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Determinants of the Demand-based Mass Public Transport System (SAUM) Optimization and Services Supply in the Urban Region of Sarbagita, Bali Province

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Abstract **-** This study aims to analyze the variables that affect the optimization of the Mass Public Transport System (SAUM) based on demand and service supply. This research was conducted using quantitative methods. The research location is in the urban area of Sarbagita, an agglomeration area in Bali. The research was conducted in October 2021, during the Covid-19 pandemic. The total population in this study was 14,140 with a sample of 397 passengers on 4 (four) Trans Metro Dewata service routes. Sampling using proportional stratified random sampling. The data used is in the form of a scale of differences in the meaning of attitudes towards an object. This research uses multivariate analysis technique with partial least square (PLS) method. The variables used in this research are Service Demand and Service Supply as exogenous variables, Service Certainty and Service Integration variables as intermediate variables and Service Optimization variables as endogenous variables. This study suggests that SAUM optimization efforts are not only based on demand and service supply but also involve variable among certainty service and service integration. In addition to the variable aspect, several indicators that are perceived to have the most role in the variables needs to be improves. These indicators include: Quality of Service on the Demand variable; Service Quantity on Service Offering variable; Service Level on Service Assurance variable; and Regularity indicator on Service Optimization variable. As an initial stage, optimization of SAUM services in Sarbagita needs to be focused on regularity indicators which include attributes of waiting time, speed, downtime and availability of information.

Keywords - Demand, Integration, Optimization services, Sarbagita, SAUM, Services certainty, Supply.

INTRODUCTION

Transportation is an important part of economic activity that has a big role in the development and welfare of the community. In general, the economic impacts of transportation are categorized into direct and indirect impacts. Direct Impact relates to changes in accessibility where transportation enables markets to occur and saves time and costs. Indirect impact is related to the decrease in commodity or service prices and/or its variations in the form of an increase in the multiplier effect. The multiplier effect is intended as the emergence of new jobs caused by a new market that occurs due to new transportation accessibility (Susantono, 2007).

In urban areas, mobility is one of the fundamental parts and is the main characteristic of economic activity. Mobility ensures the fulfillment of the need to move from one place to another, both for passengers, goods, and information. Areas with a high level of mobility generally have more opportunities for development compared to areas with low mobility. The mobility of people and goods can only be achieved with a good transportation system. Thus, urban transportation is an integral part of the economic life of the city, so it cannot escape the conflicts that occur within the city itself (Dikun, 2003).

Essentially, urban transportation problems occur because of the concentration of people, vehicles, and other economic activities in relatively narrow road spaces at the same time. Problems arise when existing transportation facilities are faced with capacity constraints and the city is faced with limited land in the construction of new transportation facilities/infrastructure. The resultant of all of this is that the city becomes a place where the movement of vehicles, people and goods becomes increasingly difficult and expensive which in turn leads to energy wastage and environmental degradation. Social cost will be the dominant part of

urban travel disutility. The powerlessness in providing a reliable and efficient transportation system can make transportation in urban areas no longer an "economic asset" but will instead develop into an "economic liability".

So far, to overcome the problem of congestion in urban areas, the government has always decided to add more roads (Rasyid, 2013). Even though it is widely known that adding roads or widening roads will not necessarily free urban areas from severe congestion (Farkas, 2007). In fact, according to the Downs-Thomson Paradox, increasing road capacity will exacerbate traffic congestion, so that expansion of the road network system as a solution to congestion is not only ineffective, but also counterproductive (Downs, 1962). Therefore, Farkas (2007) suggests to policy makers to emphasize the importance of affordable public transportation rather than building new roads in order to increase the mobility of low-income people, reduce the amount of congestion on the roads and improve air quality. Therefore, Warpani (2002) argues that an urban area that already has a population of more than one million people should have an efficient public transportation system, namely a public transportation system that is able to be integrated not only operationally but also integrated with various sectors both economic, social, and environmental. Even the integration of public transportation is considered the most rational solution to overcome urban transportation problems (Tamin, 2000; Miro, 2012).

Theoretically, the demand for transportation services is derived from the need for a person to walk from one location to another to carry out an activity (Morlok, 1991). From the literature review, it is known that there are four variables that influence the choice of transportation mode, namely the characteristics of travelers, the characteristics of the movement, the characteristics of the transportation system and the characteristics of cities and zones (Bruton, 1985; Tamin, 2000). The World Bank as quoted from Abubakar (1993) also includes the service quality variable as one of the variables that affects the choice of public transport users in urban areas. The supply side of transportation relates to the provision of transportation facilities and infrastructure to meet community needs (demand side). The offer of transportation services can be seen in terms of the equipment used, the available capacity, the technical condition of the transportation equipment used, the production of services that can be provided by the transportation company and the financing system in the operation of the transportation equipment (Morlok, 1991). The factor that influences the optimization level of mass transit services in an area is the availability of services that include the number of buses and the number of corridors, as the conclusion of research by Basuki (2014). In addition to the demand and supply of services, which are direct variables that influence the optimization of mass public transport services in urban areas, there are also other factors that are thought to be mediating variables in optimizing mass public transport services in urban areas. These factors are service certainty and service integration. The service certainty factor refers to the results of the identification of mass public transport service problems that are generally faced by urban areas in Indonesia, namely low accessibility, low service levels and service availability (Directorate General of Land Transportation, 2014). One indicator of the level of public accessibility to public transportation is the ratio between the length of the road served by the route and the total length of the road, where the higher the ratio, the higher the level of accessibility to public transportation. The low level of public transport services is indicated by high waiting times, length of travel time and inconvenience in public transport. The low accessibility and unorganized public transport service network have resulted in the community having to make several public transport transfers from the point of origin to the destination. In terms of public transportation facilities, Dagun et. al (2006) said that good transportation for public services must meet three basic criteria, namely comfort, safety, and speed. The network integration factor is also the key to the success of the public transportation service system in a region or city (Neumann and Nagel, 2011). This is because with an integrated public transportation network, the best network route can be determined which is not only based on the demand for community travel needs but also the optimal service coverage mechanism (Murray, 2001; Fernandez et al, 2008; Hadas and Ceder, 2010; Cortes et al. , 2011). In fact, network integration can have an impact on the emergence of other integrations, such as physical integration, schedules, and tariffs (Currie and Bromley, 2005; Potter, 2010; Hadas and Ranjitkar, 2012). The results showed that schedule integration on the Hong Kong Mass Transit Railway was proven to reduce waiting time by 43 percent and reduce costs by 73 percent (Wong and Leung, 2004 in Currie and Bromley, 2005). The integration of public transport information in the City of London has proven to be able to increase the ratio of costs and benefits by up to 7.67 percent (Preston, 2010).

Awareness of the important role of mass public transport has prompted the government to develop a Mass Public Transport System (SAUM) in urban areas in Indonesia, both road-based and rail-based. The current development of the Mass Public Transportation System is even the government's obligation as mandated in Article 158 paragraph (1) of Law Number 22 of 2009 concerning Road Traffic and Transportation (LLAJ): "*The government guarantees the availability of road-based mass transportation to meet the needs of people's transportation. by Public Motorized Vehicles in urban areas*". This regulation is in line with the Grand Theory of Efficiency of the urban transportation system which states that: "*The efficiency of road space is measured not by the number of vehicles passing through a road space but by the number of people using the road space. Therefore, the operation of a Mass Public Transportation System (SAUM) which has a large transport capacity optimally is the key to the efficiency of the transportation system in urban areas*".

In Bali Province, the development of SAUM, especially in the urban areas of Denpasar, Badung, Gianyar and Tabanan or better known as the acronym Sarbagita, has been stated in the Decree of the Governor of Bali Number 1186/03-F/HK/2010 dated November 11, 2010 concerning the Establishment of a Transport Route Network. General Trans Sarbagita. However, since it was first introduced in 2011, there is still a gap between the realization and the planned service delivery. From the service demand aspect, the load factor indicator shows that the average new passenger reaches 25.93 percent of the bus capacity, which consists of the load factor of Trans Sarbagita 29.76 percent and Trans Metro Dewata 22.1 percent. This condition is still far from the ideal target Load Factor, which is 100%. From the aspect of service offerings, the realization of the new corridor reached 13 percent of the plan (6 corridors of 17 corridors) and the realization of operating buses only reached 23 percent of the plan (120 buses out of 196 buses). Especially for the Trans Sarbagita service, the public's low interest in using this service is explained by a public opinion survey report conducted by academics from the Faculty of Social and Political Sciences (Fisipol) of Udayana University.

The survey was carried out on 20-28 February 2013 with survey respondents covering 1,020 Balinese spread across nine regencies/cities in Bali Province. The results of these studies and research conclude that public interest in South Bali is using public transportation, especially Trans Sarbagita which serves Corridor I from Batubulan, Gianyar Regency to Nusa Dua (Badung) and Corridor II from within Denpasar City, Unud Campus in Bukit to tourist attractions. Garuda Wisnu Kencana (GWK) is still low, so the Trans Sarbagita Bus program has not been very effective. The mass media coverage of the Trans Sarbagita service was also colored by many complaints from the public. People complained about the erratic bus schedule and did not arrive on time (Tribunnews.com, 1 July 2014). In addition, the condition of the bus stop also seems less serious and not well maintained. The public also complained about the lack of fleets and bus routes to the airport, so people were forced to use private vehicles to go to the airport (Tibunnews.com, January 13, 2015). The aspect of the slow realization of service development also does not fail to get public complaints. Until now there has been no addition of new corridors apart from the two corridors that have been operating since three years ago (Bali Post, 27 October 2014). The complaints from the community above indicate that there are still problems regarding aspects of service certainty and service integration. The existence of these gaps and public complaints indicates that the Mass Public Transportation System (SAUM) in the Sarbagita area is still not implemented optimally, both from the aspect of affordability and regularity. Affordability aspects are reflected in the low realization of corridors, while regularity aspects are reflected in the number of complaints related to service certainty.

From the description above, it is indicated that: First, the Mass Public Transport System (SAUM) service in the Sarbagita area is currently not being implemented optimally; Second, it is necessary to understand the aspects of demand and supply of services in the implementation of Mass Public Transportation System services; Third, it is necessary to mediate service certainty and service integration to make mass public transportation system services can be implemented optimally; Fourth, the service of the Mass Public Transportation System that has not been implemented optimally has resulted in the economic inefficiency of urban transportation in the Sarbagita area. The four indications are generated from a theoretical review of the direct and mediating variables that affect the optimization of mass public transport services in urban areas and are compared with empirical studies of the performance of urban mass public transport services in the Sarbagita area which are currently operating.

With the above background, it is deemed necessary to conduct more in-depth research on road-based Mass Public Transportation System services. The existence of gaps between plans and realization in terms of demand and supply of services as well as public complaints in various mass media regarding aspects of certainty and service integration indicate that the Mass Public Transport System (SAUM) in the Sarbagita area is still not implemented optimally, both from the aspect of affordability. as well as regularity. Affordability aspects are reflected in the low realization of corridors, while regularity aspects are reflected in the number of complaints related to service certainty.

Compared to previous studies that also reviewed the Trans Sarbagita mass transit program (Nirjaya et al, 2016; Widyastuti et al, 2016; Utama et al, 2019; Wedagama et al, 2020) Trans Jakarta Mass Transportation (Kurniati, 2020); Mass Transportation in Yogjakarta (Basuki, 2012) as well as on a wider scale includes several urban areas that provide urban mass transportation services, Directorate General of Land Transportation, 2014) as well as a case study of mass transportation in Bogota, Colombia conducted by Echeverry, et al (2004), found a gap between the state of the art from previous studies. Previous research has tended to only focus on evaluating the effectiveness of services and evaluating policy implementation, while in this study, a study and analysis will be conducted of the variables that affect the optimization of road-based Mass Public Transport services, especially the Urban area of Sarbagita.

Road-based Mass Public Transportation System (SAUM) services in the Urban area of Sarbagita (agglomeration) as part of the solution to overcome urban transportation problems in the Sarbagita area should operate optimally. Referring to the Minimum Service Standards (SPM) for road-based mass transportation set by the Ministry of Transportation of the Republic of Indonesia (2012), a mass public transportation service can be said to be optimal if in its operation it is able to meet the service requirements set out in the SPM, including the fulfillment of the aspect of affordability. and regularity of service. The importance of optimizing mass public transport services for a city is to increase community mobility, reduce the amount of congestion on the road and improve air quality (Farkas, 2007).

This optimization can only be achieved through a proper understanding of people's travel patterns as well as community needs and expectations for the quality of public transportation services offered. The optimization is also influenced by the service certainty factor and service integration as an intervening variable. Optimization of the resulting service through an understanding of the factors of demand for the desired service and the supply of available services as well as the existence of mediating factors in the form of service certainty and service integration are expected to provide benefits for increasing the economic efficiency of the transportation sector in urban areas.

Hypothesis Formulation

1) Service demand and supply have a positive effect on the certainty of road-based Mass Public Transportation System (SAUM) services in the Urban area of Sarbagita.

2) Service demand and supply indirectly affect the optimization of the Mass Public Transportation System (SAUM) through certainty and integration of services on the road-based Mass Public Transportation System (SAUM) in the urban area of Sarbagita.

METHODS

This research was conducted using quantitative methods. Data collection was carried out using field survey techniques through direct interviews with users of the Trans Metro Dewata public transportation. Data were collected by cross section using a list of questions which were then analyzed quantitatively. The population in this study is 14,140 passengers, which is the average daily passenger on 4 (four) Trans Metro Dewata mass public transportation routes, calculated from January 2021 to March 2021. The determination of the number of research samples from the population is calculated using the formulation Slovin which produces a total sample of 388 passengers. Furthermore, considering the characteristics of the population associated with this study, the sampling in this study was carried out using proportional stratified random sampling (Proportionate stratified random sampling). The variables of this study consist of demand and supply variables, optimization of the Road-based Mass Public Transportation System (SAUM) in urban areas (agglomeration) Sarbagita, service certainty and service integration variables. This research uses multivariate analysis technique with partial least square (PLS) method.

FINDINGS

1) Direct Effect Test

The direct influence between research variables (latent variables) based on the results of data processing using Smart PLS can be seen from the results of the path coefficients analysis shown in Table 5.29. Table 5.29 shows that there is a direct effect of exogenous variables on endogenous variables that have a positive but not significant effect, namely demand has a positive effect on the optimization of SAUM, but is not significant. This relationship is evidenced by the P-value of the variable is greater than 0.05, which is 0.675 for two-sided testing. In addition, an insignificant relationship is also shown in the relationship between demand and integration with a significance value of 0.699 respectively.

TABLE 1

PATH COEFFICIENTS (DIRECT INFLUENCE BETWEEN RESEARCH VARIABLES)

	Original Sample (O)	Standard Deviation (STDEV)	T Statistics |(O/STDEV)|	P Value
Certainty (Y1) -> SAUM Optimization (Y3)	0.210	0.104	2.017	**0.044**
Supply (X2) -> Certainty (Y1)	0.266	0.108	2.470	**0.014**
Supply (X2) -> SAUM Optimization (Y3)	0.374	0.091	4.126	**0.000**
Demand (X1) -> Certainty (Y1)	0.470	0.100	4.715	**0.000**
Demand (X1) -> SAUM Optimization (Y3)	0.033	0.078	0.420	**0.675**

TABLE 2

TOTAL INDIRECT EFFECTS VALUE (INDIRECT EFFECT OF RESEARCH VARIABLES)

	Original Sample (O)	Standard Deviation (STDEV)	T Statistics |(O/STDEV)|	P Value
Certainty (Y1) -> SAUM Optimization (Y3)	0.167	0.062	2.684	**0.008**
Supply (X2) -> SAUM Optimization (Y3)	0.222	0.067	3.327	**0.001**
Demand (X1) -> SAUM Optimization (Y3)	0.196	0.068	2.878	**0.004**

Based on Table 2, it is known that the mediation relationship in this test has a significant effect as evidenced by P-values 0.05. Based on these statistical results, the indirect effect of each relationship is proven as follows.

The Effect of Service Demand and Supply on the Certainty of Road-Based Mass Public Transportation System (SAUM) in the Urban area of Sarbagita

1) The Effect of Demand on the Certainty of Road-Based Mass Public Transportation System (SAUM) Services in the Urban area of Sarbagita

The results of this study indicate that statistically demand has a positive and significant effect on the certainty of road-based Mass Public Transportation System (SAUM) services in the Urban area of Sarbagita. This means that the higher the demand, the higher the certainty of services that are expected to be available in the road-based Mass Public Transportation System (SAUM) in the Urban area of Sarbagita. Demand variables in this study include indicators of traveller characteristics, movement characteristics and service quality. Indicators of the characteristics of travellers are measured using the attributes of the type of work and vehicle

ownership. Movement indicators are measured using the attributes of destination, time and distance of the trip. Service quality indicators are measured using the attributes of waiting time, walking distance, mode shift and travel time.

Based on the results of the perception analysis, it is indicated that the users of the Trans Metro Dewata Mass Public Transportation System (SAUM) provide good meaning for the indicators that form the service demand variable. An understanding of the indicators of the characteristics of travellers can be seen from the distribution of travel destinations, where in the research sample taken, travellers are dominated by respondents who work, followed by recreation, social, school, and finally with campus destinations. This description provides an optimization perspective that the majority can satisfy the characteristics of travelers with work purposes. Work rules requiring punctual arrival require workers to ascertain the time spent on the trip. So, the existence of transportation with a definite schedule is an absolute consideration for workers. Another characteristic that is seen is the travel time interval where the majority of respondents are in the interval of 31-45 minutes. Taking this into account, the existence of a mode of transportation must ensure that the corridor or route accommodates travel time intervals within that interval.

From the results of the analysis of travellers, it is known that the age group of 26-50 years is the age group with the largest number of users of Trans Metro Dewata. This age group usually has a period of seeking stability and a reproductive period, namely a period full of problems and emotional tension, a period of social isolation, a period of commitment and dependence, changes in values, creativity and adjustment to a new lifestyle (Hurlock, 2000).). This group is filled with people who are at a high level of productivity, so the existence of Trans Metro Dewata in this circle becomes an alternative mode of transportation for both captive and choice riders. The rapid adaptation process when dealing with new situations also causes the existence of Trans Metro Dewata to be expected to be a mode that can provide comfort in transportation for these people.

Understanding of service quality indicators is done by using the attributes of waiting time, distance traveled, mode change and travel time. In the waiting time attribute, the analysis results show that respondents are generally not willing to wait long, which results in work delays and reduces respondents' productivity. This can also reduce the comfort of respondents. In the mileage interval attribute, the results of the analysis show that policy makers need to pay attention to the mode of transportation that is able to accommodate all these mileage intervals. In addition, although most of the walking distance of Trans Metro Dewata users is below 200 meters, it is within the ideal walking distance range from/to urban public transport services in developing countries set by the World Bank, which is 300-500 meters, but this is also means that the passengers of Trans Metro Dewata transportation are people who only want to walk under 200 meters to get public transportation services. From the aspect of mode transfer, most passengers want the mode of change from starting the journey to reaching the destination is 1 time and a maximum of 2 times the mode of change. This fact is in accordance with the number of modal shifts for urban public transport services in developing countries set by the World Bank, which is a maximum of 2 times the mode of change.

Referring to the results of the analysis of the demand variable indicator, it is known that the movement characteristic indicator has a lower role than the service quality indicator. Thus, improvement in waiting time, walking distance, mode shift and travel time as service quality attributes will certainly play a significant role in increasing service certainty variables.

The demand for a mode of transportation is reflected in the number of people who choose a vehicle with certain terms or conditions, such as the quality of public transportation and its price. Theoretically, the demand for transportation services is derived from the need for a person to walk from one location to another to carry out an activity (Morlok, 1991). The World Bank as quoted from Abubakar (1997) also includes the service quality variable as one of the variables that influence the choice of public transport users in urban areas.

Denpasar City, which is the capital of Bali Province, is one of the places that has a fairly high intensity of community movement accompanied by many public and private vehicles that create traffic jams. The results of the Urban Mobility Plan (UMP) research in the Sarbagita area carried out by the Indonesian Australian Partnership for Infrastructure (KIAT) in collaboration with Bappenas and the Bali Provincial Government in 2021 showed that the city of Denpasar as the metropolitan core of Sarbagita contributed the highest percentage of motorized vehicle use, which was 42 percent. This is in line with the results of the mapping of motorized transportation travel patterns which show a very large concentration of travel attraction in the southern part of Sarbagita compared to the northern part with the exception of Ubud. This concentration of trip attraction generation affects the traffic flow pattern which is also dominant in the South of Sarbagita.

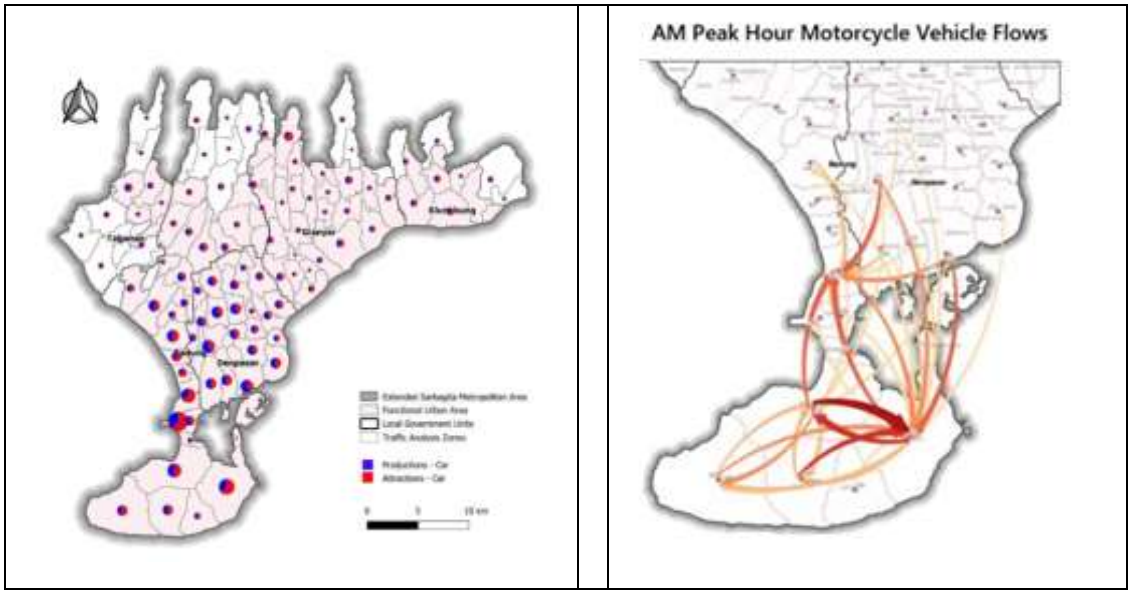

FIGURE 6.1

TRANSPORTATION DEMAND AND TRAFFIC FLOW PATTERNS IN SARBAGITA

Source: Bappenas-KIAT UMP, 2021.

The dominance of movement with private vehicles causes traffic jams that make vehicle users uncomfortable and cause psychological effects such as stress. This actually provides an opportunity for the Mass Public Transportation System (SAUM) which can minimize the number of vehicles on the road. So, in general, people's expectations of the existence of SAUM are quite high. However, the existing phenomenon shows that the level of demand for public transportation in the Sarbagita area is still very low. This is reflected in the average load rate (number of passengers divided by the carrying capacity) of Trans Metro Dewata public transportation currently operating at only 24 percent, far below the ideal figure of 80 percent (Dishub, 2021). Referring to the theory put forward by Belrao and Cabral (2007), where the optimal public transportation service system can only be achieved through a proper understanding of people's travel patterns (travel behavior) as well as community needs and expectations (preferences) on the quantity and quality of public transportation services. This indicates that there is a close relationship between the public transportation service system and people's attitudes and behavior, especially travel behavior and modal choice because the community is the main actor in the public transportation service system (Eboli and Mazzulla, 2011; Bandura, 1986 in Wang and Chen, 2012). This is because each community has a different travel motivation. In addition, the public also has a different interest point of view with the operator and the government so that they can be considered as the right judge to assess the performance of public transportation services (Khisty and Lall, 1998 in Siswoyo, 2008; Eboli and Mazula, 2011). The results of research conducted by Wedagama, et al. (2020) regarding the Performance Analysis of the Trans Sarbagita Mass Public Transportation Service Based on Passenger Satisfaction Perceptions concluded that almost all service attributes need to be improved in service, including the ease of reaching the Trans Sarbagita Bus stop, the caretaker's attention in treating passengers professionally, the punctuality of the departure of the Trans Sarbagita Bus and the suitability of service hours with the time required by the community.

The importance of mass public transportation services has been regulated in Law number 22 of 2009 concerning LLAJ which mandates that the government guarantee the availability of road-based mass transportation in urban areas. As part of efforts to optimize SAUM services, this study emphasizes the importance of understanding the transportation demand that arises so that the certainty of SAUM services in the Sarbagita area can be increased. This understanding includes indicators of travel characteristics, movement characteristics and service quality. Furthermore, to measure the success rate of improvement from the aspect of service certainty, this study proposes the use of indicators of accessibility, service level and service availability that reflect the service certainty variable. The accessibility indicator is measured by using the ratio attribute between the length of the road served by the route and the total length of the road. Service level indicators are measured using the attributes of waiting time, travel time and comfort. Service availability indicators are measured using the attributes of the number of buses and the number of corridors.

2) The Effect of Supply on the Certainty of Road-Based Mass Public Transportation System (SAUM) Services in the Urban Area of Sarbagita

The results of this study indicate that statistically supply has a positive and significant effect on the certainty of road-based Mass Public Transport System (SAUM) services in the urban area of Sarbagita. This means that the higher the supply, the higher the certainty of road-based Mass Public Transportation System (SAUM) services in the Urban area of Sarbagita. Service supply variables in this study include indicators of service quantity, infrastructure characteristics and service prices. The service quantity indicator is measured using the attributes of the number of buses, the number of corridors and the availability of feeder routes. The

indicators of infrastructure characteristics are measured using the attributes of traffic conditions, availability of bus stops and parking. The service price indicator is measured using the Trans Sarbagita tariff attribute.

Based on the results of the analysis of respondents' perceptions of the service offering variable, it is indicated that the users of the Trans Metro Dewata Mass Public Transportation System (SAUM) give a good meaning to the service offering variable. This fact is supported by the results of a survey of respondents' perceptions of the number of buses serving on each route which states that they are sufficient and reinforced by respondents' perceptions regarding the number of available routes/corridors. Currently, there are 2 (two) Bus Rapid Transit (BRT) based services that serve mass public transportation in the Sarbagita area, namely: Trans Sarbagita and Trans Metro Dewata. Although the two services are provided with the same service system, namely the Buy The Services System, the Bali Provincial Transportation Service as the manager of the Trans Sarbagita service operates services on 2 (two) different routes/corridors with 4 (four) Trans Metro Dewata routes/corridors. managed by the Ministry of Transportation of the Republic of Indonesia. Thus the two services are complementary.

Referring to the results of the analysis of service supply variable indicators, it is known that the indicators of service quantity, infrastructure characteristics and service prices have relatively the same role. Thus, improving the attributes of the number of buses, the number of corridors, the availability of feeder routes, traffic conditions, the availability of bus stops, parking and service rates will certainly have a significant influence on the service certainty variable.

The current condition of SAUM services in the Sarbagita area cannot be said to be over demand or over supply. On the one hand, the level of use (Load Factor) of mass transportation on existing routes which is still very low, suggests that the existing services are over-supply. But on the other hand, there are still many areas that have not been served by public transportation. This is evident from the perception of respondents who think that the feeder/connector route is still lacking. This condition causes many areas that have unserved potential demand, including the Captive Riders group to have difficulty accessing these mass public transportation services. For this reason, it is necessary to create new routes to improve accessibility between regions and connectivity between services so as to grow potential demand for public transport service users from areas that have not been served.

The supply side of transportation relates to the provision of transportation facilities and infrastructure to meet community needs (demand side). The offer of transportation services can be seen in terms of the equipment used, the available capacity, the technical condition of the transportation equipment used, the production of services that can be provided by the transportation company and the financing system in the operation of the transportation equipment (Morlok, 1991). In theory, there are several factors that influence the offer of public transport services. According to Marvin (1979) these factors are related to speed, safety, frequency, regularity, capacity, affordable price, responsibility and convenience. Furthermore, Tamin (2000) states that service offerings can be grouped into two categories: Quantitative Factors, consisting of: travel time, waiting time at the bus stop, walking time to the bus stop, time while moving, fares, fuel costs, availability of parking spaces and parking rates as well as Qualitative Factors, consisting of: comfort and security, reliability and regularity, and others. Basuki (2012) in his dissertation conducted research to develop indicators and benchmarks for the performance of urban public transport services by taking a Case Study of Urban Public Transport in the Special Region of Yogyakarta. The results show that the low quality of urban public transportation services is due to an incomplete planning system, an imbalance between facilities and infrastructure so that urban public transportation is seen as impractical, inflexible and uncomfortable and even expensive. The development of performance indicators for urban public transport services with a regular system and modified BRT results from the research includes accessibility, reliability/accuracy, safety, comfort, tariffs, infrastructure and facilities.

As part of efforts to optimize SAUM services, this study emphasizes the need to improve service offering variables so that the certainty of urban public transport services in the Sarbagita area can be increased. These improvements include indicators of service quantity, infrastructure characteristics and service prices. Furthermore, to measure the level of success, this study proposes the use of indicators of accessibility, service level and service availability that reflect the service certainty variable. The accessibility indicator is measured by using the ratio attribute between the length of the road served by the route and the total length of the road. Service level indicators are measured using the attributes of waiting time, travel time and comfort. Service availability indicators are measured using the attributes of the number of buses and the number of corridors.

Indirect Effect of Service Demand and Supply on Optimization of the Mass Public Transportation System (SAUM) through Service Assurance and Service Integration on the Road-Based Mass Public Transportation System (SAUM) in the Urban Area of Sarbagita

The results of this study indicate that statistically the demand and supply of services has a positive and significant effect on the optimization of the Mass Public Transport System (SAUM) through service certainty and service integration on the road-based Mass Public Transport System (SAUM) in the urban area of Sarbagita. This means that good service certainty and integration can significantly increase the influence of service demand and supply on the optimization of the road-based Mass Public Transportation System (SAUM) in the Urban area of Sarbagita. From the results of the perception analysis, it is indicated that the users of the Trans Metro Dewata Mass Public Transportation System (SAUM) give a good meaning for the service optimization variable.

Indicators on certainty variables such as (accessibility of services as measured by the comparison between the length of the route and the total length of the road, the level of service as measured using the attributes of waiting time, travel time and convenience; and service availability measured using the attributes of the number of buses and the number of corridors) and integration such as

(physical integration as measured by the availability of private vehicle parking locations at the terminals/stops traversed by public transport; network integration measured using the attributes of connected public transport services between routes; and fare integration measured using the unified attribute of tariffs between public transport services). The influence of supply and demand on the optimization of SAUM. If viewed specifically, all of these indicators play a very important role that is considered by respondents in using SAUM. Demand and supply will not be able to optimally affect the services provided if these indicators are not managed properly.

So far, to overcome the problem of congestion is to add roads (Rasyid, 2013). Even though it is widely known that adding more roads or adding road construction will not necessarily free urban areas from severe congestion (Farkas, 2007). In fact, according to the Downs-Thomson Paradox, increasing road capacity will exacerbate traffic congestion. The general conclusion is that the expansion of the road network system as a solution to congestion is not only ineffective, but also counterproductive (Downs, 1962; Thomson, 1977). A similar paradox was proposed by Smeed and Wardrup (Barter, 2000), where the number of cars needed to move a number of people is much greater than the number of buses needed to carry the same number of people. So a replacement from a bus car will allow traffic to move faster. It was also found that if everyone traveled by the "slow" method of transportation, namely the bus, then they could actually travel faster than if they all used the "fast" method of car. The use of the Down-Thompson paradox and the Smeed-Wardrup paradox in this study is solely to emphasize that optimizing the service of the mass public transportation system is the main solution to solving the main problem that causes inefficiency in urban transportation, namely traffic congestion, and not road construction. new. This is because road space is a limited public good. That is why the efficiency of road space is measured not by the number of vehicles passing through the road space but by the number of people passing through the road space. Thus, the key to the efficiency of the urban transportation system is the use of modes with large transport capacities.

Therefore, Farkas (2007) emphasizes the importance of providing affordable public transportation rather than building new roads in order to increase mobility for low-income people, reduce congestion on roads and improve air quality. This is also in line with the statement of Murray (2001) and Gwilliam (2008) which state that public transportation is an important component in the overall process of managing the urban transportation system which is even considered as an instrument of spatial development policy that can improve and enhance the shape of the city. Furthermore, Warpani (2002) stated that an urban area that already has a population of more than one million people should have an efficient public transportation system. The importance of mass public transportation services has also been regulated in Law No. 22 of 2009 concerning LLAJ which mandates that the government guarantee the availability of road-based mass transportation in urban areas.

Road-based Mass Public Transportation System (SAUM) services in the Urban area of Sarbagita (agglomeration) as part of the solution to overcome urban transportation problems in the Sarbagita area should operate optimally. From the analysis results, the prospect of mass public transportation related to the development of infrastructure and current community behavior actually still has hope to be developed. Based on the data obtained, it is known that more than half of the respondents own a motorcycle with a percentage of 64 percent. This fact shows that there is a market share of people who own private vehicles who want to use public transportation. This is a motivating factor for the government to improve infrastructure and service facilities in order to attract more service users from the Choice Riders class, namely travelers who have private vehicles. Moreover, the policy of developing mass public transportation is the government's obligation as mandated in Law No. 22 of 2009 concerning Road Traffic and Transportation (LLAJ). Thus, regardless of the current situation of infrastructure development and community behavior, mass public transportation in the Sarbagita area still has to be addressed and developed as an effort to realize the efficiency of the urban transportation system.

Referring to the Minimum Service Standards (SPM) for road-based mass transportation set by the Ministry of Transportation of the Republic of Indonesia (2012), a mass public transportation service can be said to be optimal if in its operation it is able to meet the service requirements set out in the SPM, including the fulfillment of the aspect of affordability. and regularity of service. The importance of optimizing mass public transport services for a city is to increase community mobility, reduce the amount of congestion on the road and improve air quality (Farkas, 2007).

This is in line with the results of research on identifying the problems of mass public transportation services that are generally faced by urban areas in Indonesia, namely low accessibility, low service levels and service availability (Directorate General of Land Transportation, 2014). One indicator of the level of public accessibility to public transportation is the ratio between the length of the road served by the route and the total length of the road, where the higher the ratio, the higher the level of accessibility to public transportation. The low level of public transport services is indicated by high waiting times, length of travel time and inconvenience in public transport. The low accessibility and unorganized public transport service network have resulted in the community having to make several public transport transfers from the point of origin to the destination. In terms of the availability of public transportation facilities, Dagun et. al (2006) said that good transportation for public services must meet three basic criteria, namely comfort, safety, and speed. Factors that affect the level of optimization of mass transit services in an area are the availability of services that include the number of buses and the number of corridors, as the conclusion of research by Basuki (2014) which suggests that the low quality of urban public transport services is due to an incomplete planning system, an imbalance between facilities and infrastructure so that urban public transport is seen as impractical, inflexible and inconvenient and even expensive.

The need for the provision of SAUM services in the Sarbagita area is based on: the need to reduce the use of private vehicles through efforts to divert the movement of people by using mass public transportation to realize the efficiency of the transportation system in urban areas; the government's obligation to ensure the availability of road-based mass transportation in urban areas (article 158 paragraph 1 of Law number 22 of 2009 concerning Road Traffic and Transportation); the low level of use of public

transportation in Sarbagita and the phenomenon of complaints about the low quantity and quality of services currently operating; there are groups of people who have no other choice in traveling other than using public transportation (Captive Riders).

Referring to the description above, it can be concluded that in order to realize the economic efficiency of urban transportation in the Sarbagita area, it is necessary to provide a road-based Mass Public Transportation system that operates optimally. This optimization can only be achieved through a proper understanding of people's travel patterns as well as community needs and expectations for the quality of public transportation services offered. The optimization is also influenced by the service certainty factor and service integration as an intervening variable.

This refers to the theory put forward by Belrao and Cabral (2007), where an optimal public transportation service system can only be achieved through a proper understanding of people's travel patterns (travel behavior) as well as community needs and expectations (preferences) on the quantity and quality of service. public transportation. This indicates that there is a close relationship between the public transportation service system and people's attitudes and behavior, especially travel behavior and modal choice because the community is the main actor in the public transportation service system (Eboli and Mazzulla, 2011; Bandura, 1986 in Wang and Chen, 2012). This is because each community has a different travel motivation as well. In addition, the public also has a different interest point of view with the operator and the government so that they can be considered as the right judge to assess the performance of public transportation services (Khisty and Lall, 1998 in Siswoyo, 2008; Eboli and Mazula, 2011). The importance of mass public transportation services has also been regulated in Law No. 22 of 2009 concerning LLAJ which mandates that the government guarantee the availability of road-based mass transportation in urban areas.

Currently, to provide guidelines for the development of road-based mass transportation services, the government has set the Minimum Service Standards (SPM) for road-based mass transportation through the Regulation of the Minister of Transportation of the Republic of Indonesia number PM. 10 of 2012 concerning Minimum Service Standards for Road-Based Mass Transportation which was further refined through the Regulation of the Minister of Transportation of the Republic of Indonesia number PM. 27 of 2015 concerning Changes to Minimum Service Standards for Mass Transportation, Regulation of the Minister of Transportation of the Republic of Indonesia number PM. 10 of 2012 concerning Minimum Service Standards for Road-Based Mass Transportation. Thus, a mass public transportation service can be said to be optimal if in its operation it is able to meet the service requirements set out in the SPM, namely the type of service and the quality of service. Types of services include: Security; safety; comfort; affordability; equality; and regularity.

Based on the results of the evaluation by Bappenas of the urban transportation system, it is concluded that so far, the Best Practices for the Development of Mass Public Transportation have not been developed. Basuki (2012) in his dissertation conducted research to develop indicators and benchmarks for the performance of urban public transport services with various types of services, by taking a Case Study of Urban Public Transport in the Special Region of Yogyakarta. The results show that the low quality of urban public transportation services is due to an incomplete planning system, an imbalance between facilities and infrastructure so that urban public transportation is seen as impractical, inflexible and uncomfortable and even expensive. The development of performance indicators for urban public transport services with a regular system and modified BRT results from the research includes accessibility, reliability/accuracy, safety, comfort, tariffs, infrastructure and facilities. Thus, there is no ideal Urban Mass Public Transportation service in Indonesia so that it can be used as a reference for improving SAUM in the Sarbagita area.

So far, the successful implementation of SAUM which has become a reference for the development of urban SAUM in several countries is in the City of Bogota, Colombia. In 2000, TransMilenio was introduced in the city of Bogota as a bus designed as a rapid transit system.

TransMilenio consists of four components, namely: dedicated infrastructure, efficient operation, sophisticated ticketing process, and the existence of a special agency that handles the planning, development and supervision of these modes of transportation. The TransMilenio ticket costs 900 pesos (0.30 USD). The ticket can be used for other buses on routes that TransMilenio does not pass. Ticket prices that apply to all destinations, so there is a cross-subsidies between passengers who travel close to far. The pricing system reflects social equality because generally the poorer people live far from the city center.

To operate, the government created a public company known as TransMilenio S. The company is a very small structure that is financed from three percent of ticket sales and other additional activities. In just three years, TransMilenio can serve five million commuters and residents in the metropolitan area. In a day, Transmilenio made 630,000 trips. After 5 (five) months of operation it was reported that TransMilenio had reduced fatal traffic accidents by 93 percent; reduce air pollution by 40 percent, reduce passenger travel time by 32 percent (9 percent of whom drive a car to work), passenger acceptance rates by 88 percent and ticket prices equivalent to 0.36 USD without subsidies. According to Echeverry et al (2004), Transmilenio's success in attracting more passengers is due to several factors, namely: lower costs and lower pollution; efficient in operation so that it does not cause pollution and moral hazard for vehicle operational actors. TransMilenio stipulates that the salary of the driver is not based on the number of passengers, so that the driver does not concentrate on finding passengers, which in turn makes the travel time of passengers very long; faster travel time; and the existence of TransMilenio connecting existing modes of transportation.

Currently, one of the government's efforts to ensure the operation of SAUM services in accordance with the established Minimum Service Standards (SPM) is through the provision of urban public transport subsidies as regulated in the Minister of Transportation Regulation Number PM 9 of 2020. This subsidy aims to increase the use of passenger transportation. quality, comfortable, safe, and affordable urban public services. The provision of this subsidy is carried out through the Buy The Services scheme in the form of purchasing services from public transportation companies to provide public passenger transportation in urban areas to the public.

One example of the application of this regulation is the Trans Metro Dewata service. This service is a program from the Ministry of Transportation of the Republic of Indonesia and Bali is the third service after Palembang and Surakarta in the Buy The Service (BTS) program. The operator operating the Trans Metro Dewata service is PT Satria Trans Jaya. The operational costs of Trans Metro Dewata are subsidized 100 percent by the Central Government. Thus, the implementation of SAUM services is a collaboration between the government and the private sector as operators. Given that the management of the Trans Metor Dewata service is fully funded by the State Budget, the Trans Metro Dewata service operates using the Road-based Minimum Service Standards (SPM) for road-based Mass Transportation set by the Indonesian Ministry of Transportation. The efforts that have been made by the Trans Metro Dewata management to overcome the very low demand are the application of free tickets for passengers, the operation of services consistently both in terms of the type of service and the quality of service. Types of services include: Security; safety; comfort; affordability; equality; and regularity. The service quality includes: indicators; and value, size or quantity. However, these efforts cannot necessarily increase demand. As previously discussed, an explicit constraint in the provision of SAUM services is the challenge of developing a service corridor that will have an impact on the financing aspect, both in the preparation stage which includes the provision of facilities and infrastructure, as well as in the operational stage regarding the financing needs of the Buy The Services scheme. In addition, the obstacle that may arise is the challenge of other transportation entrepreneurs (Taxi Transportation, Rental and Tourism) who are affected by the development of SAUM services which erode the market share of the transportation.

If the SAUM service can operate optimally, an efficient urban transportation system will be created, where the limited road space will be able to function optimally. Optimizing public transport services will reduce the use of private transport vehicles, which will reduce public transportation costs and reduce air pollution. Empirically, optimization of public transport services also reduces the rate of road accidents. The beneficiaries of this benefit are mainly users of public transportation, both from the Choice Riders group and especially from the Captive Riders group. In general, the benefits will be enjoyed by the urban community where the traffic will be smoother and orderly and the environmental quality of urban areas will be better. For the government, the benefits derived from implementing the mandate of the Law related to the obligation to provide mass public transportation services in urban areas as stated in (Article 158 paragraph 1 of Law Number 22 Year 2009 concerning Road Traffic and Transportation), also reduces the government's burden for provision of new roads to accommodate the movement of private vehicles.

The results of this study indicate that in order to optimally improve mass public transport services based on the demand and supply variables, it is necessary to improve the service certainty variable and service integration so that the optimization of urban public transport services in the Sarbagita area can be improved. Increased service certainty variables include indicators of accessibility, service level and service availability. The increase in integration variables includes indicators of physical integration, network integration and tariff integration as a reflection of service integration variables. Furthermore, to measure the success rate of improvement, this study proposes using indicators of affordability and regularity to reflect service optimization variables. The affordability indicator is measured by using the attributes of ease of moving services and tariff integration. Regularity indicators are measured using the attributes of waiting time, speed, downtime and information availability.

CONCLUSION AND SUGGESTION

Conclusion

Based on the results of research on the discussion that has been described previously, it can be concluded that Service demand and supply have a positive and significant impact on the certainty of road-based Mass Public Transport System (SAUM) services in the urban area of Sarbagita. Demand has no significant effect on the optimization of the road-based Mass Public Transport System (SAUM) in the urban area of Sarbagita. Indirectly, the demand and supply of services has a positive and significant impact on the optimization of the Mass Public Transportation System (SAUM) through service certainty and service integration on the road-based Mass Public Transportation System (SAUM) in the urban area of Sarbagita.

Based on the conclusions above, several things can be suggested, namely efforts to optimize SAUM need to be carried out to realize the efficiency of the transportation system in the urban area of Sarbagita. The optimization efforts are not only based on demand and supply of services but also involve variables between service certainty which include indicators of accessibility, service level and service availability and service integration variables which include indicators of physical integration, network integration and tariff integration.This research produces variables, indicators and measurement attributes in a structured manner in a unified system that can be used as an approach in planning and developing SAUM services so that they can run optimally.

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