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Public Perception and Preferences on the Bus Service Performance to Encourage Ridership and Shift from Private Vehicle Use

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ABSTRACT

The use of private vehicles can have many negative impacts on various aspects of life. Therefore, the government, as a public service provider, has tried to provide bus-based public transportation services. However, the growth in the number of private vehicles each year continues to increase, while the number of passengers using bus transportation is far below the targeted load factor. This study aims to: 1) assess the perceptions of private vehicle users on the performance of existing bus transportation services; 2) analyze bus service attributes that influence public's desire to switch from using private vehicles, and 3) examine user preferences for using bus as the main mode of transport for their daily mobility. Data collection was carried out using questionnaires distributed to 270 samples of people who live in the districts served by the bus route. The analysis techniques used were descriptive statistics, descriptive qualitative, content analysis, and quantitative analysis. The results showed: 1) the perception of private vehicle users on the performance of existing bus transportation services is dominated by positive comments and responses; 2) bus service attributes that influence public's desire to switch from using private vehicles, namely fare affordability, maintenance of bus stops and buses, and operating hours while the attribute with the smallest influence is the payment system; 3) User preferences for bus transportation services are in the form of security types, media types, and operating hours show compatibility with existing services. For walking and cycling distances, respondents chose <100 meters for walking and <500 meters for cycling; besides that, the majority of respondents prefer fares below current prices and feel comfortable with cash payment methods.

1. INTRODUCTION

Every individual needs to travel due to the demands to meet the needs that require a person to travel and choose the mode to be used. According to Tamin [1], there are two options to do a trip, namely on foot and by using a vehicle. The use of vehicles is also divided into private vehicles or public transportation. Most Indonesian people prefer to use private vehicles in their activities. A study conducted by Affandi and Parikesit [2] in Jakarta showed that convenience, freedom, cost, speed, and pleasure are some of the factors that are the main considerations so that people prefer private vehicles.

Not only in Jakarta, but also the people of Makassar City tend to rely on private vehicles. According to data from South Sulawesi Central Bureau of Statistics [3], the number of two-wheeled and four-wheeled vehicles at the end of 2021 reached 1,634,852 units, with an annual increase of 3%. This rise in private vehicle usage can have negative impacts across various aspects. In addition to causing congestion [4], accidents, and noise [5], the combustion gases from vehicles are a source of pollution that not only affects physical and mental health but also harms the environment and economy [6]. Moreover, the predicted loss due to traffic congestion in Makassar is about 21 billion per day. Based on the number of registered vehicles within the Makassar administrative area, each vehicle contributes equal to IDR 3,800,000 every day [7]. The number is significantly higher than the average income of regional minimum wage. Therefore, the use of private vehicles needs to be reduced so that the negative impacts of the transportation sector can also be reduced. One of the best alternatives in overcoming this problem is by maximizing public transportation services. In 2021, the Indonesian Ministry of Transportation introduced the TEMAN Bus program under the name Trans Mamminasata [8], which is present as a step to fulfill the need for public transportation services in accordance with Government Regulation of the Republic of Indonesia No. 30 of 2021. The program is expected to attract private vehicle users to switch to mass transportation [9].

However, since the introduction in 2021, the number of users has been below the targeted load factor. This can be seen from the results of the performance evaluation of the number of Trans Mamminasata service passengers conducted by ITDP [10], which shows that the highest number of passengers served per bus per day is only 104. This value does not meet

the service standards for medium-sized buses, which should load 500-600 passengers for each bus per day. In addition, based on data from South Sulawesi Provincial Transportation Office [11], the highest load factor value of Trans Mamminasata throughout 2023 was 65.24% and did not meet the standard load factor value of 70%.

Therefore, a more in-depth study is required to assess the level of demand and people's interest in using public transport. Understanding public perceptions and preferences, as well as identifying the factors that influence their decision to use public transport, is crucial to avoid mismatches between policies and expectations. Such mismatches often arise from differing perceptions between authorities and the public, who are the users of these services [12]. This study aims to: 1) assess private vehicle users' perceptions of the performance of existing bus transit services; 2) analyze the bus service attributes that influence people's willingness to switch from private vehicles; and 3) examine user preferences for using bus as the main mode of transport for their daily mobility.

2. LITERATURE REVIEW

One of the initial steps that can effectively be taken to overcome the rampant use of private vehicles and mitigate the negative impacts briefly discussed in the introduction is by reducing private vehicle ownership itself. However, due to the variety and complexity of factors (socioeconomic, perception and attitude, and access) that influence this decision, this strategy is not easy to implement [13]. Therefore, reducing dependence on private vehicles by encouraging the transition to using public transportation can be a strategic solution [14]. Understanding the main factors behind a person's intention to use a private vehicle in relation to public transportation is an important element in this process [15]. External factors that determine a person's decision to use private vehicles include socio-demographics [16, 17], infrastructure [18], quality of the transportation system [19-21], economic incentives/ disincentives [22], and legislation [17]. In addition, preferences and travel characteristics are also key factors that underline a person's choice of the mode to be used [23]. However, Macea et al. [22] states that internal factors such as attitudes and perceptions have a significant impact on decision making. Currently, the opinions of private vehicle users as potential users of public transportation are not adequately considered, and this can be seen from a number of studies on the quality of public transportation that only focus on the perceptions of the transportation users themselves. The foundation for forming a strategy to attract private vehicle users to switch involves analyzing the perception and impact of public transportation services on the level of satisfaction of private vehicle users [24]. These statements are the reasons to conduct a study with a perception and preference approach. Several studies with similar objectives have been conducted in previous years. Arnaya et al. [25] categorized the main factors in choosing a mode of transportation into two, namely cost and quality, emphasizing that in forming a strategy to attract people to switch from using private vehicles, it is necessary to improve the quality factor (time, safety, accessibility, security, reliability, comfort, and cleanliness). Research conducted by Al-Msari et al. [26] in Kuala Lumpur City aimed to determine the factors that can influence the desires of private vehicle users and showed results (fast service, route accessibility, comfort, and cheap fares) like previous studies. Using the Theory of Planned Behavior (TPB) approach as a theoretical basis, Devika and Harikrishna [27] revealed that travel time and comfort are significant factors in driving the transition process. Furthermore, in a study conducted on five major cities in Europe using Ordinal Logit Models (OLM), de Oña et al. [24] identified two groups of public transportation service attributes that were considered essential by private vehicle users. The first group consists of frequency, punctuality, intermodality, cost, and cleanliness, while the second group consists of service hours, proximity of stops to the origin or destination of the trip, speed, temperature, and safety. Another study conducted by de Oña [28] compared the perceptions of private vehicle users in the cities of Madrid and Lisbon regarding the five most important service attributes and showed that both cities had the same opinion on four attributes (punctuality, frequency, information, and intermodality). For one other attribute, Madrid residents chose speed while Lisbon residents prioritized service hours.

Although there have been studies conducted to analyze the point of view of private vehicle users on bus transportation service attributes, the author still identifies several gaps. The indicators or attributes used, such as comfort, reliability, and time, remain general and macro. Furthermore, most previous studies were conducted in large cities in developed countries with good transportation systems. Meanwhile, the city to study has a transportation system with less-than-optimal performance, as it still faces issues related to the number of passengers. Thus, the study will be conducted by analyzing perceptions and preferences for several more specific bus transportation service performance attributes, aiming to produce findings that can serve as a basis for formulating practical strategies to increase public interest in switching to bus transportation. Due to the lack of perspective from the general population regarding their preferences on using public transport services, this research employs combined qualitative and quantitative approaches to gain a deeper understanding of the unwillingness to use the public transportation service.

3. METHODS

This study is conducted in Makassar city. Makassar is the capital of South Sulawesi Province, in Indonesia. Besides, Makassar is the primary city of Mamminasata agglomerated area that consists of four cities/regencies, i.e., Makassar, Maros, Sungguminasa, and Takalar. The population in this study is all residents who live in the 19 sub-districts served by the Trans Mamminasata bus in Corridor 2 within radius of 500m in Makassar city (Figure 1). The district is in the suburban area of Makassar. The total population is 281,173 people. Sample determination is using simple random sampling with 10% margin of error. Based on the Isaac and Michael table, the number of samples based on the mentioned population number is 270 people. Despite the 10% potential bias, considering the case study location and the bus’s route service area, the number of samples is sufficient to examine preferences and perceptions for further quantitative and qualitative analysis.

The data collection technique involved using a semi-open questionnaire distributed randomly within housing clusters in the study locations. Additional criteria were included to find suitable respondents, i.e., respondents who have experience using the bus service before. A Likert scale was used to assess the influence of service attributes on respondents' willingness

to switch to bus transportation. The scale consisted of four alternative responses: 4 = very influential, 3 = influential, 2 = very little effect, and 1 = no effect. The analysis techniques applied include descriptive statistics, descriptive qualitative analysis, and content analysis, used to categorize private vehicle users' perceptions of the existing bus transit services. Additionally, the Statistical Package for the Social Sciences (SPSS) was used to calculate the mean and standard deviation from the Likert scale questionnaire scoring.

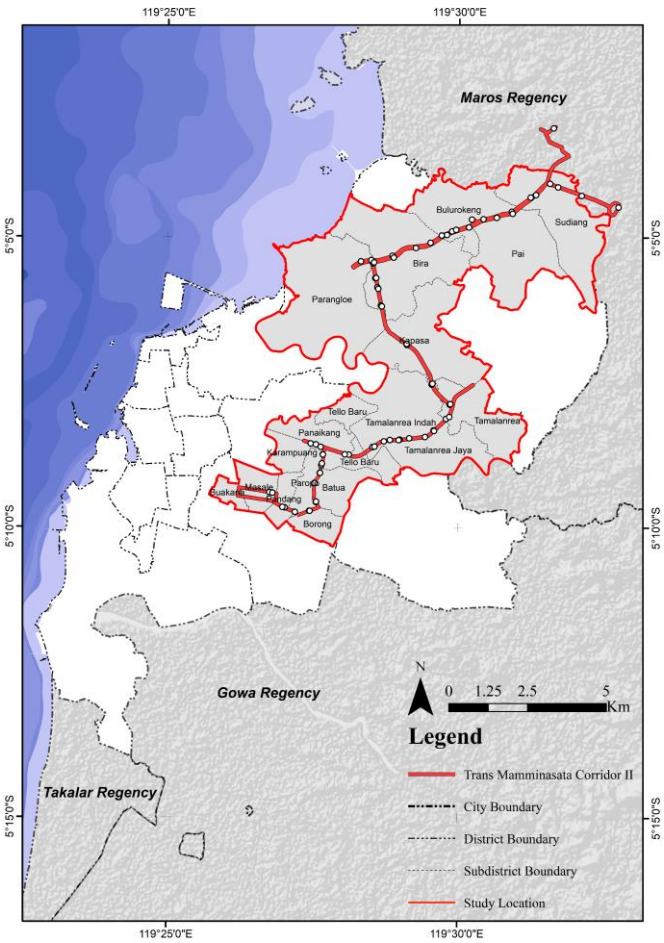

Figure 1. Map study location

4. RESULTS AND DISCUSSION

Before completing the questionnaire on perceptions and preferences for public transport services, respondents were asked about their current willingness to switch from private vehicle use to bus transport. The survey results show that 55% of respondents have the desire to switch while the rest do not (Figure 2). The high willingness to switch to public transport is in contrast with the number of users using the bus service after two years of implementation. Despite the gradually increased number of users, the numbers remain below the targeted load factor.

4.1 Characteristics of respondents

Based on the research sample, the characteristics of the respondents are described as follows: 71% of respondents were female and 29% were male. Respondents in the age range of 17-25 years have the highest percentage, which is 46%. The respondents' educational background shows that 57% of the respondents are high school/vocational/high school graduates. The data show that most respondents are students. These are groups that mainly use private vehicles for their daily activity. In Indonesia, a significant number of traffic accidents involve young people. Nationally, the implementation of the bus service contributes to reducing the number of traffic accidents caused by younger people.

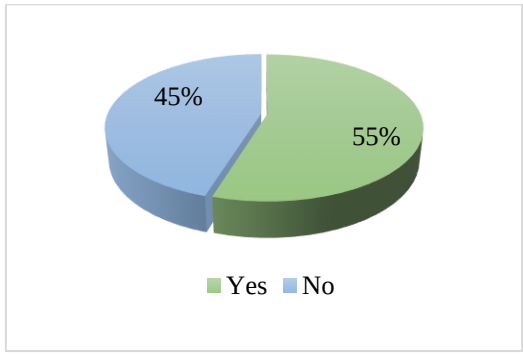

Figure 2. Desire to switch to bus transportation

Based on income levels, most respondents have an income of <IDR 1,500,000, with a family size percentage of 21% having >5 family members. Of the total respondents, only 20% own a motorized vehicle in the form of a car, inversely proportional to motorcycle ownership, with a total percentage of 99%. Detailed respondent characteristics can be seen in Table 1. Data shows that a high percentage of respondents (80%) do not own private vehicles. These are the targeted users for the bus services.

More than a decade before the bus service was introduced within Makassar City, the public transport service consisted of paratransit vehicles with a capacity of 10-12 passengers. Despite their fixed routes, the service lacked a fixed schedule and designated stops. Moreover, due to the decreasing number of users in the last ten years, the owners did not have enough money to upgrade the vehicles. Most of the vehicles in operation were more than 10 years old. Therefore, due to the unreliability of the previous public transport system, most people in Makassar preferred to use private vehicles to support their daily mobility for decades. Ultimately, endless traffic congestion problems are inevitable.

Table 1. Characteristics of respondents

Demographic Characteristics		Amount (n)	Percentage (%)
Gender	Female	192	71%
	Male	78	29%
Age	17-25 years	123	46%
	26-35 years	78	29%
	36-45 years	36	13%
	46-55 years	21	8%
	≥56 years	12	4%
Last education	Elementary School (SD)	6	2%
	Junior High School/Islamic Junior High School (SMP/MTs)	13	5%
	High School/Vocational School/Islamic Senior High School (SMA/SMK/MA)	154	57%
	Strata One (S1)	76	28%
	Master/Doctor (S2/S3)	4	1%
	Diploma	17	6%

Job	Students	82	30%
	Civil Servants/TNI/POLRI	10	4%
	Private/State-Owned Enterprise Employees	48	18%
	Entrepreneur	44	16%
	Trader/Entrepreneur	26	10%
	Housewife	48	18%
	Unemployment	12	4%
Income	< IDR 1,500,000	125	46%
	IDR 1,500000-2,500,000	68	25%
	IDR 2,600,000-3,500,000	42	16%
	> IDR 3,500,000	35	13%
Family size	2	44	16%
	3	45	17%
	4	72	27%
	5	51	19%
	>5 people	58	21%
Number of private car vehicles	0 units	215	80%
	1 unit	47	17%
	2 units	8	3%
	3 units	0	0%
Number of private motor vehicles	0 units	3	1%
	1 unit	191	71%
	2 units	61	23%
	3 units	15	6%

4.2 Perception of private vehicle users toward the performance of existing transportation services

This study examines the performance of transportation services based on several factors, including service coverage, pedestrian and bicycle paths, punctuality, real-time information, supporting facilities, bus and bus stop maintenance, fare affordability, payment system, application usage, operating hours, and ease of switching modes. Respondents' perceptions are categorized into three groups: positive, negative, and neutral (with neutral responses including terms like 'don't know,' 'enough,' 'pretty good,' etc.). The following Figure 3 illustrates the percentage of each perception category, which will be further explained in the description of each service performance.

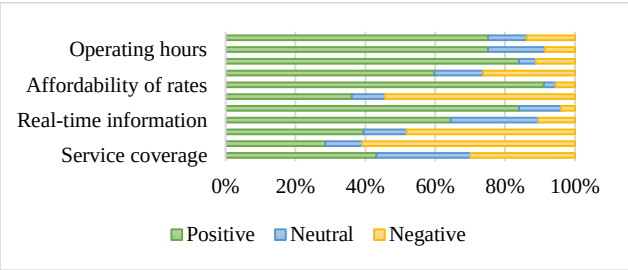

Figure 3. Percentage of perception categories

Based on Figure 3, factors that show significant negative responses are bus and bus stop maintenance, punctuality, pedestrian and bicycle paths, and service coverage. These factors are the main limitations of the current bus services. Along the routes, there is a lack of physical bus stops. Users can find the bus stop location only by looking at the provided applications (MitraDarat). The service also does not provide a timetable of the bus arrival. The headway is planned every ten minutes; however, due to the mixed traffic routes, the bus cannot always be on time. These are the main reasons for the punctuality issues. However, users can track the bus location via the application. In this case, there might be some people who lack familiarity with the provided technology, therefore, some users might find it difficult to use the service. In addition, most of the clusters around the bus routes do not have appropriate walking and cycling infrastructure. The service coverage of the bus is also limited. This should be addressed for future policy and development to increase ridership and attract more people to switch from private vehicles to mass transit.

4.2.1 Service coverage

Based on Figure 3, private vehicle users' perceptions of service coverage are quite varied. A positive perception is held by 43.19% of respondents, who believe that the current service coverage is good. Neutral perceptions primarily expressed as 'don't know' (26.76%). On the other hand, 30.05% of respondents expressed a negative opinion, stating that the current bus transportation services only reach certain areas of Makassar City and operate primarily on main roads. Additionally, they noted that bus stops have remained insufficient, and the routes do not pass through densely populated areas. At present, the range of bus services remains limited. Since its launch in 2021, there have been four corridors in operation. However, in early 2023, two service corridors were discontinued due to low ridership and budget constraints. Although new corridors were introduced in early 2023, they still do not cover all areas of Makassar City and Mamminasata.

The negative opinion of service coverage is reasonable and has been expected from respondents' perception. Bus service coverage cannot be fully optimized because most residential areas are in low-density regions, making it challenging to serve them effectively and efficiently with mass transit. Therefore, an integrated first/last mile service area is needed in this case. For areas within walking distance, improvement in walking infrastructure is necessary. In addition, areas with longer distances should be served by lower capacity vehicles that play a role as a feeder for mass transit in these low-density areas. This type of service has been implemented in Jakarta (Jaklingko). Electric-based vehicles for feeder service can support more sustainable transport systems.

4.2.2 Pedestrian and bicycle paths

In this service attribute, the perceptions based on Figure 3 were categorized as negative (60.95%), positive (28.57%), and neutral (10.48%). The majority of respondents indicated that there are currently no dedicated pedestrian or bicycle lanes, forcing them to share space with motorized vehicles on the roads. Additionally, respondents complained that existing pedestrian areas at certain points were inadequate, damaged, or had been repurposed as parking lots or street vendor spaces. A few respondents also mentioned that pedestrian and cycling paths are underutilized because people tend to prefer online transportation, which offers door-to-door service.

Walking and cycling infrastructure are the main elements in transit development. Many studies have found that improvement in these elements contributes to increasing transit ridership [29-31]. The lack of proper pedestrian and cycling paths also affects the ease of using public transport. Well-developed pedestrian and cycling infrastructure have the potential to increase people's interest in using public transport services from their homes as the first/last mile mode.

4.2.3 Punctuality

Figure 3 presents that in the timeliness category, the largest percentage of opinions was negative (48.25%). Respondents

explained that while there is information about operating hours, there is currently no information on bus arrivals and departures. Some also noted that bus punctuality is hindered by traffic congestion during rush hours, as buses share lanes with other vehicles in mixed traffic. Additionally, 39.47% of respondents had a positive opinion, and 12.8% had a neutral opinion. However, most respondents did not specify what they considered good or sufficient.

Currently, bus transportation services are equipped with mobile applications that allow users to track the bus's position and estimate travel time. However, to boost public interest in using public transportation, service reliability must be enhanced. Improving the clarity of departure times and bus schedules at bus stops is essential to increase user interest. Nevertheless, the fact that buses still share lanes with other modes of transportation remains a challenge in maintaining timely services.

4.2.4 Real-time information

Most respondents gave a positive opinion (64.44%), noting that real-time information via the internet makes it easier to manage schedules and reduces time spent waiting. Additionally, the widespread use of mobile phones among the public supports this convenience. However, some respondents with neutral (25.00%) and negative (10.56%) perceptions argued that not everyone owns a smartphone, and using the internet can still be difficult and impractical for some. The percentage comparison is shown in Figure 3.

This suggests that bus schedule and route information should also be made available outside of the app, such as at bus stops, on buses, and on other information boards, to reach a broader audience.

4.2.5 Supporting facilities

As shown in Figure 3, 84% of respondents had a positive perception of supporting facilities, such as Wi-Fi or charging stations, stating that these amenities enhance comfort for bus users and increase the attractiveness of bus transportation. Meanwhile, 12% of respondents held a neutral opinion, believing that these facilities were not particularly necessary. A small proportion (4%) had a negative perception, expressing concerns that the facilities might not be used appropriately by bus users. The availability of Wi-Fi services is seen as essential, as bus schedules, stop locations, and routes are typically accessed via applications that require an internet connection.

4.2.6 Maintenance of bus stops and buses

The graph in Figure 3 shows that the highest percentage of respondents (54.37%) had negative perceptions, primarily regarding the condition of bus stops. Many respondents pointed out that the bus stops are currently inadequate due to a lack of routine maintenance, and vandalism has led to missing materials. In some areas, the bus stops sign is only written on the street with no shelters. Positive perceptions (36.11%) and neutral perceptions (9.52%) were mainly directed at the condition of the buses. Currently, the bus is always clean and equipped with an air conditioner.

4.2.7 Tariff affordability

Based on Figure 3, many respondents (91.10%) had a positive perception, stating that current bus fares are cheap and affordable. A small portion of respondents (3.39%) with a neutral opinion felt the fares were reasonable, while 5.51% of respondents with a negative perception still considered the fares expensive. Currently, the bus fare is IDR 4,600 for general passengers, with lower fares for students and senior citizens at IDR 2,000. Passengers who switch corridors only need to pay once within a 1-hour and 30-minute window. Compared to the price of ride-hailing service and paratransit with the same distance, the bus fare is significantly cheaper. Affordable fares are likely to increase public interest in using public transportation. Despite the low average income of all respondents, among others, bus fares are not the features that have a negative response. Evidently, in this case, transport cost is not the main consideration in mode selection.

4.2.8 Payment system

Figure 3 shows mixed responses to the current cashless payment system. A majority of respondents (59.76%) had a positive view, finding cashless payments convenient and practical. However, 26.29% of respondents held a negative opinion, citing that the system was complicated and difficult to use. Neutral perceptions (13.94%) pointed out those elderly individuals and those unfamiliar with smartphones or apps may struggle with the process, unlike younger or tech-savvy users. To increase user interest, bus services should accommodate various payment methods. In some developed cities, passengers can purchase tickets directly on public transport. Service improvements should focus on integrating payments through a single ticketing system while still allowing for multiple payment options.

4.2.9 Application usage

Most respondents gave a positive response (83.98%) by mentioning that the use of the application can make it easier to find information about buses, while other respondents with neutral (4.76%) and negative perceptions (11.26%) thought it was difficult because not everyone understood and had a smartphone. The percentage value for more detail can be seen in Figure 3.

4.2.10 Operating hours

Based on Figure 3, the majority of respondents gave a positive opinion of 75.11% and neutral as much as 16.31% saying that the current bus transportation operating hours were very good and sufficient, there were only a few respondents with a negative response of 8.58% who thought that service hours were still lacking and needed to be added.

4.2.11 Ease of switching modes

For the performance of ease of switching modes, the categories of perceptions received are based on the graph: Positive (75.11%), negative (13.73%), and neutral (11.16%). Based on respondents' perceptions, the conditions for getting public transportation are currently still easy, especially in online transportation services (Figure 3).

Figure 4 shows the most frequent expressions across all perceptions of existing bus transit service performance. The word “make it easier” is the most frequent opinion on real time information, payment system, and app usage. The phrase “none” was mentioned most frequently on pedestrian and bicycle paths and accuracy of information. The phrase “don't know” often comes out on the range of services, the word “help” on supporting facilities, the expression “not maintained” on the maintenance of bus stops and buses, “cheap” on the affordability of fares, and “good” which often appears on the ease of switching modes.

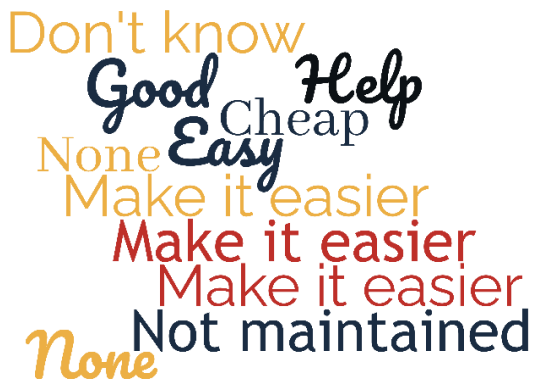

Figure 4. Words with the most frequency in each service attribute

4.3 Bus service attributes to influence people's desire to switch from using private vehicles

In Table 2, there are attributes that have been sorted based on the mean value obtained through calculations with SPSS. The greater the mean value obtained indicates the greater the influence of service attributes on the desire of private vehicle users to switch to using the bus. The top three service attributes that can have a big influence are: fare affordability, bus and bus stop maintenance, and operating hours while the attribute with the smallest influence is the payment system.

Table 2. Service attributes by influence

Service Attributes	Mean	Standard Deviation
Tariff affordability	3.59	0.638
Bus stop and bus maintenance	3.48	0.770
Operating hours	3.48	0.730
Application usage	3.46	0.764
Ease of switching modes	3.40	0.759
Punctuality	3.37	0.758
Supporting facilities	3.34	0.828
Real-time information	3.33	0.776
Service coverage	3.28	0.782
Pedestrian paths	3.18	0.821
Payment system	3.16	0.911

Based on age, the influence of fare affordability was mostly chosen by respondents with an age range of 26 to ≥56 years, as well as respondents with an income < IDR 1,500,000. This is due to differences in economic strata among everyone. Besides, those respondents revealed that cheap fares can greatly help financial problems. Considering that online transportation fares are currently quite expensive, it was also mentioned that cheap fares could increase public interest and interest in switching to using buses. Moreover, most of the respondents are people who do not own private vehicles; thus, cheaper fares are the main consideration for them. These findings show conformity with research conducted by de Oña et al. [24] and Al-Msari et al. [26] which state that cheap fares or cost factors have an influence on the desire to switch.

Maintenance of bus stops and buses is mostly chosen by respondents with the professions of self-employed, civil servants/TNI/POLRI, unemployed, and traders/entrepreneurs while in terms of income, this attribute affects respondents with an income range of IDR 1,500,000-IDR 2,500,000 and >IDR 3,500,000. Based on respondents' perceptions, the convenience factor is the main reason this attribute was chosen. Research conducted by Arnaya et al. [25] and Al-Msari et al. [26] states that convenience is one of the essential attributes for private vehicle users. To use the bus service, one must wait at a predetermined point, if the available bus stops are not maintained, people will be reluctant to use the bus.

The operating hours themselves were mostly chosen by respondents with an income of >IDR 3,500,000 and respondents with an age range of 36 - 45 years and ≥56 years. Respondents assume that each community has activities at different times, therefore service time is very influential to support the activities of many people starting from morning until late at night. Long bus service operating hours are said to be very helpful and facilitate the community in traveling. The selection of this attribute shows the results of the same study on Lisbon City residents who consider operating hours to have a major influence [28].

Students with an age range of 17-25 years old, which is the largest percentage of respondents, chose the use of applications as an influential attribute. This attribute also affects respondents with the profession of private employees. Respondents think the existence of an application that provides information about buses will greatly facilitate and help the community. Meanwhile, the low influence of the payment system is due to the cashless payment procedure which is currently not known or understood by most people, so it is considered difficult and complicated.

4.4 User preferences for bus transit services

Preferences for bus transit service attributes discussed are walking and cycling distances to bus stops, media for obtaining information, types of security at bus stops and buses, service fares, payment methods, and the start and end of service times.

Table 3 presents the analysis of preferences from private vehicle users based on direct responses in the distributed questionnaires. By gender, age, occupation, and income, respondents indicated that the most comfortable walking and cycling distances are less than 100 meters for walking and less than 0.5km for cycling. Most respondents chose the shortest distance, suggesting a low interest in using non-motorized transportation, even though most public transport trips begin and end on foot. This is in line with the study of Nurhalima [32]. The inappropriate walking infrastructure is not the sole reason for a lack of willingness to walk such a distance. Temperature and climate also affect the decisions. A study by Jayadilaga et al. [33] similarly found low walking frequency and duration in Makassar City. Respondents' perceptions suggest that this is because pedestrian and bicycle lanes are available only in limited locations and are not fully utilized as intended.

For accessing information about bus services, the majority of respondents-aged 17 to 55 and grouped by occupation and income-prefer smartphone applications, with 64% indicating that apps offer convenience. Meanwhile, respondents aged 56 and above prefer information through wayfinding boards placed at bus stops and nearby areas. According to older respondents, using smartphones and the internet remains quite challenging.

The most preferred form of security service is CCTV, chosen by 60% of respondents across nearly all age, gender, occupation, and income groups, except for respondents in the civil servant/NI/POLRI professions and those with incomes above IDR 3,500,000, who preferred the presence of security

guards. The preferred fare range is IDR 4,000-4,200, with 59% of respondents mainly based on income group and gender-choosing this option. This differs from the willingness to pay in Banjarbakula City, where people preferred fares above the government-set price [34]. Respondents aged 17-25, however, preferred a fare of IDR 4,300-4,500. A study by Putra and Kurnia [35] found that income positively influences user preferences, which aligns with the findings here: respondents with incomes above IDR 3,500,000 preferred the highest fare range of IDR 4,900-5,100.

Table 3. Private vehicle users' preferences for bus transit service attributes

Indicators		Amount (n)	Percentage (%)
Walking distance	<100 meters	144	53%
	101-200 meters	64	24%
	201-300 meters	26	10%
	301-400 meters	13	5%
	>400 meters	15	6%
	Others (1 km, 900 m)	8	3%
Cycling distance	<0.5 km	138	51%
	0.5-1 km	86	32%
	1.1-2 km	32	12%
	>2 km	9	3%
	Others (>3 km)	5	2%
Media types	*Wayfinding*	53	20%
	Application/Smartphone	174	64%
	Website	8	3%
	Others (Wayfinding and apps, Everything, Google maps, Apps and websites)	35	13%
Security types	Security officer	67	25%
	CCTV	163	60%
	Others (All, Emergency dial, Wifi)	40	15%
Service rates	IDR 4,000-4,200	160	59%
	IDR 4,300-4,500	41	15%
	IDR 4,600-4,800	30	11%
	IDR 4,900-5,100	32	12%
	Others (Free, IDR 5,000-10,000, <IDR 4,000, based on distance)	7	3%
Payment methods	Cash	109	40%
	Applications (qris, gopay, ovo, etc.)	97	36%
	Electronic card/e-money (Flazz, Brizzi, Tap cash)	29	11%
	Others (all, cash and app, app and card, and card and cash)	35	13%
Start and end of service time	05:00-18:00	20	7%
	05:00-20:00	26	10%
	05:00-22:00	210	78%
	Others (05:00-24:00, 05:00-23:00, 06.00-21:00)	14	5%

Although most respondents find cashless payments convenient, the preferred payment method is cash (40%), just 4% more than the app-based method (36%). Younger respondents, aged 17-25 and 26-35, preferred app payments, while those aged 36 and above preferred cash due to unfamiliarity with cashless payment procedures and app use. This finding aligns with the study [36], which found that older adults find electronic payments challenging. Income also played a role: respondents earning less than IDR 1,500,000 or between IDR 1,500,000 and 2,500,000 preferred cash, while those earning between IDR 2,600,000 and 3,500,000 and above tended to choose app-based payments.

Regarding service operating hours, 78% of respondents across gender, age, and income groups preferred the hours of 05:00-22:00, while some unemployed respondents preferred an operating time of 05:00-18:00.

After completing the questionnaire, respondents were asked about their willingness to switch to bus transportation if public transport services aligned with their preferences. The results showed that 86% of respondents were interested in switching, while the remaining 14% had no desire to switch from using private vehicles (Figure 5).

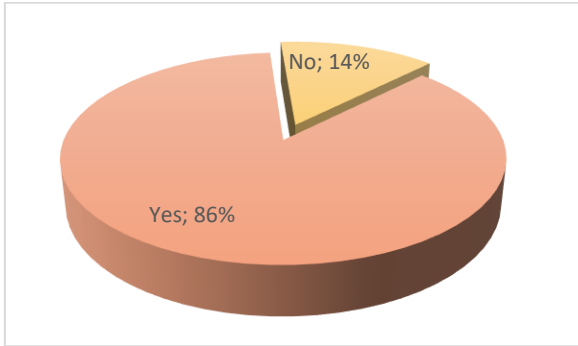

Figure 5. Willingness to switch if the service matches preferences

5. POLICY IMPLICATION

Based on these research results, some policy implications should be addressed for further development of public transportation in Makassar City and its surroundings. The suggestions are described as follows:

(1) Implementation of socialization and education regarding bus service information, integrated bus service usage procedures, and the benefits and impacts of using public transportation services for the future. The socialization can be conducted through various media, including digital media as part of immediate actions.

(2) Improvement in the ticket purchasing system in the medium-term program. Implementing an improved ticket purchasing system is necessary to increase readership. Ticket purchasing should be easily accessed through minimarkets or ticket machines available at bus stops and on buses; in addition, supporting various payment methods, including cash. The current payment system is a non-cash system that many people still do not understand. In addition, based on community preferences, cash payment is the method with the largest percentage. A system that allows ticket purchases through minimarkets or ticket machines at bus stops and on buses aims to increase convenience for the public in using bus transportation. Utilizing minimarkets as ticket distribution partners is considered because minimarkets have spread to almost every region, even within relatively close distances. Furthermore, purchasing tickets through minimarkets allows for various payment methods, making it accessible to all levels of society, whether they feel comfortable with digital payments or cash. Meanwhile, the availability of ticket machines at bus stops and on buses can facilitate real-time purchases and reduce waiting times due to the fast transaction process. In addition to implementing the ticket purchase system, education regarding cashless procedures should

continue through socialization, education, and visual communication media.

(3) Improving the functionality of the application that allows users to access information and make payments for bus services in a single application. Based on the preferred media type for obtaining bus information, the majority of respondents chose apps/smartphones as their favored medium. Therefore, the strategy of improving the application's functionality is expected to increase ease of access to information and support activities related to bus services, such as fare payments, within a single application.

(4) Building dedicated bus lanes (dedicated right-of-way), especially on roads that are often congested. This might be a long-term program. The lack of certainty regarding bus arrival and departure schedules, caused by buses operating alongside other vehicles, leads people to choose private vehicles as they are considered more efficient. The availability of dedicated lanes will improve bus transportation services by reducing travel time and congestion, making schedules more predictable and potentially encouraging the bus ridership.

(5) Improving the connectivity or integration of pedestrian and cyclist lane networks to bus stops. A complete, uninterrupted, and safe network of walking areas is a basic characteristic of urban walkability [37]. Currently, in addition to their limited number, existing pedestrian and bicycle paths face challenges in terms of comfort and safety. To address these issues, in the short term, efforts can be made to repair damaged pedestrian and bicycle infrastructure, regulate the use of paths according to their intended function, provide access for people with disabilities equipped with markings, and add safe crossing paths. In the long term, integration and connectivity should be addressed by including other authorized institutions, such as transport, planning board, public works and spatial planning institutions.

6. CONCLUSION

Public perceptions of bus transportation services have become more positive. Many respondents shared favorable opinions on service attributes such as service coverage, real-time information, supporting facilities, fare affordability, payment systems, app usage, ease of switching modes, and operating hours. Negative feedback was primarily directed at the condition of pedestrian and bicycle paths and the punctuality of services.

According to SPSS calculations, the top three bus service attributes that influence people's willingness to switch from private vehicles are fare affordability, bus and bus stop maintenance, and operating hours. Some user preferences align with current services, such as CCTV for security, apps for information, and buses operating from 05:00 to 22:00.

Regarding walking and cycling distances, most respondents preferred the shortest options: less than 100 meters for walking and less than 0.5 km for cycling. Additionally, respondents favored fares in the range of IDR 4,000–4,200 and cash payments, which differs from the current fare of IDR 4,600 that uses a cashless system. Despite some negative factors, 55% of the respondents are willing to switch to using public transport services. Undeniably, some service improvement is necessary that should be addressed for future planning and policy.

7. LIMITATIONS AND FUTURE WORKS

This study focuses solely on one bus service corridor operating in Makassar City. This limitation hinders the findings from accurately describing the perceptions and preferences of private vehicle users in other corridors or cities with different characteristics from Makassar City. To address this, one effort could be to increase the scope of the research area to include several bus corridors in Makassar City and other cities, providing a more comprehensive explanation regarding the perceptions and preferences for bus transportation. In an attempt to generalize the results, this study employs a simple random sampling technique. However, due to the lack of resources and time concern, limited samples lead to high margin of error. Further studies should broaden the sample size and minimize the margin of error. The data collection results present imbalances in the sample. This is evident in the large percentage of female respondents or respondents with student status who are dominant. Therefore, future research should consider the use of multi-stage sampling methods, ensuring the research results are more representative. The use of questionnaires and open questions should also be considered, allowing the public to provide suggestions, hopes, and criticisms of bus transportation, which will be useful in the future for improving service performance. Moreover, a more detailed process such preliminary pilot study to validate the questionnaires and measurements can yield reliable and valid results.

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