The quality of information desired by paratransit users in Medan, Indonesia

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Abstract. In many developing cities, like Medan, the state of public transportation is considered inadequate and limited to paratransit, locally known as ‘angkot.’ While advanced mass transit systems are still far in the future, improving the paratransit is arguably the most plausible supporting solution at the moment. Paratransit users in Medan have reported to our study that reliability is one of their sources of disappointment. Technological development nowadays should ease the problem through the quality of real-time information provision. In this preliminary study, we conducted surveys to explore users’ perspective and desire for transit information services. Questionnaire responses from 350 tech-savvy users were collected from several centers of activity and terminals. It is as expected that most respondents experienced uncertainty using the current paratransit, and acknowledged the importance of having information services. Further result shows the user’s high expectancy towards information related to fleet location and arriving time estimation. In general, users were willing to use information services if provided regardless of the additional costs. This preliminary study gives a meaningful view of the opportunity to improve public likeness to this local paratransit service. This research is part of research on perception and preference of paratransit user on real-time information provision.

1. Introduction

Urban mobility in major Asian developing cities has been dominated by private car and motorcycle. The lack of adequate public transport services is widely known as the primary cause, both in terms of available networks and provided facilities. In most developing countries, the city’s public transportation is commonly limited to paratransit.[1] It provides services as daily transportation mode inside the city. However by definition, paratransit normally have no fixed schedule, stops, or even route. In Asia, paratransit is usually operated by private sectors and perform under an affordable fare. Some Asian countries like Indonesia and India still have a non-motorized type of paratransit, either pulled by human or animal. Having had numerous limitations, it has gradually been losing popularity among urban citizen.[2] Among many types of paratransit in Indonesia, our focus aimed at the motorized type of paratransit operating in Medan, North Sumatera, specifically the four-wheeler/minibus locally known as Angkot.

Medan is the capital city of North Sumatera province, and located on the eastern side near the Malacca Strait. It is home for over 2.2 million people, sprawled on a 265 km² of area. Despite being one of the biggest and major cities in Indonesia, Medan has yet possessed a good and sustainable
transportation system. Department of Transportation of Medan reported that more than 80% of daily trip were made on private vehicle such as motorcycle. Indonesian Bureau of Statistics also recorded that private vehicle ownership is growing in Medan, as well as population. Citizen in Medan rely on becak (rickshaw), Angkot (minibus), taxis and the fast-growing ridesharing platform as their mode of transportation other than private vehicle. Recently, Government of Medan released a news statement that according to their study, Medan would potentially suffer a total gridlock by 2024. Several rail-based mass transit projects are in preparation in order to prevent such threat. While it is inevitable to start investing in rail-based mass transit, it is illogical to think that such gigantic project will be ready in a few years to accommodate the immediate mobility demand in Medan. On the other hand, it is highly more advisable to improve the current public transportation services at the same time.[3]

Angkot is a four-wheeler minibus mode of transport, which can carry 14 passengers in full capacity. In terms of economic cost and accessibility, Angkot is arguably the best alternative among available paratransit and even compared to the ridesharing platform. Angkot network comprises of hundreds of line that cover extensive area in Medan. There are approximately 170 lines, and around 6000 fleets of Angkot available in Medan according to Department of Transportation. The fare is based on distance travelled, rather flexible (rough calculation), but in general it is extremely affordable.[4] It is an important characteristic since travellers in Medan weigh affordability the most in choosing mode of transportation.[5] However, its service quality and user experience are horrible and thus lower public willingness to use. In addition, the augmentation of private vehicle ownership directly affects the popularity of Angkot, which also causes significant decrease in its occupancy. Angkot in Medan is still operated by private sectors, which is one of the main hindrances to improve its service quality.

In 2016, we conducted a study to explore how motorcycle riders perceive Angkot as public transport in Medan. The survey included responses from more than 400 daily commuters who ride motorcycle, and aimed to identify motorcycle riders’ reasoning of not using Angkot for their daily commute. The result shows that motorcycle riders find reliability as one of the sources of disappointment in Angkot service. Reliability was defined as the uncertainty caused by not having any knowledge of when the next Angkot fleet will arrive, or whether there still is any fleet serves at some particular late hours of the day. Lubis et al. in 2005 found a similar result regarding the lack of reliability.[6] Similar study of ours in 2018 confirmed the same opinion as students in Medan think that there needs to be an improvement in certainty when using Angkot.[4] Urban travelers and commuters hate uncertainties, especially if it is time-related.[7][8].

The idea we are proposing was that it is necessary to enhance the operation and to optimize the utilization of Angkot as part of the public transportation system in Medan in accordance with government long-term urban mobility plan. Improving reliability would be one of the strategic steps in doing so. One of the widely known alternatives to satisfy this objective was providing real-time information for Angkot user.[9] The implementation of such technological advancement has been used extensively in the world to help making public transportation services better. Gooze et. al. found that real-time information improves travelers experience. Furthermore, it ameliorates public transportation images, which will most likely increase ridership in the future.[10][11][12]

2. Public Transport Information System
Information about public transportation is an integral part of its operation and services. Such information helps travellers to prepare and plan their trip better, especially for trips that require a transfer.[13] The most traditional public transport information system for passengers is promotional brochure, leaflet, and city route map. Technological advancement has shifted the way of thinking from these traditional modes of information to a more relatable system in the form of real-time information (RTI). Urban traveler requires greater and more attractive information that are ready anytime they need it.[14]

Real-Time Information (RTI) can be provided to public transport passenger using various facilities, such as online websites, information screen at-stop/on-fleet, screen on public places, and internet-based mobile applications. Online website such as Google Maps is one of the best examples of a real-
time information system, by which people can access real-time traffic and also alternatives for using public transportation to reach their destination.

Major benefits of implementing RTI are a decrease in waiting time, an increase in satisfaction, an increase in ridership, and an increase in personal security.[15] The most positive effect of RTI is the decrease in waiting time. By having the knowledge about when the next fleet arrives, it allows users to delay or hustle their departure to the waiting spot, and thus reduce their actual waiting time. Furthermore, satisfaction improvement is practically the product of reduced waiting time. Not only the actual waiting time, RTI has also been found affecting perceived waiting time of users.[16]

BRT system Transjakarta in the capital of Indonesia and Trans Semarang in Semarang city utilize information screen in some of their bus stops to give passengers the knowledge of how long they need to wait for another bus. The information is accessible in real-time, placed on the strategic spot, and easy to read. These aforementioned examples of RTI are mutually implemented in an established public transport system. However, there has been so little attention on enhancing the same service to paratransit. A fairly closer comparison would be shuttle services. It was found that RTI improves the feeling of security and level of satisfaction among shuttle user. Although, the effect lasted for short-term only.[17]

An example of paratransit RTI can be found in Bandung city. Research Center for Information and Communication Technology at Institut Teknologi Bandung (ITB) has collaborated with the government of Bandung city on developing an attractive mobile application that allows passengers to access information related to Angkot in real-time. The Android-based application called SemutApp is freely distributed in Google Playstore. One type of available information in the App that passengers can access in real-time is the location of the Angkot fleet. The apps also incorporated social sharing and gamification to enhance user experience while using the apps.

3. Research Questions and Methodology
Investing in an improvement of the public transportation information system requires a large amount of resources, not only time but also money.[18] It is crucial to carefully plan for such future improvement in order to minimize the risk of a waste of investment occurred. Therefore, we are interested in exploring paratransit (Angkot) user’s perception and preference for RTI when it made available. As part of such objective in this preliminary study, we were focusing on identifying what sorts of information that paratransit user needs to improve their travel experience. Several questions that follow are: What are their opinions pertaining to uncertainties in current paratransit operation? In what form do they want to access RTI to help their travel experience? Would they be willing to pay a more expensive fare for RTI service? How does providing RTI affect their intention to use paratransit more in the future?

An intercept interview survey was used to collect the user’s perception regarding real-time information needs. Respondents were approached and interviewed in several centers of activity while they were waiting for Angkot to arrive, and some other respondents were interviewed inside Angkot while making their trip to the destination. Intercept survey method was chosen to ascertain whether the person being approached belongs to the population interest. Our population in particular was users who are familiar and have some experience with at least mobile applications and other technological terms. This was to ensure that our respondents actually understood our object of interest, and thus, we could minimize compromised/unrelated answers. Survey location was focused on centers of activity that are served by a couple of Angkot existing lines, and also at several terminals in Medan. We distributed and managed to receive usable responses from 350 Angkot paratransit users. Incomplete questionnaires were omitted beforehand.

The questionnaire comprises of three sections. Firstly, respondents are asked to provide their general socioeconomic identity such as age, income, and occupation, etc. Secondly, respondents are asked to answer questions related to their typical trip characteristics using Angkot. Lastly, we asked respondents to give their opinion regarding their travel experience with Angkot specifically in terms of
4. Results and Discussions
The survey results are divided into three sections. The first section displays the summary of socioeconomic status and typical trip characteristic of the respondents. Secondly, the respondents’ travel experience is presented. Lastly, we show the distribution of respondent’s opinion regarding travel experience and future intention.

4.1. Socioeconomic Status and Trip Characteristic
The summary of this section is presented in Table 1. There were slightly more female (43.1%) respondents than male (56.9%) who completed the survey. The majority of our respondents (60%) were aged between 18 to 35 years old. The age group with the least respondents was between 50 to 65 years old. In fact, we even provided another age group (over 65 years old) tick box as we expected there might be elders who still use this paratransit. However, we hardly found respondents older than 65 and most elderly users did not satisfy our requirement of being tech-savvy.

| Socioeconomic Characteristic | N   | Percentage |
|-----------------------------|-----|------------|
| Gender                      |     |            |
| Male                        | 151 | 43.1%      |
| Female                      | 199 | 56.9%      |
| Total                       | 350 |            |
| Age Group (years old)       |     |            |
| < 17                        | 39  | 11.1%      |
| 18 - 25                     | 110 | 31.4%      |
| 26 - 35                     | 100 | 28.6%      |
| 36 - 50                     | 87  | 24.9%      |
| 50 - 65                     | 14  | 4.0%       |
| Occupation                  |     |            |
| Student                     | 118 | 33.7%      |
| Civil Servant               | 31  | 8.9%       |
| White Collar                | 77  | 22.0%      |
| Blue Collar                 | 39  | 11.1%      |
| Businessman/Entrepreneur     | 57  | 16.3%      |
| Other                       | 28  | 8.0%       |
| Income (million Rupiah)     |     |            |
| < 1                         | 120 | 34.3%      |
| 1 - 2.5                     | 118 | 33.7%      |
| 2.5 - 5                     | 105 | 30.0%      |
| > 5                         | 7   | 2.0%       |
| Car Ownership               |     |            |
| None                        | 271 | 77.4%      |
| One                         | 67  | 19.1%      |
| More than one               | 12  | 3.4%       |
| Motorcycle Ownership        |     |            |
| None                        | 237 | 67.7%      |
| One                         | 101 | 28.9%      |
| More than one               | 12  | 3.4%       |

In terms of occupation, the majority of our respondents (33.7%) were students, ranging from Junior High to University students. Other occupation categories were dominantly housewives but also ranging from soldier to clergy. Our respondents primarily belonged to three of the income groups: below 1 million Rupiah (34.3%), between 1-2.5 million Rupiah (33.7%), and between 2.5-5 million Rupiah (30%). Most respondents whose income under 1 million Rupiah were students. For students, we defined income as their monthly allowance given by their parents. As we can see, paratransit user uncertainties, and also their willingness for such information facility in the future. Answers for questions related to opinion were stated in a 5-level Likert Scale.
in Medan normally has mid-level of income (between 1 to 5 million Rupiah), whereas the higher level of income would much prefer to use other modes.

It was previously mentioned that citizen in Medan primarily choose their mode of transport based on their ability to pay. More than 65% of respondents have no private motorcycle, and more than 75% have no private car. It is understandable that having one of these private vehicles would be too costly for them. Furthermore, approximately 30% of the respondents apparently possessed one or more private vehicle in their home. We can compare this number to information collected in Table 2. Almost 30% of the respondents were not paratransit (Angkot) daily and frequent user.

In Table 2, we can see that the majority of the respondents (61.1%) normally make their trip inside the city using Angkot whereas the other (29.4%) use private vehicle. In terms of intensity, daily-user (41.4%) was defined as Angkot users who use it every day of the week, and more than twice per day. Non-daily users (17.1%) were those who always use Angkot but not on a daily basis, mainly because their work or business did not require them to travel daily. Lastly, occasional users (41.4%) were those who use Angkot only on the unplanned or routine trip. Those who dominantly use private vehicle fall under this category.

| Trip Characteristic | N  | Percentage |
|---------------------|----|------------|
| Dominant Mode of Travel |    |            |
| Angkot              | 214| 61.1%      |
| 50 - 50             | 33 | 9.4%       |
| Private Vehicle     | 103| 29.4%      |
| Level of Intensity  |    |            |
| Daily User          | 145| 41.4%      |
| Non-Daily User      | 60 | 17.1%      |
| Occasional User     | 145| 41.4%      |
| Typical Trip Purpose|    |            |
| School Trip         | 112| 32.0%      |
| Working             | 129| 36.9%      |
| Business/Trading    | 31 | 8.9%       |
| Shopping            | 65 | 18.6%      |
| Other               | 13 | 3.7%       |
| Travel Distance     |    |            |
| < 500m              | 19 | 5.4%       |
| 500 - 1km           | 60 | 17.2%      |
| 1 - 5km             | 162| 46.3%      |
| > 5km               | 109| 31.1%      |

People who normally use Angkot for worktrip, and school purpose were 36.9% and 32% respectively. For business, and shopping purpose were 8.9% and 18.6%, respectively. Other trip purposes were varied, ranging from a social visit to recreation. Only a few of the trip (5.4%) by Angkot user made for a very short distance (under 500m). Most of the respondents (46.3%) reported that they typically travel for 1-5 km using Angkot. The other majority (31.1%) of the respondents usually travel for more than 5 km, to which we asked further questions regarding their origin and destination. Most respondents who travel for such distance using Angkot stated that they live around suburban, and thus required them to travel farther to reach their working place, school/university, or malls.

4.2. Passengers Experience with Current Angkot Services
In this study, we are specifically interested in identifying uncertainties regarding these two operational characteristics, namely: availability of seats and off-vehicle waiting time. Availability of seats or crowding information is influential for the user so that they can make better travel decision.[19]
However, another practice found that apparently it did not significantly change user’s travel decision.[20]. The mutual finding was that it still helped improving the positive image of public transportation. Respondents were asked to tell their experience about how long they usually need to wait before the next Angkot fleet arrives for them. They were also asked to tell their experience pertaining to how often they were unable to find any available seats in the arriving fleet after already waiting for some time. The finding shows that the majority of respondents (over 60%) experienced difficulties in finding seats after waiting for Angkot fleet for some time. It is considered as one source of dissatisfaction as users sometimes needed to wait for the next fleet to arrive.

Since Angkot in Medan has no dedicated stops, users are required to wait for the fleet on the sidewalk, or on the road shoulder. Majority of the respondents (30.3%) agreed that they normally experience 8 to 15 minutes waiting time, and another 23.1% stated that they even experience more than 15 minutes waiting for the next Angkot fleet. There are only less than 30% of the respondents that experience quite shorter waiting time. However, it is possible that the user’s perceived waiting time was overestimated mainly due to impatience and inconveniency during the wait. Two sources that could form this perceived waiting time are past experiences and prior knowledge.[21] Therefore, there is a possibility that users, in this case, exaggerated the duration. Despite that, we decided to categorize the numerical value to more general diction with comparative adverbs, such as very long, quite long, very short, and so on.

As we can see in Figure 1 the respondents who think that the uncertainty with available seats is extremely bad and uncertain, and those who think that the uncertainty with waiting time is very long / quite long are 62% and 53.4% respectively. The former was greater most probably because the paratransit users often found themselves in cases where after waiting for quite some time the Angkot fleet finally arrives but there is no seat for them. It could be described as an accumulation of disgruntlement.

![Figure 1. User’s travel experience with current angkot.](image)

Respondents were asked for their opinion regarding the importance of having this information: number of seats available in the next fleet, the arrival time of the next fleet, location of the next fleet. The result indicates that the majority of the respondents think that information about arrival time (48.6%) and seats (50%) are very important for them. We can see that 82.9% of the respondents think it is ‘important’ to have knowledge about whether there will be any available seats for them or not. If compared to information about fleet arrival time (79.7%), this indicates that users feel the former information as more valuable. Given the result in Figure 1, it is understandable.

In Figure 2, we can see the importance rating comparison between fleet arrival time and location. The objective of these two types of information is mutual. It is in our intention to identify how paratransit users assess their waiting time more conveniently. It can be seen that users value arrival
time information more than the location. It is most likely because waiting time still feel less certain even though users know where the next fleet is.

This preference for choosing information can be compared to driving a car with the help of Google Maps. As we start driving to our destination the software informs us two things namely 1) our distance to location 2) estimated travel time to reach that same destination. While distance-to-destination is not going to vary any time of the day, travel time will most likely do based on the traffic at that particular time. Therefore, travel time would provide more relatable information than mere location.

![Figure 2. Importance ratings of different kind of information](image)

4.3. Passenger Needs for Information Service

Respondents were asked to choose and/or name their desired real-time information (RTI) to be provided should there be any future improvement. We provided several information characteristics to choose based on the literature review of worldwide practice. It is found that there are five types of real-time information most commonly provided by public transport operator, namely: 1) travel time estimation 2) route/line traffic information 3) number of occupying passengers 4) fleet location 5) fleet arrival time estimation.[16][22][23][24]

![Figure 3. Type of information desired by paratransit user](image)

![Figure 4. Mode of information desired by paratransit user](image)
Figure 3 shows how the user’s choice for information varies. It can be seen that information about fleet arrival time estimation in real-time is the most popular one (35%). On the other hand, it seems that dissatisfaction and importance are not necessarily correlated with information preference. We can see that only 25% of the respondents choose the information about number of occupying passenger inside Angkot fleet. This is rather unexpected as the result in Figure 1 and 2 indicated that users would more likely choose the information about available seats. It is possible that different wording (available seats vs. occupying passengers) in the question might cause different perception in respondents understanding.

Providing this fleet information in practice would require vast amount of investment, especially for data collection. The initial part of consideration would be the physical infrastructure. Fleet location, speed, and estimated time are commonly tracked by GPS, which is installed inside the fleet. Meanwhile, number of occupying passengers can be recorded using a camera, which is also installed inside the fleet. Another part of concern should be the technological design: programming, etc.

In relation to their choice of information, we gave the respondents further question regarding their desired mode of information. As we previously mentioned in section 2, the most commonly utilized modes of information are website page, information brochure/leaflet, information screen, short message service, and mobile applications. Prior to choosing, we provided the respondents with explanations about each of these modes. For instance, information screen means dedicated screen placed on the sidewalk at certain road spot all-around the city where Angkot passes. It is crucial to convey the definition of these modes to respondents because the characteristic of paratransit is quite different from the general public transport, especially the non-existence of dedicated stops.

Figure 4 presented the most popular mode that is desired by paratransit users. The majority of the respondents (57%) choose to be able to access real-time information through their smartphone application. The second most popular choice was information screen (25%). Practically, installing such screen all around the city would be very demanding. However given other choice of mode of information, it is expected that paratransit users would choose this alternative. In fact, SMS will most likely add more cost to them since users will have to pay mobile charge to ask for information. Website page is easily accessible anywhere as long as there is an Internet connection. However, users probably expect simpler way to access real-time information.

4.4. Additional Costs for Information Service

Hypothetically speaking, suppose the RTI services were provided, it is likely that there will be additional cost to paratransit user. It could be an increase to the current fare, or additional charge outside the paratransit such as data / phone and application subscription charge. Therefore, we asked respondents for their perception should this RTI scenario be implemented in the future. The result is presented in Table 1.

Based on the result (83.7%), it is fair to say that paying more in the future would not be a problem for the paratransit users in order to access the aforementioned real-time information. However as expected, most of the respondents are willing to pay only for small additional cost (500-1500 Rupiah). Some of the respondents even asked for ‘Free’ in the multiple choice set. For those respondents who chose 2500 Rupiah, we asked further to find out the maximum cost they are willing to pay. All 4.6% acknowledge that they are willing to pay for any additional cost. Public transport must be affordable, and therefore any improvement should not cause unreasonable burden for the users.

Khattak et. al. research found corresponding result that people are willing to pay for improved information, but suggested that the process of gaining this information is cost-sensitive.[25] In relation to this finding, paratransit user might not use it in the future if the service were too costly. Therefore, it is essential to investigate the suitable fare and cost that minimally burden users’ ability to pay.

Respondents were eventually asked how the provision of this RTI affects their intention to use in the future. Majority of our respondents (65.4%) responded positively to the provision should it be implemented. This number is only slightly higher than the percentage of respondents who were already Angkot loyal user (61%), which implies only a few of non-frequent user stated that they would
be more attracted to use Angkot. On this basis, it is fair to question whether the improvement in this aspect of Angkot operation would most likely improve ridership in the future. It is possible that these non-frequent users do not think RTI provision will significantly improve their travel experience, and that there are other service attributes in this paratransit that need more attention. Eboli et. al. found that among several service quality attributes associated with public transportation system, information provision had the lowest willingness to pay (WTP) value.[26]

### Table 3. Future attitudes toward RTI provision.

| Future Attitude                                      | N   | Percentage |
|------------------------------------------------------|-----|------------|
| Are you willing to pay for this additional information service? |     |            |
| Yes                                                  | 293 | 83.7%      |
| No                                                   | 57  | 16.3%      |
| Total:                                               | 350 |            |
| Amount of additional cost you are willing to pay (Rupiah) |     |            |
| 500                                                  | 140 | 40.0%      |
| 1000                                                 | 93  | 26.6%      |
| 1500                                                 | 19  | 5.4%       |
| 2000                                                 | 82  | 23.4%      |
| 2500                                                 | 16  | 4.6%       |
| Total:                                               | 350 |            |
| Do you think this service will improve your intention to use Angkot more frequently in the future? |     |            |
| Very Much                                            | 229 | 65.4%      |
| Fairly                                               | 97  | 27.7%      |
| Slightly                                             | 12  | 3.4%       |
| Indifferent                                          | 12  | 3.4%       |
| Not at all                                           | 0   | 0.0%       |

Past researches suggested that real-time information provision increased ridership because it improves the travel experience.[27] These studies were mostly conducted on an established and more advanced public transportation system such as rail-based Mass Transit system or Bus Rapid Transit system, which possibly generate different behavior from the user. Nevertheless, it is fair to believe that the major benefit from RTI provision would be an increase in ridership.[15]

### 5. Conclusions and Further Research

In this study, we looked at potential paratransit (Angkot) reliability improvement in order to increase its attractiveness. Providing real-time information (RTI) is widely known to satisfy that objective. The end goal of this research is to provide basis for future policy and implementation strategy regarding RTI. Therefore in this preliminary study, we were interested in exploring what kind of real-time information paratransit user needs, and what mode of information they desire to utilize to access that information. It was presented that, as expected by related study [22], paratransit user in Medan experienced uncertainties in terms of having able to sit or having to wait for how long. They think that real-time information such as available seats, fleet location, and fleet arrival time are desirable, and that they would like RTI to be part of the improvement in the future. The finding of this study exhibits three of the most desirable information about Angkot. Should there be future RTI implementation plan, the corresponding result could be considered as the starting point.

Providing these information should alleviate uncertainties problem that Angkot user has experienced. It is also expected that this improvement should result in a decrease of waiting time. [15][16][21] Since it has been found that waiting time weighs heavily on public transportation usage [8], a certain provision of information would imply an increase in public transportation attractiveness.

There were five most commonly provided RTI, among which fleet arrival time is the most desirable information for the paratransit user. It was further reported that Mobile Apps is the best mode of information for the user to access RTI. Other alternatives were information screen and short
message service. Paratransit users were willing to pay the additional cost if applied for information, ranging from 500 to 1500 Rupiah. Lastly, the user stated that information provision would most likely improve their willingness to use Angkot more frequently in the future. The finding shows that an implementation of real-time information on Angkot would better be focused on one mode of information, which is Mobile Applications.

This study is part of our research in user perception and preference toward RTI implementation to Angkot in Medan. Based on the underlying information we obtained from this study, it is important to investigate how paratransit will respond to different scenarios of information-provision in order to plan for the most operationally and economically plausible RTI system for Angkot. Several attributes such as additional cost, reduction in waiting time, and satisfaction would be the main inclusion in the further choice analysis.

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