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Motorcycle Riders' Perception of the Characteristics of Paratransit In Medan, Indonesia

Reynaldo SIAHAAN[1]* · Charles SITINDAON[2] · Oloan SITOHANG[3]

[1]Department of Civil Engineering, Saint Thomas Catholic University, Medan, Indonesia, Email: siahaan.reynaldo@gmail.com
[2]Department of Civil Engineering, Saint Thomas Catholic University, Medan, Indonesia, Email: charles_sitindaon@yahoo.co.id
[3]Department of Civil Engineering, Saint Thomas Catholic University, Medan, Indonesiamail: obed_sito@yahoo.com

Abstract

In developing countries, the uncontrolled rise of private vehicle ownership, such as motorcycles, constitutes a great deal of air pollution in the city. While the motorcycle is quite convenient, public transport lacks many qualities, and for some cities, like Medan, they are limited to paratransit. This study aims to reach an understanding of motorcycle riders' perception of the existing paratransit and its relation to their reasoning to choose the two-wheelers daily. We utilized a structured questionnaire and interviewed 456 daily-commuting riders to assess 13 service aspects of the existing paratransit and their primary reason for using a motorcycle. Our findings suggest that riders collectively agree that affordable fare, easy to find, and short walking distance are the best trait of the existing public transport in Medan. Meanwhile, travel time, time-availability, and hygienic issues are reported to be the most hindering aspects. This perspective is consistent with riders' reasoning behind their mode choice, which is based primarily on time efficiency. This research highlights the comparison of riders' need in commuting and their opinion about the existing paratransit. While it is yet interesting to learn how those aspects weigh in with each other, the result of this study still offers prudent recommendations in developing mode-shifting strategic policies to encourage more public transportation use in Medan city.

***Keywords**: motorcycle riders, paratransit, service characteristic, urban mobility, medan*

1. Introduction

In developing countries, especially in Southeast Asia, people are highly dependent on private vehicles, namely private automobiles and motorcycle (Senbil, Zhang, & Fujiwara, 2007). The reason behind this is ranging from travel cost consideration to insufficient public transport options (Kenworthy, Laube, & Newman, 1999). A more recent study suggested that the contributing factors might differ from time to time, related to the transportation environment and cultural norm of the urban areas (Yagi, Nobel, & Kawaguchi, 2012). Moreover, land use, population density, and income level have also been reported as the driving cause of motorcycle use (Fevriera, de Groot, & Mulder, 2020; Limtanakool, Dijst, & Schwanen, 2006). All in all, one of the most relevant driving factors that reduce public willingness to use public transport has been widely known for its inadequate service quality. It is vital to maintain proper service quality for public transport to keep attracting private vehicle users. Several studies have explored this notion and investigate how service quality could increase public transport users. Redman et al. (2013), for instance, conducted a systematic review and addressed policymaker and transport planner that understanding what attractive quality attributes are desired would enhance the effectiveness of public transport improvement.

Unfortunately, the majority of cities in Southeast Asia have yet the size of the budget needed for desirable urban public transportation systems such as subways and light rails. The

*corresponding author

public's urban mobility primarily relies on what we call paratransit, a less regulated informal and flexible urban public transport. Cross-country review showed that there are numerous types of paratransit in Asia (T Shimazaki & Rahman, 1996; Toshikazu Shimazaki & Rahman, 1995). These studies were then synthesized and updated (Phun & Yai, 2016). In Indonesia, people are most familiar with the four-wheeler minibus called *Angkot*, and the three-wheeler motorized/non-motorized rickshaw called *Becak*. *Angkot* possesses a wider coverage, larger capacity, and relatively more convenient than *Becak*, and therefore generally more popular as a daily mode of transport.

Many works of literature in various developing countries had explored the perceptional quality of paratransit (e.g., *Angkot* in Indonesia) based on the user's perspective (Choocharukul & Sriroongvikrai, 2011; Joewono & Kubota, 2007a, 2008; Okamura, Kaneko, Nakamura, & Wang, 2013; Phun, Kato, & Yai, 2017; Rahman, Das, Hadiuzzaman, & Hossain, 2016; Tarigan, Susilo, & Joewono, 2014). Maintaining good service is paramount to keep paratransit's loyal users from shifting to the private vehicle. However, if our long-term objective is more people travel by public transportation, then we believe it is also equally important to understand motorcycle riders' point of view regarding the service characteristic of the existing paratransit. This study aims to investigate how motorcycle riders perceive service attributes of paratransit in Medan city, and how this is aligned with riders' motivation to use the motorcycle.

The following section 2 presents some general contextual information to aid problem comprehension. Next, section 3 explains the study area and the methodology used to reach the objective of this study. Section 4, divided into two sub-sections, explains the result of data collection and the corresponding analysis. Discussion is provided in section 5, and followed by concluding remarks from this study in section 6.

2. Medan in Brief: City and Transportation Overview

Medan is one of the five most populated and growing cities in Indonesia, accommodating more than 2.2 million people (Statistics Indonesia, 2019). It is the 7th largest economy in Indonesia and the third fast-growing economic in Sumatera Island. The increase of Medan population as expected contributes to the growth of private vehicle ownership. According to Medan Transport Authority, 94% of the daily trip is made using the private vehicle, among which more than 80% is made with the motorcycle. The current road network lies about 3,191.50 km (Statistics Indonesia, 2015), compared to 3,078.35 km in 2010. It is evident that the growth of private vehicle outweighs the current supply of road infrastructure. It is worth anticipating that Medan would suffer from extreme traffic congestion in the several coming years. The strategic measure should be implemented in an urgent manner. Immediate mass transit development and revitalization of existing transport means need to be done to facilitate the growing urban mobility.

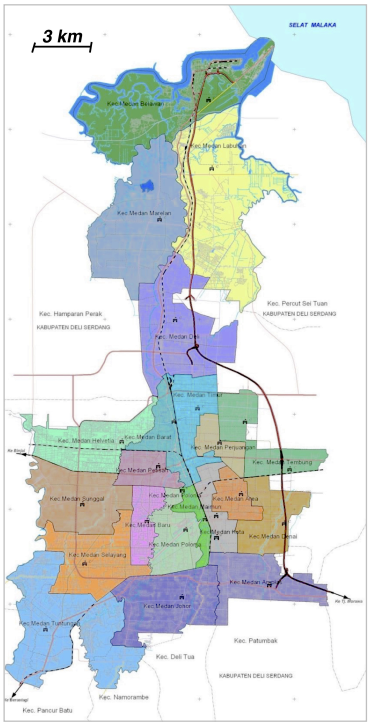


Figure 1. Administrative map of Medan (modified from RTRW kota Medan)

There are currently limited choices of public transportation operating in Medan. The people are faced with only the kinds of transport such as Taxis, Buses, Non-/Motorized rickshaw, and the locally popular paratransit known as *Angkot*. There are more than 160 operational lines, and more than 5000 fleets of *Angkot* operate daily in Medan. Taxis are available in most parts of

the city. They are typical and generally similar to any country in Asia in terms of fare system, capacity, permitted route, etc. Motorized rickshaw, also known as *becak motor*, is a three-wheeled motorized vehicle that can only carry two passengers. It should be available almost everywhere inside the city, but the fare could be much more expensive than paratransit. Bus Rapid Transit service routes have been available since 2015, although gleam horribly. Having no dedicated bus line and been only relatively similar to *Angkot*, the ridership is, in fact, very low. Lastly, competing with high confidence is emerging ride-hailing apps.

An ambitious project to tackle Medan's future mobility threat is already on progress. The government has launched the plan to construct an integrated public transportation system, combining an extension of the existing BRT system and the development of Light Rail Transit (LRT), according to the Indonesian Ministry of National Development Planning (2016). However, given the extravagant nature of such a massive transportation project, it will take years and a massive amount of financing, before ready to operate. It is safe to propose a short improvement to existing paratransit service as a short-term covering strategy.

3. Methodology

Design and Targeted Population

This study aims to explore the motorcycle rider's perception of the existing public transportation in Medan. Specifically, we are interested in exploring the perceived quality of the paratransit, known as *Angkot* in Indonesia. In order to satisfy such objectives, a survey in the form of direct interviews with motorcycle riders as data collection is needed. Omitting people who are relatively unable to perform their trip on their own, we determine the sampling criteria as follows: people whose daily commuting and travel are made with the motorcycle, who live and/or work in Medan and are older than 16 years old. Potentially, the size of the population in this study would be roughly 1.5 million people. Therefore, using a margin of error of 5 and 95% confidence level, any sum of total sample size larger than 380 respondents would be statistically acceptable. Taking less complexity into account, we do not specifically segregate riders who live in the surrounding area of Medan but work in the city downtown.

Data Collection and Analysis

We designed a structured questionnaire set consisting of three sections designated for the riders. The first section contains questions related to general socioeconomic information. The second section comprises of questions regarding mode usage and trip characteristics. A question regarding motivation in using the motorcycle is also included in this section. We ask respondents to choose and rank three main reasons for using the motorcycle. Lastly, the third section is meant to record the perceived quality of *Angkot* using a 5-level Likert-scale item rating. By considering interviewee comprehension, the scale was combined with a state of agreement wording (agree, disagree, etc.). Intercept interviews were made face-to-face in various public places, which we considered as the center for attracting activities. Likert-scale was utilized in the survey so that it is possible to measure the level of perceived quality. The survey was conducted and completed in one week.

Rider's motivation to use the motorcycle is commonly related to time efficiency, economic consideration, and flexibility. For the third section of the questionnaire, we arrange aspects of public transportation that are comparable to those possessed by motorcycle. Different aspects of motorcycle usage that drives motivation had been investigated in various past studies (Asri, Ramli, Ali, & Samang, 2013; Hagen, Pardo, & Valente, 2016; Joewono, Lauw, & Hendy, 2013; Jou & Chen, 2014; Marquet & Miralles-Guasch, 2016). However, since *Angkot* as paratransit does not fully operate like general public transportation, several particular traits were not included to be asked in the item rating section. A total of 13 aspects/items are included in the survey.

Table 1. List of item used in the questionnaire related to service aspect

Item No.	Aspect	Remark
1	Safety from criminal act	*clear*
2	Safety from accident	*clear*
3	Comfort	physical feature such as seats, air conditioning, lights
4	Hygienic facility	in-vehicle physical and air cleanliness
5	Walking distance to access	average required distance in order to find *Angkot*
6	Service area coverage	accessibility to various desired destinations
7	Waiting time	average required time until the next fleet arrives
8	Easiness to find	location passed by *Angkot* route
9	Trip cost/fare	*clear*
10	Fare-service suitability	*clear*
11	Daily availability	available each day of the week
12	Time-of-day availability	operational includes early-morning and late-night
13	Travel time	average time spent to complete a trip

We used descriptive statistics to present the result of the first and second sections of the survey. In relation to the rider's motivation, we calculated the average score based on the ranked reasons. Among the three reported reasons, the first ranked is scored 3, the second is scored 2, and the last is scored 1. The final score is based on the ratio to the maximum possible score. We conducted factor analysis for the items in section 3 of the questionnaire in order to reduce the dimension into factors that are representable in general. The result of the third section was expected to depict how riders consider *Angkot* as a mode of transport. A comparison to the rider's motivation was also possible to discuss based on the perceived quality result.

4. Results

Descriptive Statistics of Socioeconomic Characteristic

A total of 456 validated responses from motorcycle riders were collected. The following table presents the socioeconomic characteristic of our respondents. The average income of our respondents is as expected within IDR 1-3 Million (USD65-203). Based on past literature, this level of income is more plausible to own a motorcycle, whereas higher income class is more likely to opt for a car (Joewono et al., 2013; Jou & Chen, 2014). However, it was also reported that income might not significantly drive motorcycle usage (Asri et al., 2013; Senbil et al., 2007).

The number of large household size respondents in this survey is considerably low. This is mainly due to large households tend to use a car instead (Senbil et al., 2007). Moreover, car ownership characteristic also confirms this tendency. The majority of our respondents are students and aged younger than 30 years old. Moreover, it is agreeable that the proportion of employees as respondents is also dominant. However, it is probable that the final result of this study might be potentially biased to young-adult since the proportion of respondents who are in their 20s is dominantly high.

Table 2. Summary of socioeconomic characteristic

Information		N	%
AGE	younger than 17	32	7.02
	17-29	278	60.96
	30-39	87	19.08
	40-49	39	8.55
	50-59	14	3.07
	older than 60	6	1.32
GENDER	Male	278	60.96
	Female	178	39.04
EDUCATION BACKGROUND	Elementary	5	1.10
	Junior High	36	7.89
	Senior High	247	54.17
	Bachelor	160	35.09
	Graduate School	8	1.75
OCCUPATION	High School Student	44	9.65
	College Student	183	40.13
	Employee	141	30.92
	Self-Employed	69	15.13
	Other	19	4.17
HOUSEHOLD SIZE	1-3	176	38.60
	4-8	264	57.89
	greater than 8	16	3.51
AVERAGE MONTHLY INCOME	Less than 500k IDR	88	19.30
	500k - 1,500k IDR	144	31.58
	1,500k - 3,000k IDR	125	27.41
	3,000k - 7,500k IDR	88	19.30
	Greater than 7,500k IDR	11	2.41
MOTORCYCLE OWNERSHIP	One	251	55.04
	More Than One	205	44.96
CAR OWNERSHIP	Yes	79	17.32
	No	377	82.68

Riders' Motivation to Use and Trip Characteristics

The following table presents the general trip characteristic of a daily motorcycle ride. Based on this data collection, most trips made using a motorcycle in Medan are mainly medium-distance (1-5km), which takes around 30 minutes to complete. It is fair to say that there might be unaccounted longer trips made by riders. Since our survey location is mainly in the center area of the city, there is a possibility that riders in our survey are mainly people who primarily travel in the adjacent area to downtown.

Riders were also asked to state their frequency of travel using the motorcycle and also using public transport (*Angkot*). Significant proportions (>90%) of the riders rarely use public transportation, and the majority of them (>35%) do not usually use *Angkot* at all.

Table 3. Summary of trip characteristic of motorcycle riders

Information		N	%
AVERAGE TRIP DISTANCE	Less than 500 m	36	7.89
	500 – 1.5 km	84	18.42
	1.5 – 5 km	190	41.67
	5 – 10 km	116	25.44
	Greater than 10 km	30	6.58
AVERAGE TRAVEL TIME	Less than 15 min	69	15.13
	15 – 30 min	188	41.23
	30 – 60 min	165	36.18
	60 – 120 min	31	6.80
	Greater than 120 min	3	0.66
DAILY USAGE OF MOTORCYCLE	1	32	7.02
	2	124	27.19
	3	100	21.93
	4	77	16.89
	More than 4 trip	123	26.97
FREQUENCY OF PUBLIC TRANSPORT USAGE	Never	160	35.09
	1-2 times/week	269	58.99
	2-5 times/week	21	4.61
	5-7 times/week	4	0.88
	more than 7 times/week	2	0.44

Each of the riders ranks three main reasons why they use a motorcycle for their daily trip. It was found that riders expect a better outcome in the efficiency of time spent on a trip made with the motorcycle. On the contrary, the low price of capital investment in buying a motorcycle was the least of their main reason to own and use a motorcycle. An interesting point was obtained in relation to owning another private vehicle. It was reported that the inability to purchase a car (or drive) was one of the determining reasons for choosing the motorcycle. Not being able to drive a car was also one of the reasons, although it was scored relatively low. Potentially as income and ability to pay increases, some riders would most likely buy the private car.

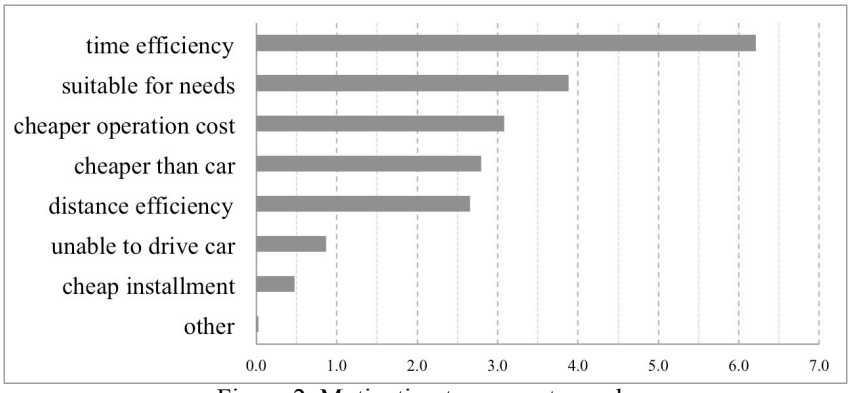
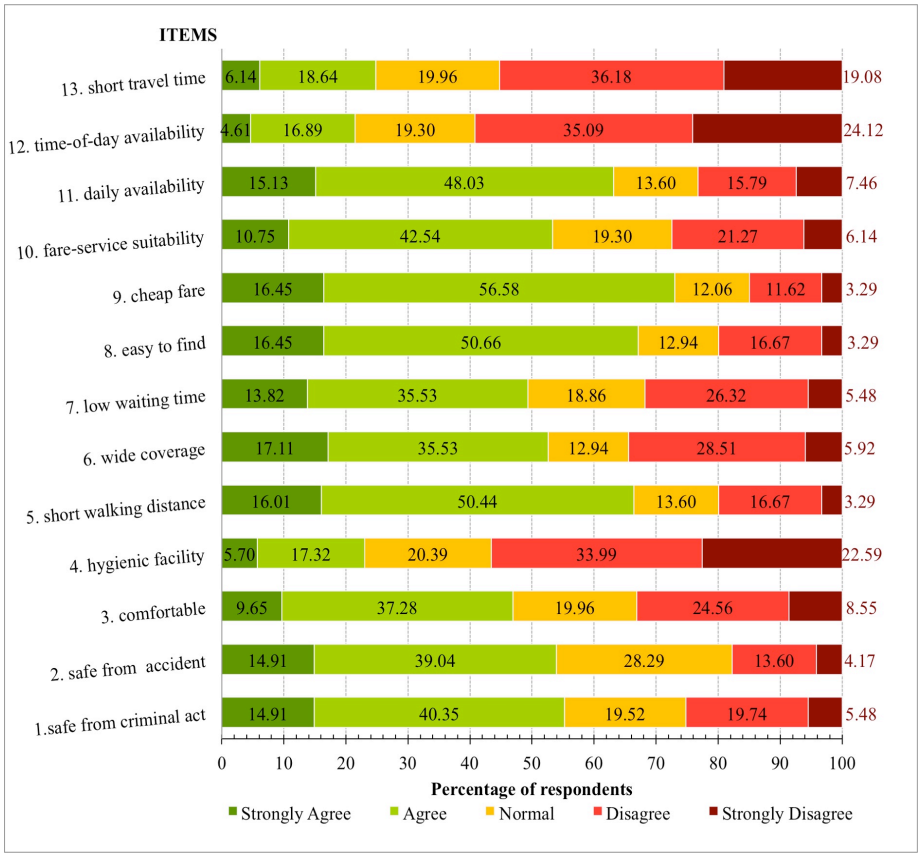


Figure 2. Motivation to use motorcycle

Perceived Quality Of Angkot

The following chart in Figure 3 shows the perception of motorcycle riders on various aspects of *Angkot* as public transportation. All items were presented in the form of positive statements, such as cheap, short time, clean, etc. and then riders were asked to give their opinion in rating toward each statement. Cronbach's Alpha reliability coefficient is acceptable for each item. The lowest rating (value=0) on the Likert scale is represented by "strongly disagree" and color-coded in dark red, whereas the highest rating (value=4) is represented by "strongly agree" and color-coded in dark green.



NO.	Cronbach's Alpha
ITEM13	0.774
ITEM12	0.778
ITEM11	0.779
ITEM10	0.780
ITEM9	0.794
ITEM8	0.771
ITEM7	0.773
ITEM6	0.773
ITEM5	0.775
ITEM4	0.783
ITEM3	0.774
ITEM2	0.789
ITEM1	0.793

Figure 3. Motorcycle riders' perceptional assessment on service aspect of paratransit

Generally, the items' ratings shown in Figure 3 give meaningful information since the responses given possess relatively good internal consistency, and were not dominated by neutral answers. Among the 13 items provided in the questionnaire, there were three aspects that received bad ratings by more than half of the respondents. It was reported that travel time (55.26%), availability during the day (59.21%), and fleet's hygiene (56.58%) were perceived negatively by motorcycle riders. Moreover, it was worth noting that daily-availability was not considered bad by the riders. This is most likely because normally *Angkot* does not operate every hour of the day (especially late at night). In terms of operational hour, it is not well regulated or scheduled in anyways. However, people will definitely find them available every day, including on weekends. Item 3 and 7 are related to comfort, and waiting time received relatively neutral to bad opinion. In practice, a large number of *Angkot* fleet lacks maintenance, especially for the interior part. Moreover, there is currently no *Angkot* fleet operating with a functional Air-Conditioning system. It is understandable that riders perceived hygiene and comfort were problematic issues in *Angkot* service. In terms of waiting time, *Angkot* drivers tend to stop and wait for passengers at certain places that, based on their experience, would be where there are many passengers. As a consequence, maintaining decent headway is difficult in practice, and passengers might need to wait for fleet longer than they are supposed to.

On the other hand, the majority of the items actually received good ratings by more than half of the respondents. Four items (5,8,9,11) related to walking distance, easiness to find, fare, and daily availability respectively, were regarded as acceptable by more than 60% of the respondents. Walking distance and easiness-to-find are, in fact, intercorrelated. Fare is clearly the best advantages of *Angkot* since it charges roughly within IDR 3000-15000 ($0.2 – $1) per trip. Moreover, the result also showed that riders perceived *Angkot* fare as suitable for its service. It might be proper to say that riders think *Angkot* is cheap for a reason, which is the lack of adequacy. In this study, we initially expected that there would be more aspects perceived as dissatisfying than acceptable. This is worth noting that riders actually tend to

have more neutral opinions toward *Angkot* as public transport. The lack of frequency in *Angkot* usage might have a role in this neutral tendency. However, there are clearly several aspects that need more attention, according to the riders' perspective. The following chart visually depict the strengths and weaknesses of *Angkot* based on the average rating of each aspect of service.

Average rating												
Item 13	*12*	*11*	*10*	*9*	*8*	*7*	*6*	*5*	*4*	*3*	*2*	*1*
2.39	2.47	2.15	1.50	2.59	2.29	2.26	2.60	2.71	2.30	2.48	1.43	1.57

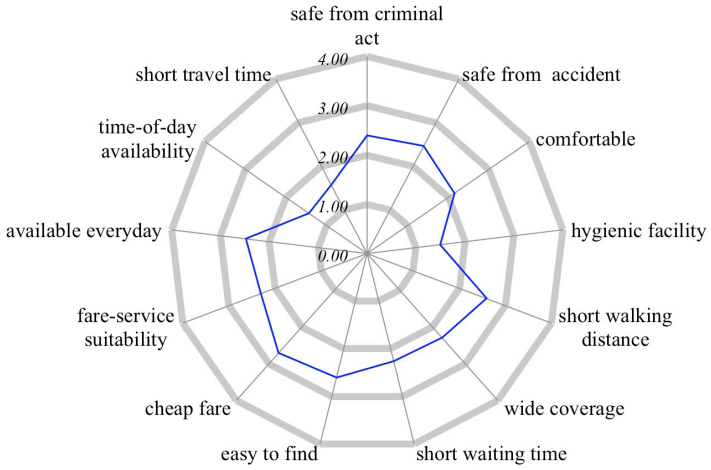


Figure 4. Average rating of service aspects of paratransit

In order to reduce the number of quality items into a generalized number of factors, we performed factor analysis in Stata. The extraction method used in the analysis was principal component analysis, and the axis was rotated using the Varimax rotation method with Kaiser Normalization. Factor loading of less than 0.6 was not presented in the result. There are five significant factors that represent all the measured items. Item 1 and 2 constitute the first factor named Safety. Item 3 and 4 constitute the second factor related to Comfort. Item 5, 6, 7, and 8 represents Reliability. Item 9 and 10 constitute factors related to Affordability. Lastly, Item 11, 12, and 13 represent the Availability factor in terms of both time and space.

Table 4. Result of factor analysis

	Factor Loading					**Associated Label**
	1	**2**	**3**	**4**	**5**	
Item1			0.860			Safety
Item2			0.867			
Item3					0.617	Comfort
Item4					0.859	
Item5	0.831					Reliability
Item6	0.710					
Item7	0.782					
Item8	0.765					
Item9				0.879		Affordability
Item10				0.757		
Item11		0.637				Availability
Item12		0.861				
Item13		0.738				

Using the presented result of factor analysis, we constructed a new radar map of strength and weakness of public transport in these five aspects of service based on the motorcycle rider's perception. Both comfort and availability have smaller average ratings (<1.00) than the other three aspects.

Average rating				
Safety	Comfort	Reliability	Affordability	Availability
2.43	1.82	2.44	2.51	1.82

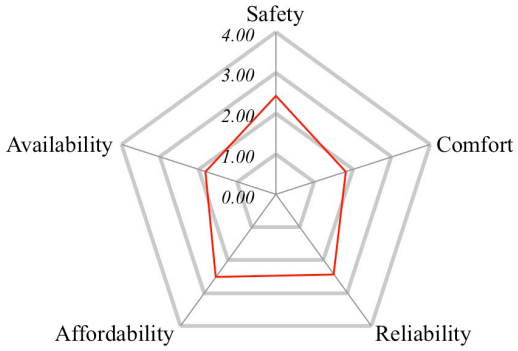


Figure 5. Average rating of associated factors related to service aspects of paratransit

5. Discussion

The general notion about why people tend to prefer motorcycle to public transport for their urban trip has long been associated with the lack of adequate public transport (Hagen et al., 2016; Joewono et al., 2013; Petragradia, Hendarto, Frazilla, & Wibowo, 2009; Susilo, Santosa, Joewono, & Parikesit, 2007). In this study, we investigated motorcycle riders' perception of public transportation in Medan, specifically the paratransit, also known as *Angkot*.

Riders reported that their primary reason for choosing a motorcycle was majorly related to time efficiency. It could be further explained that the reasoning was generally about the trade-off between time and cost. In some cases, it is understandable that time and cost even represent the same terminology, simply as a cost. Based on the reported list of motivation factors to use a motorcycle, there is an indication that riders value their time flexibility in making their urban trip without suffering a drastic change of cost in the process. People who ride a motorcycle can easily decide their departure time and most likely able to estimate their arrival time based on their daily trip experience. Meanwhile, the inability to control and the uncertainty of additional cost (both time and money) if the trip was made with *Angkot* is too dissatisfying. This finding is also supported by past studies such as Rahman, Das, Hadiuzzaman, & Hossain, 2016; Tarigan, Susilo, & Joewono, 2014. Riders' perception of travel time using *Angkot* as public transportation also showed a deficient rating (< 2.0).

There is a possibility that motorcycle riders would move to paratransit *Angkot* if operators and government could solve various issues in *Angkot* related to time waste. In this regard, the government holds vital a role in creating effective regulations and providing support (both technically and financially). In fact, operators are less capable of ensuring high quality of *Angkot* service while their profit relies solely on trip fare. According to the current system, operators are left alone and limitedly regulated. In response to this, *Angkot* drivers are pressured to meet profit even when the number of passengers is going down drastically. Drivers are struggling to reach their daily target and therefore tend to behave at one's pleasure (including stopping intermittently to wait for passengers) as long as they can reach their objective. Delayed *Angkot* round trip is always going to affect potential passenger's waiting time. It is recommended that, in order to sustain paratransit *Angkot* in Medan, the local government should start evaluating the business model and regulation of *Angkot*. Furthermore, in the era of emerging motorization and ride-hailing apps, the future of this kind of paratransit would be doubtful unless the proper strategy is applied by the government in collaboration with *Angkot* operator.

In this study, it was revealed that trips made by the riders in Medan were categorized as short to medium travel distance (1.5-10km), as well as short to medium travel time (15-60min).

During interviews, riders stated that given the same trip distance, there is a high possibility that the trip using *Angkot* would take one-half to twice longer than using a motorcycle. The fact that a motorcycle would give them more time to save makes riders naturally choose it as more suitable for their needs. Studies in the past revealed that an improvement in paratransit (in this case: *Angkot*) could generate a willingness to shift mode among private vehicle users (Joewono & Kubota, 2007b; Siahaan, Tarigan, & Hutauruk, 2020). However, it should also be understood that not only one or two improvements are needed, but continuous evaluation and development also hold a crucial role in sustaining the paratransit. As society and the average income soon grow, the challenge does not lie solely on encouraging mode shifting to *Angkot* or public transport in general but also keeping *Angkot*/public transport users from shifting to the private vehicle (Joewono, Santoso, & Susilo, 2015; Phun & Yai, 2016; Tarigan et al., 2014).

Paratransit *Angkot* improvement needs to be addressed effectively by focusing resources on the most critical aspects of service. For example, enacting cheaper *Angkot* trip fare might be a good idea since travel cost significantly affects service quality and satisfaction (Rahman et al., 2016). However, fare reduction might not be the most defining strategy in the foreseeable future because, based on this study, motorcycle riders already agree that *Angkot* fare is cheap. Even though a study in the past suggested that ensuring better in-vehicle security would be beneficial for Paratransit *Angkot*'s image (Joewono et al., 2015), our study found that motorcycle riders already perceived *Angkot*'s security relatively acceptable. On the other hand, improving the comfort and hygiene aspect, as also suggested by aforementioned past studies, should be the best strategy to focus on. The role of *Angkot* operator will be essential in ensuring a cleaner and more comfortable environment inside the *Angkot* fleet.

6. Conclusion

The outbreak of motorization in Indonesia has started for decades and major cities are facing a challenging era where most urban trips are made using the private vehicle. In developing cities, like Medan, public transportation is strictly limited to several bus lines and informal transport/paratransit (such as *Angkot* and *Becak*). Promoting better paratransit would be a more reasonable action in order to reduce private vehicle domination. It is widely suggested that the lack of quality in public transport (including paratransit) is one of the main reasons people tend to choose the motorcycle. In this study, we are interested in investigating motorcycle riders' perception of paratransit *Angkot*'s aspects of service. By comparing riders' motivation to use motorcycle and their perception of *Angkot* service, we propose a better understanding to improve paratransit *Angkot* in the immediate future.

Based on our survey, riders' motivation to use motorcycle accords with their perception of *Angkot* service in one aspect in particular, which is time efficiency. The amount of wasted time and longer travel time using *Angkot* is too unfavorable for motorcycle riders. Moreover, the state of comfort and cleanliness of *Angkot* is poorly regarded by the riders. Lack of daily maintenance by the driver/operator leads to such an improper condition. An indication of future car purchase intention also emerged in the survey. This was denoted by riders' motivation to use the motorcycle in relation to being unable to purchase or drive a car. One of the most systemic strategies to improve *Angkot*'s image is to solve the issue of how to ensure a more seamless and comfortable trip using *Angkot*. The next mass transportation system in Medan should take many years in the future before fully operable. There is a dire need for collaboration and commitment between the local government and operator in order to promote and sustain the current paratransit *Angkot* in Medan. Otherwise, merely waiting for a mass transportation system would be disastrous for the future of mobility in Medan.

7. Acknowledgement

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