger complaint service availability
Accessibility	1. Ease of access to many places 2. Long route 3. Stop at every semi-paratransit stop place 4. Ticketing system
Reliability	1. Semi-paratransit arrive regularly 2. Earning based on the number of passengers 3. Earning based on travel km system
Comfort	1. The high rate of load factor 2. Cleanliness of semi-paratransit 3. Reliable semi-paratransit vehicle machine (regular service)
Security and Safety	1. Security and safety facilities availability (first aid kit, glass breaker) 2. Low accident rate
Effects on the Environment	1. Fuel consumption 2. Environmental friendly vehicle

TABLE IV
CRITERIA AND SUB-CRITERIA FROM SEMI-PARATRANSIT PASSENGERS

Main Criteria	Sub Criteria
Service	1. Easy reach of semi-paratransit stop 2. Special needs passenger facilities availability 3. High Frequency of semi-paratransit arrival 4. The hospitality of semi-paratransit driver 5. Passenger complaint service availability
Accessibility	1. Supporting facilities availability to access semi-paratransit stop (park and ride facility) 2. Adequate transport network 3. Easy access to all places 4. Short transit time 5. Affordable semi-paratransit fares

	6. Ticketing system payment
Reliability	1. On time semi-paratransit arrival 2. Clearly and orderly semi-paratransit arrival information 3. Short travel time 4. Secure vehicle speed 5. Minimal extra waiting time, time to reach the destination
Comfort	1. Clean 2. Air conditioner availability 3. The quiet sound of the vehicle
Security and Safety	1. Low accidents rate 2. Low criminal rate (theft, harassment, etc.)
Effects on the Environment	1. Lots of coverage area 2. Environmental friendly vehicle

Those criteria and sub-criteria for each perspective will be used as the basis of data collection for this research.

III. METHODOLOGY

Table II summarizes the overall data. It can be seen that Analytical Hierarchy Process (AHP) method is used in analyzing data of the semi-paratransit problem. In the AHP method, the indicators are divided into criteria, sub-criteria and hierarchical alternatives at each level. Once the hierarchy was built, it proceeds by setting the priority of the procedure to determine the relative importance of the elements at each level. [8] describes the ratio of 9 responses in AHP. Research on semi-paratransit transport with AHP method aims to obtain a description of the sequence of problems, identify the influence of stakeholders on the transportation system, and to obtain a priority plan of the development of urban transport in the future. Furthermore, the data are evaluated by several factors: factors that represent the basic problems, then the higher level factors, and the last is all the factors are analyzed to obtain the final result. The evaluation index system consists of two levels (hierarchy), namely:

Hierarchy 1: Criteria such as security, accessibility, convenience, immediacy, reliability, user satisfaction, energy/fuel, and environmental influences and other alternatives that may arise.

Hierarchy 2: Indicators, which are spelled out from hierarchy 2 [5].

This analysis is carried out by reviewing several perspectives of the stakeholders of semi-paratransit transport activities which are divided into 4 categories: municipal government and related offices, semi-paratransit transport operators, semi-paratransit drivers, and semi-paratransit users. By dividing this analysis into four perspectives, the expectation is each stakeholder know what to do to develop this semi-paratransit transport and the policy, plans and action could be done in a more effective time frame.

For AHP method, respondents from each perspective gave preference to 2 elements, which are equally important, moderate, more important and most important (in the form of ratings 1, 3, 5, 7, 9) and compromise value between two values for qualitative assessment (2, 4, 6, 8) [8]. After forming

the preference matrix, the relative weights of each element are calculated by normalizing the eigenvector and then determining the largest eigenvalue of the comparison matrix. The value is estimated by the geometric mean of each line in the preference matrix [8].

Data from weighting scaled matrix are processed to produce a priority vector which shows the weight of each criterion. Priority vector is obtained by the following steps:

1. Normalized each matrix column by dividing each value in the matrix column with the corresponding matrix column summary.
2. Calculate the number of each matrix row.
3. Priority vectors are generated by calculating for the averages of each matrix row.

To validate the calculation, a consistency test is performed with the following steps:

1. Construct multiplication between the criteria matrix with priority vector
2. Calculate the value of lambda (λ), which is obtained from the average of the multiple matrices divided by the priority vector.
3. Calculating the CI value (Consistency Index)
$$CI = (\lambda - n) / (n - 1) \quad (1)$$
4. Calculating the RI value
$$RI = 1,98 * (n - 2) / n \quad (2)$$
5. Calculating indigo CR (Consistency Ratio)
$$CR = CI / RI \quad (3)$$
6. If the RI result is less than 0.1; then the analysis is consistent, and the priority vector results can be used.

To obtain a comprehensive analysis using AHP method, primary data obtained from survey results, such as the survey of semi-paratransit transport passengers (98 respondents), survey of semi-paratransit drivers (72 respondents), survey of semi-paratransit transport occupancy, frequency survey of semi-paratransit transport, semi-paratransit transport operator interviews and interviews from related government officials. Secondary data is obtained from the Department of Transportation and the Department of Public Work and data obtained from the internet. In addition, demography data and Road network data are needed. Data obtained from the Transportation Department are semi-paratransit transport route, the current number of semi-paratransit transport, semi-paratransit public transport route map and the existing semi-paratransit transport operation management.

IV. RESULTS AND DISCUSSION

4.1 Case Study

Indonesia is categorized as developing countries and one of the largest archipelago in the world. Magelang which is located on the island of Java, Indonesia was chosen as a case study.

Magelang is a medium-sized city that has a semi-paratransit type of transport as its public transport. The total area of Magelang is 1812 Ha with a population of 124.627 inhabitants. The topographic condition of Magelang is described as a lowland with vary relatively angle and surrounded by mountains. The development of Magelang is dominated by developing areas from the south to the north which has relatively flat topography. The majority of the population work as traders, followed by industrial workers and civil servants. The population working in the transport sector is quite small (4%).

In the commercial sector, Magelang has several facilities such as traditional markets, modern markets, shops, supermarkets, gas stations, and others. In the tourism sector of Magelang has tourist destinations such as Kyai Langgeng Park, Gunung Tidar, Museum, Chinatown Area and Playgrounds [9].

The node network of Magelang consists of three points of nodes, namely:

1. Tidar terminal (Main Terminal)
2. Tidar subterminal (Ikhlas Road)
3. Kebonpolo subterminal

In addition to the 3 node points above, Magelang also has an unofficial terminal, located in Canguk, Soping and Sentot Alibasa Road. With the development of areas and activities in Magelang, the provision of semi-paratransit transportation in Magelang is described as follows:

1. Semi-paratransit route number 1 consist of 29 vehicles
2. Semi-paratransit route number 2 consist of 36 vehicles
3. Semi-paratransit route number 3 consist of 35 vehicles
4. Semi-paratransit route number 4 consist of 37 vehicles
5. Semi-paratransit route number 5 consist of 19 vehicles
6. Semi-paratransit route number 6 consist of 28 vehicles
7. Semi-paratransit route number 7 consist of 30 vehicles
8. Semi-paratransit route number 8 consist of 30 vehicles
9. Semi-paratransit route number 9 consist of 28 vehicles
10. Semi-paratransit route number 10 consist of 38 vehicles
11. Semi-paratransit route number 11 consist of 10 vehicles
12. Semi-paratransit route number 12 consist of 15 vehicles

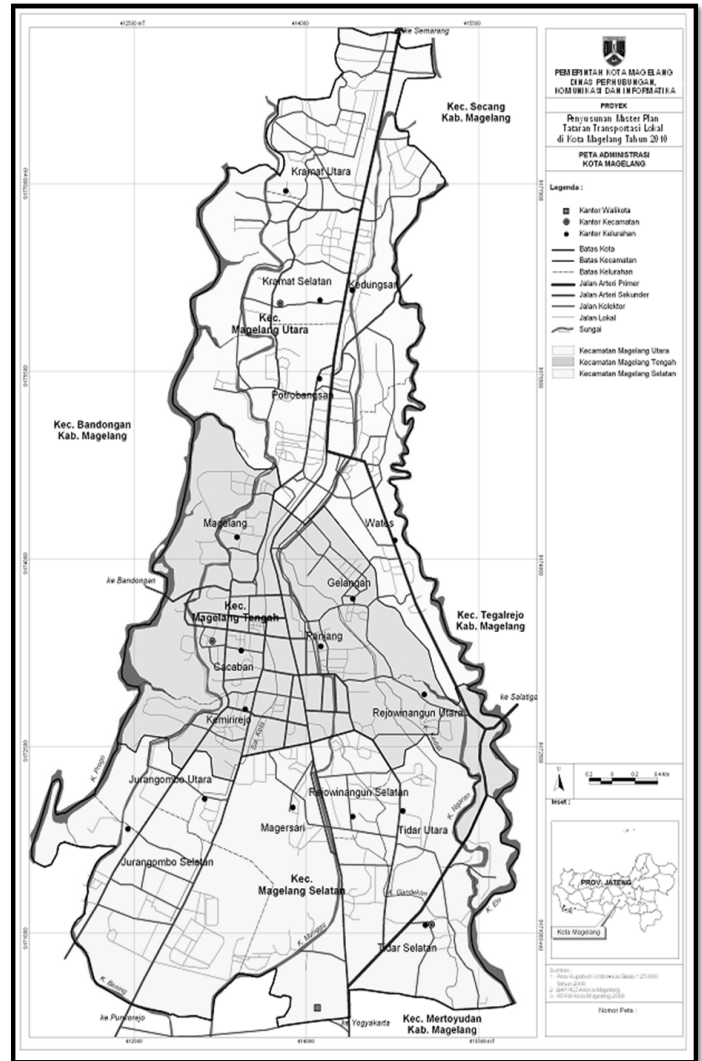


Fig. 1. Magelang Map [9]

4.2 Evaluation Process

Questionnaires and survey forms were prepared to obtain valid and comprehensive data in this study. The number of semi-paratransit users is estimated 5% of the total population (120 thousand inhabitants) or assumed as many as 6000 passengers in a day. The number of drivers of semi-paratransit is obtained from the number of semi-paratransit vehicles operating in Magelang, which is as many as 335 vehicles from 12 semi-paratransit route lines. Before Analysis Hierarchy Process (AHP) conduct, the real performances of semi-paratransit are needed to be observed. To obtain the current semi-paratransit transport performance, the survey of load factor/occupancy and frequency survey of semi-paratransit transport carried out during peak hours (06.00 - 08.00), and off-peak periods (10.00 - 12.00).

The load factor survey is conducted to find out how many passengers are transported by semi-paratransit vehicle compared to the number of seats available (in percent). The design of questionnaires is also included time stops and the suitability of semi-paratransit routes. Frequency survey of

semi-paratransit is observed along the selected road (outside vehicle) and aims to know the frequency of semi-paratransit arrival and headway (time interval).

In the AHP method, first developed the research goal. Under the research goal, the first level is the factors that influence the choice of goals. Sub-criteria are developed based on the description of the factors connected to the first hierarchy at the second level. The research goals have analyzed the problems and its solving based on the perception of the users, drivers, related offices and semi-paratransit operators. The first hierarchy is described in table 1, table 2, table 3 and table 4 as the main criteria. The second hierarchy is described in the same table as sub-criteria.

4.3 Results

4.3.1 Semi-paratransit Characteristic

The survey of semi-paratransit users has been conducted on 98 respondents. The survey locations are Kebonpolo sub-terminal, Ikhlas sub-terminal and Tidar terminal. The characteristic of semi-paratransit passengers is described with Venn diagram in Fig. 2 and Fig. 3.

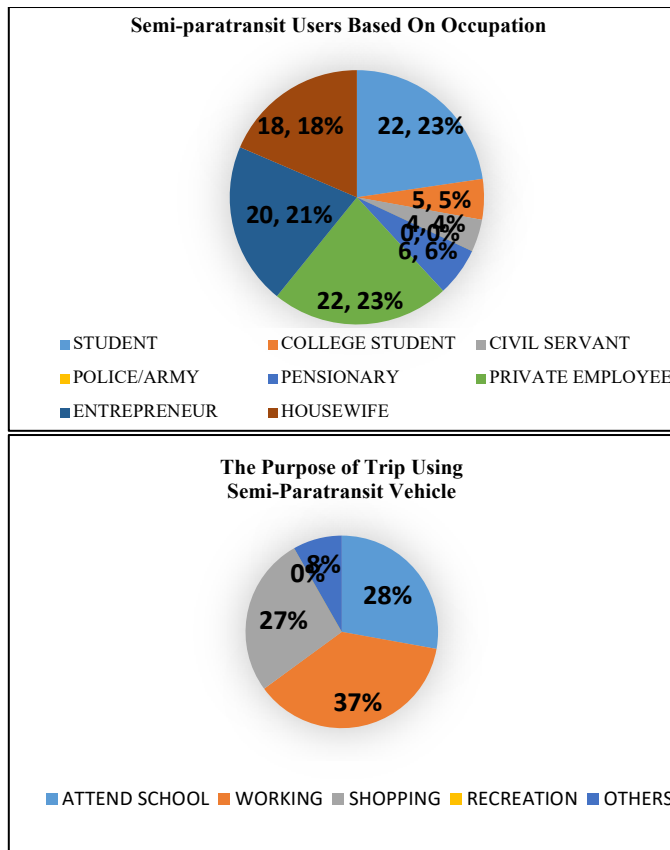


Fig. 2. Semi-Paratransit Users Based on Occupation Diagram and The Purpose of Trip Using Semi-Paratransit Vehicle Diagram

Based on the occupation of semi-paratransit users, the majority of passengers are private employees and students. Civil servants at least use, while none of army or police officers use semi-paratransit. The purpose of the semi-paratransit trip is to work (37%), followed by to attend school (28%), shopping, and recreation. The result show consistency with previous result (occupation of semi-paratransit users), in

which the majority of semi-paratransit users are a private employee, the purpose of the trip is to work.

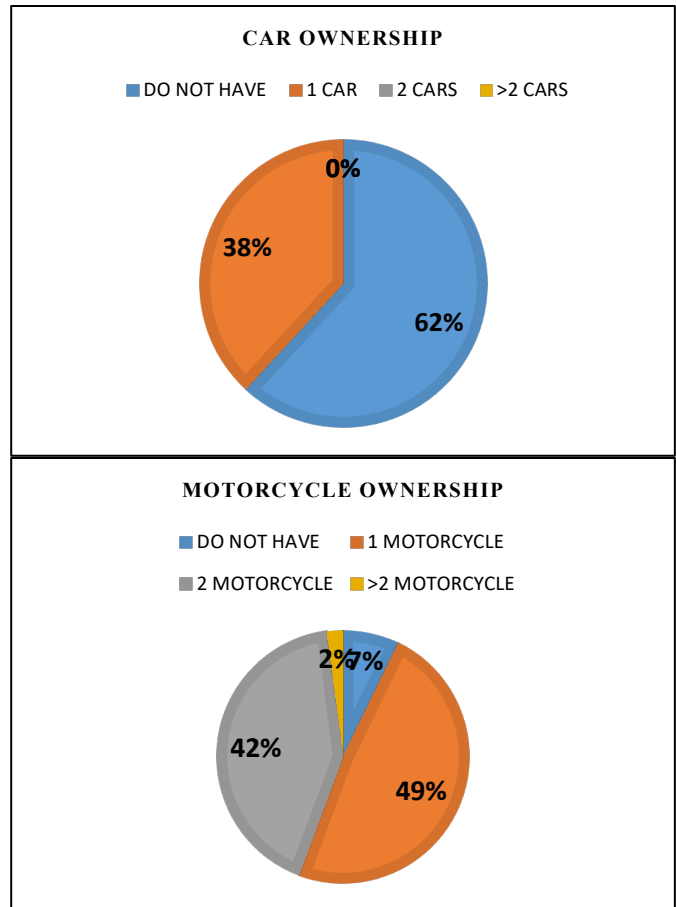


Fig. 3. Car and Motorcycle Ownership Diagram

Based on the diagram, although the majority of the semi-paratransit users already have private vehicles, they still have the desire to trip with the semi-paratransit vehicle. Therefore, with the rapid and sustainable development of semi-paratransit, there is a hope that the use of a semi-paratransit can be increased.

4.3.2.Semi-paratransit Performance

Real problems are seen when the performance data of semi-paratransit are analyzed. Semi-paratransit in Magelang did not show a good performance. In peak hour, with the frequency of semi-paratransit arrival as presented in the table (number of arrivals per hour), the estimated number of passengers in semi-paratransit is low. From 12 seats available, for route number 4, the semi-paratransit is only filled with 3 passengers, while for route number 11 is also 3 passengers. The highest frequency of semi-paratransit arrival per hour at peak period is for route number 4 (above 30 semi-paratransit per hour). Otherwise, the frequency of route number 7, 11 and 12 in 1 hour are less than 5 vehicles.

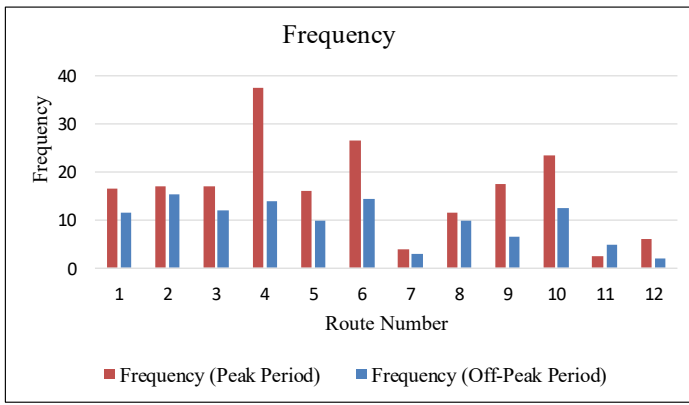


Fig. 4. The Frequency of Semi-Paratransit (Arrival/Minute)

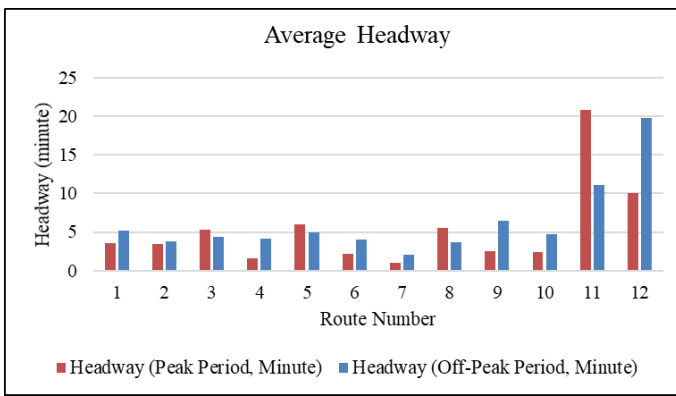


Fig. 5. The Average Headway of Semi-Paratransit

Semi-paratransit transports do not have a regular schedule of arrival. This is because the semi-paratransit driver's payment system is based on the number of passengers on a working day. From the headway chart, the majority of semi-paratransit arrivals are less than 10 minutes. For line 11 and 12 the arrival of semi-paratransit less than 25 minutes. The low certainty level of semi-paratransit trip, causing the reliability, travel time and accessibility is low. This is of course far from ideal conditions.

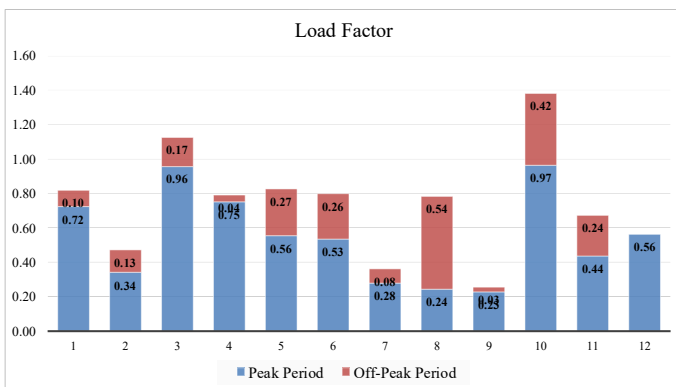


Fig. 6. Load Factor

In peak period, route number 10 and 3 can achieve average load factor 0,97 and 0,96, which means semi-paratransit vehicle full of passengers. On the other hand, route number 12 did not operate at the off-peak period. During the off-peak period, the highest number of load factor is only 0,54.

The low performance of semi-paratransit can lead to decreased existence. The semi-paratransit service is unreliable. In the AHP method, analysis of problem-solving from all perspective is necessary to improve the sustainability of semi-paratransit as suitable public transport for a medium-size city.

4.3.3 Analysis Hierarchy Process Results

Political commitment is a catalyst and becomes the main key to the change of the urban transport system, especially in the public transport sector [10]. In accordance with the proverb, where there is a will, there is a way. The stakeholders that become the object of this research are the Department of Transportation, Public Works and Spatial Department and Regional Development Planning Agency of Magelang. It is needed a support of political will and commitment of action from relevant government stakeholders.

Experts and observers in Indonesia often refer to the conditions of transport services in neighbour countries, for example, Singapore, in order to improve the quality of urban transport systems [10]. In Singapore, there has been a condition below standard quality of transport services with individual operations. In the 1950s there had been chaos due to a massive demonstration of public transport operators. Nowadays, these conditions have occurred in almost region of Indonesia. Additionally, the appeared of online ridesharing motorcycle caused public transport operators to intend to conduct a massive demonstration due to the decreasing amount of income.

Learning from the case in Singapore, in the early 1970s, Singapore undertook the public transport operators with consistent consolidation steps. Public transport entrepreneurs merged into three large companies which held the license of several route regions [10]. The management of public transport continued to expand and made many improvements and now become SBS and SMRT company in collaboration with the LTA (Land Transport Authority). Public transport operated professionally, competitively, rearranged route, and added public transport vehicles. In Indonesia, this public transportation consolidation business has been initiated in Jakarta with Trans Jakarta and Solo with Batik Solo Trans.

According to those reviews, the researcher attempted to establish a scheme for the development of semi-paratransit performance by compiling several indicators and performing pairwise comparisons based on the semi-paratransit operator perspectives. The result can be seen in Table V.

The survey was also conducted on the driver of urban transport in Magelang to find out the problem-solving priority scale. [2] explained that urban transport reform can be done by eliminating the deposit system and replacing it with a system of miles per trip. The target of deposit per day resulted in

semi-paratransit operation disorder, reckless driving, even irregularly stops moreover in the middle of the road to get passengers resulting in chaotic and congestion. The payment system based on miles of the trip is not too familiar to the semi-paratransit driver and operators in Magelang. With the improvement of urban transport management, hopefully, there is an improvement welfare of semi-paratransit drivers.

From the semi-paratransit user perspectives, there are several things to concern, in accordance with the fulfilment of the Minimum Service Standard. Several indicators have been established into criteria and sub-criteria in AHP method analysis hierarchy. To further clarify the results of AHP analysis for semi-paratransit improvement, the recapitulation of AHP analysis results can be seen in table 5.

TABLE V
ANALYSIS HIERARCHY PROCESS RESULTS

Overall Goal	Main Hierarchy	Score	Secondary Hierarchy	Score
The Analysis of Problem Solving Priority of Semi Paratransit Services from Government and Related Offices Perceptions	Attitude	0.446	Publish the political attitude and action plan	0.67
			Spread those action plan to mass media	0.33
	Knowledge	0.244	A comparative study to the advanced city with sophisticated semi-paratransit transport	0.74
			Give political motivation	0.22
			Participate in international or national forum	0.04
	Awareness	0.239	Awareness and desires to develop semi-paratransit transport	0.78
			Boost the national or international financial support	0.22
	Action	0.071	Public transport infrastructure development	0.47
			Developing public transport management (consolidation of public transportation operators)	0.26
			Integrate sustainable transport policy in planning and implementation	0.12
			Seek for national or international appreciation opportunities	0.09
			Minimum service standard development	0.06
The Analysis of Problem Solving Priority of Semi Paratransit Services from Semi-Paratransit Operators Perceptions	Security and Safety	0.41	Zero accidents	0.55
			A low rate of crime	0.25
			Security support facilities availability	0.2
	Comfort	0.19	Clean and tidy	0.41
			A target number of passenger fulfillment a day	0.38
			Full of passengers at peak hour	0.15
			Air conditioner availability	0.06
	Service	0.16	Semi-paratransit repair and driver management review regularly	0.44
			High satisfaction index from passengers	0.35
			Low complaints	0.12
			Semi-paratransit ownership system (individually to the professional company)	0.09
	Accessibility	0.15	High arrival frequency during peak hour	0.75
			Arrival information service	0.25
	Reliability	0.05	On time arrival	0.5
			Clearly and orderly semi-paratransit arrival information	0.5
	Effects on the Environment	0.04	The amount of fuel used	0.77
			Environmental friendly vehicle	0.23
The Analysis of Problem Solving Priority of Semi Paratransit Services from Semi-Paratransit Drivers Perceptions	Service	0.31	Hospitable driver	0.83
			Passenger complaint service availability	0.17
	Security and Safety	0.2	Low accident rate	0.54
			Security and safety facilities availability (first aid kit, glass breaker)	0.46

Overall Goal	Main Hierarchy	Score	Secondary Hierarchy	Score
	Comfort	0.18	A high rate of load factor	0.48
			Reliable semi-paratransit vehicle machine (regular service)	0.29
			Cleanliness of semi-paratransit	0.23
	Reliability	0.14	Semi-paratransit arrive regularly	0.56
			Earning based on the number of passengers	0.34
			Earning based on travel km system	0.1
	Accessibility	0.13	Ease of access to many places	0.51
			Stop at every semi-paratransit stop place	0.23
			Long route	0.2
			Ticketing system	0.07
	Effects on the Environment	0.05	Fuel consumption	0.77
			Environmental friendly vehicle	0.23
	The Analysis of Problem Solving Priority of Semi Paratransit Services from Semi-Paratransit Passengers Perceptions	Service	0.28	Easy reach of semi-paratransit stop
Special needs passenger facilities availability				0.26
High Frequency of semi-paratransit arrival				0.21
The hospitality of semi-paratransit driver				0.19
Passenger complaint service availability				0.08
Comfort		0.18	Clean	0.66
			Air conditioner availability	0.18
			The quiet sound of a vehicle	0.16
Accessibility		0.17	Easy access to all places	0.23
			Adequate transport network	0.2
			Short transit time	0.18
			Supporting facilities availability to access semi-paratransit stop (park and ride facility)	0.17
			Affordable semi-paratransit fares	0.16
			Ticketing system payment	0.04
Security and Safety		0.16	Low accidents rate	0.6
			Low criminal rate (theft, harassment, etc)	0.4
Reliability		0.15	On time semi-paratransit arrival	0.4
			Clearly and orderly semi-paratransit arrival information	0.23
			Short travel time	0.21
			Minimal extra waiting time, time to reach the destination	0.1
			Secure vehicle speed	0.06
Effects on the Environment		0.05	Lots of coverage area	0.56
			Environmental friendly vehicle	0.44

V. CONCLUSIONS

This research was carried out to find out the condition of semi-paratransit and developed a problem-solving strategy with AHP method. Based on the semi-paratransit performance observation, semi-paratransit has low frequency and load factor. In order to improve the sustainability of semi-paratransit the results show that attitudes from government and related offices which include showing political attitudes and action plans and spreading political attitudes and action

plans to the mass media are top priorities. In addition, according to the perception of semi-paratransit passengers, the first priority to be solved is semi-paratransit services, and then increased the convenience, facilitate and expand the accessibility of semi-paratransit.

Meanwhile, for drivers, service (hospitable driver, passenger complaint service availability) is the most important priority to

be improved. Otherwise; security, safety, reliability is prioritized over accessibility.

Development of semi-paratransit policies can be carried out by constructing political will and commitment by understanding the existing problems. In this study, various indicators, attributes, and criteria have been elaborated to understand the current condition of semi-paratransit and developed the problem-solving priority strategies.

The arrangement of semi-paratransit transportation in Magelang can also be developed with several strategies such as the consolidation with semi-paratransit operators to become a professional company. To compete with other modes of transportation, Travel Demand Management (TDM) can also be implemented. The TDM strategies that can be carried out are time management of vehicles so that public transport, private vehicles and online public transport do not operate together, implementing high parking rates in the city center, limiting motorcycles on certain roads, vehicle age restrictions, development of park and ride facilities, improvement of public transport service and infrastructures, development of technology and public transport information, and develop land use (long period action). The improvement of semi-paratransit has to be done with large-scale infrastructure development. The government must also be prepared to carry out public transport rejuvenation to improve service, comfort, and affordability of semi-paratransit transport.

For further research, financing mechanisms can be carried out in the development of semi-paratransit and the analysis of effective and efficient semi-paratransit transportation management.

Meanwhile, for drivers, service (hospitable driver, passenger complaint service availability) is the most important priority to be improved. Otherwise; security, safety, reliability is prioritized over accessibility.

Development of semi-paratransit policies can be carried out by constructing political will and commitment by understanding the existing problems. In this study, various indicators, attributes, and criteria have been elaborated to understand the current condition of semi-paratransit and developed the problem-solving priority strategies.

The arrangement of semi-paratransit transportation in Magelang can also be developed with several strategies such as the consolidation with semi-paratransit operators to become a professional company. To compete with other modes of transportation, Travel Demand Management (TDM) can also be implemented. The TDM strategies that can be carried out are time management of vehicles so that public transport, private vehicles and online public transport do not operate together, implementing high parking rates in the city center, limiting motorcycles on certain roads, vehicle age restrictions, development of park and ride facilities, improvement of public transport service and infrastructures, development of technology and public transport information, and develop land use (long period action). The improvement of semi-paratransit has to be done with large-scale infrastructure development. The government must also be prepared to carry out public

transport rejuvenation to improve service, comfort, and affordability of semi-paratransit transport.

For further research, financing mechanisms can be carried out in the development of semi-paratransit and the analysis of effective and efficient semi-paratransit transportation management.

REFERENCES

- [1] Cervero, Robert, "Linking Urban Transport and Land Use in Developing Countries," *The Journal of Transport and Land Use* Vol. 6 No. 1 pp. 7-24, 2013.
- [2] Munawar, Ahmad, "Perencanaan Angkutan Umum Berkelanjutan," *UNISIA* No. 59/XXIX/I/2016 (2016)
- [3] Siuhi, Saidi, and Judith Mwakole, "Opportunities and Challenges of Smart Mobile Application in Transportation," *Journal of Traffic and Transportation Engineering (English Edition)*; 3 (6): 582-592, 2016.
- [4] Xiao-Kun, Wang, Hu Bou-yu, Chen Wei-qiang, Liu Xin, and Guan De-Yong, "Design of Service and Supervision and Subsidies Evaluation System for Urban Public Transport," *Applied Mechanics and Materials* Vol. 135-136 pp 414-420, 2012.
- [5] Wu, Hongyang, Ligai Yang, Yulin Jiang, and Haozhi Zhang, "Evaluation Methodology of Public Transport Operators Management and Services in China," *Applied Mechanics and Materials* Vol. 209-211 pp 671-676, 2012.
- [6] Dragu, Vasile, Eugenia Alina Roman, and Vlad Catalin Roman, "Quality Assessment in Urban Public Transport," *Theoretical and Empirical Researches in Urban Management*, Vol 8, No.3 pp. 32-43, 2013.
- [7] Bian, Yang, Lin Zhao, and Jian Rong, Jianchen Weng, "Evaluation on Public Transit Operational Level of Service Based on Public Transportation Priority Strategy," *Applied Mechanics and Materials* Vol. 253-255 pp 1900-1905, 2013.
- [8] Budiarta, I Nyoman, "Perencanaan dan Evaluasi Sistem Transportasi Logistik Kota Denpasar yang Ramah Lingkungan," *Konferensi Nasional Teknik Sipil 7*. Universitas Sebelas Maret, Surakarta, 2013.
- [9] Dinas Perhubungan, "Komunikasi dan Informatika Pemerintah Kota Magelang," Laporan Akhir Perencanaan Master Plan Tataran Transportasi Lokal di Kota Magelang. Magelang, Indonesia, 2012.
- [10] Nasional, Kementerian Perencanaan dan Pembangunan, "Langkah Jitu Pembenahan Angkutan Perkotaan," Jakarta, 2015.
- [11] Basuki, Imam, "Pemeliharaan Kinerja Angkutan Umum Perkotaan Menuju Transportasi Berkelanjutan," *Konteks 6*, Universitas Trisakti. Jakarta, 2012.
- [12] Basri, Seta, "Analisis Kuadran Harapan dan Persepsi Publik," 2011.
- [13] Idris, Zilhardi, "Kajian Tingkat Kepuasan Pengguna Angkutan Umum Di DIY," *Dinamika Teknik Sipil*, Volume 9, Nomor 2, 2009.
- [14] Maryunani, Woro, and Evi Puspitasari, "Studi Fasilitas Pejalan Kaki dan Kendaraan Tidak Bermotor di Kota Magelang dalam Mendukung Transportasi Berkelanjutan," Universitas Tidar. Magelang, 2014.
- [15] Perhubungan, Kementerian Republik Indonesia, "Pemberian Subsidi Angkutan Penumpang Umum di Jalan," Jakarta, 2007.
- [16] Perhubungan, Kementerian Republik Indonesia, "Standar Pelayanan Minimal Angkutan Massal Berbasis Jalan," Jakarta, 2012.