

The Influence of New Service Attributes in the Trans-Sumatera Railway Operation Plan on User Choice



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ABSTRACT

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The Indonesian government, through the Directorate General of Railways, Ministry of Transportation, plans to operate the trans-Sumatra Rail Way or train transportation mode (TSRW), so that cities on the island of Sumatra will be fully connected. Meanwhile, on the one hand, the construction costs are very high, starting from the rails and bridges, stations and trains themselves, and on the other hand, cities in Sumatra are already operating with satisfactory service to travelers using road transportation modes, both ICIP buses and Small passenger cars (LPC) have very easy access, while on trains each passenger has to go to the station first or access is low, so it is feared that once this Trans Sumatra Rail Way (TSRW) or train operates, it will not be of interest to people traveling between cities on the island of Sumatra. So, to ensure that the Trans Sumatra Rail Way (TSRW) or train is in demand by people traveling between cities and provinces on the island of Sumatra, it is necessary to carry out a study by presenting a new service attribute that is not yet available in other modes of transportation besides the Trans Sumatra Rail Way (TSRW) or train and also so far. Currently, there are no studies that discuss this mode choice which includes this new service attribute, namely continuous integration between trains and online transportation such as Go-Car, Grab and Maxim by combining the payment of one ticket on the train ticket so that train passengers can be picked up at home and delivered to the train station for free which is called seamless service. The results of the study show that with the existence of this new service attribute as a new variable, it turns out that this trans Sumatra rail-way mode has a great opportunity to be used by people traveling between cities on the island of Sumatra with great opportunities with a market share of 81 percent.

1. INTRODUCTION

The quality of mass public transportation services is determined by how travelers as public transportation users perceive several services provided by certain public transportation. Public transportation services that determine quality are safety and accessibility. The accessibility referred to by the study [1], still does not fully reveal the other service attributes of a public transportation service even though it has detailed other attributes such as comfort, traveler's age, gender and so on.

Transportation system services by integrating various forms of transportation modes will influence the development of the areas served by the transportation system. The successful development of a country or region is greatly influenced by the role of transportation as the lifeblood or leading sector of economic, social, cultural, political and defense and security life.

The direction of development of the transportation system is to realize the mobility of people and goods needed for life

evenly and efficiently [2].

To accelerate the realization of this direction, the government has prepared a plan to develop various modes of transportation that are appropriate to the geographical conditions and characteristics of certain regions, one of which is the construction of a trans Sumatra railway network (trans Sumatra rail way).

However, according to Miro et al. [3], the realization of this plan cannot be separated from various aspects of consideration, both economic, environmental and the existing conditions of railway operations on the island of Sumatra itself.

Physically, the railway infrastructure network on the island of Sumatra is still not fully connected from the city of Banda Aceh to the city of Bandar Lampung or is still clustered in northern Sumatra, central Sumatra only in West Sumatra and southern Sumatra in Sumatra. South and Lampung only, so that services between big cities on the island of Sumatra are not connected, as a result, rail transportation services to people traveling between big cities on the island of Sumatra are not optimal and are still services within the scope of regional areas

by conditions. demand from each region or not yet in the form of a national scale network (Inter-City Inter-Province) as is the case on the island of Java.

The implication of the condition of railway services on the island of Sumatra as described above is that all passenger and goods travel need on a national scale (inter cities inter provinces) on the island of Sumatra, are accommodated or served by road transportation modes with a share of 25%, air transportation modes with the share is 25% and sea transportation, especially the Tanjung Priok Port Corridor - Belawan Port, is 50% [4]. Meanwhile, outside the Tanjung Priok Port - Belawan Port Sea Corridor, almost all large cities on the islands of Sumatra and Jakarta are connected by road transportation services (buses and trucks) and air transportation modes (planes).

Bearing in mind and considering the large costs of providing TSRW rail network infrastructure, including the procurement of stations as nodes, which are estimated at more than US \$16,060 billion, with a total planned rail length of 5,084 km [5], is it possible for the service provider to be able to at least return investment funds with maximum service attributes to service users, aspects of the number of transportation rates, operating frequency and travel time competing with road, sea and air transportation modes.

Each mode of public transportation has its own service characteristics that are different to influence users' choice of transportation mode, such as travel time, travel costs, departure frequency, comfort, and safety factors.

Meanwhile, Laurentia and Syafi'i [6] only studied the factors of ticket price, travel time, comfort, and frequency of travel as attributes of transportation mode services that influence travelers in choosing transportation modes. In addition, Djoeddawi et al. [7] only included the variables travel costs, travel time, and departure frequency as characteristics of transportation mode services that influence user behavior.

Research conducted by Neely [8] in estimating the potential movement of travelers from public buses to trains (railway re-activation plan from Jember to Panarukan), only adopted 2 transportation mode service attributes as variables that influence the behavior of travelers in choosing alternative modes, namely travel time and fare.

Li et al. [9] stated that this rail-based mode of transportation (train) has its own characteristics in the form of advantages and disadvantages like other modes of transportation such as public buses, travel or planes in serving travelers.

To attract travelers, every mode of transportation that will be provided, in this case, TSRW, must eliminate its shortcomings to compete with modes of transportation that are already operating, namely buses and planes. One of the disadvantages of the train mode according to the study [10] that its operations are not flexible either before the trip or during the trip, which is known as not going from door to door.

This research is intended to help a little in the implementation of TRSW operations by examining the opportunities or potential needs of people traveling, whether there is interest from people traveling between big cities on the islands of Sumatra and Jakarta. or not, provided that the services provided are at least the same as the existing modes of transportation currently operating, especially road, air, and sea, by including the new service attributes of the rail transportation mode as a new variable which is considered to have the potential to influence the behavior of travelers in using this mode. train transportation as a vehicle, namely in

the form of integration of trains with online road transportation in a sustainable form (the price of train tickets includes the cost of online transportation that picks up home/hotel where the traveling public is along the railroad corridor that connects the city of origin Padang to the destination city of Pekanbaru).

Bearing in mind and considering the large costs of developing the TSRW rail network infrastructure and train stations as the node points, as well as the procurement of vehicle facilities (trains) and train management, associated with the modes of transportation that are already operating, the problem in this research is: How big is the market share opportunity? (potential) TSRW passengers with services that are at least the same as the current operating modes of transportation (road and air transportation) by including new service attributes for transportation modes in the form of variable of trains with online highway transportation in a continuous form (train ticket prices are included the cost of online transportation that picks you up at home/hotel where the traveling public is located along the railway corridor that connects the city of origin of Padang to the destination city of Pekanbaru).

Thus, the research aim is to estimate the potential for this TSRW mode to be used by the traveling public by presenting a new service attribute in the form of integration of trains with online highway transportation in a sustainable form (train ticket prices include the cost of online transportation that picks up houses/hotels where the traveling public is located along the railway corridor that connects the city of origin of Padang to the destination city of Pekanbaru).

This research is important to carry out because the Minister of Transportation [11] said that in 2024 the operation of TSRW transportation services must be realized. Considering that time is not far away, all stages of work must be carried out quickly, including this research as a basis for operators to provide train services so that large investments are not wasted.

This research only examines the existence of market share or the potential travel needs of the traveling community from the city of Padang as a nodal point of origin to the city of Pekanbaru (the Padang-Pekanbaru corridor) as a basis that can describe or represent other corridors, namely to big cities in the islands of Sumatra and Jakarta in Java.

This means that what is being studied is whether there is interest (desire) among people traveling from the city of Padang to Pekanbaru as a basis. Cases for other large cities on the island of Sumatra and Jakarta on the island of Java use the TSRW transportation mode which has been served so far and use the road transportation mode. highway and air with the characteristics of the train service offered, especially the minimum fare, which is the same as road and air transportation modes, but the TSRW transportation mode, will include continuous integration with online transportation with 1 ticket.

Meanwhile, the scope of the research area is people traveling from the origin of Padang city to Pekanbaru (the Padang-Pekanbaru corridor), as shown in Figure 1.

The results of this research can be used as a basis for economic considerations for railway transportation operators as service providers before construction and operation trans-Sumatra (inter cities and provinces).

The outcome of this research is in the form of a large number of potential users of the rail transportation mode which will be operated to serve between large cities on the islands of Sumatra and Jakarta. The basis is the Padang-Pekanbaru corridor; if new service attributes are applied to the rail mode in the form of continuous (seamless service) highway at one

tariff.



Figure 1. Planned map of the trans-Sumatra railway for the Padang – Pekanbaru section
 Source: Directorate General of Railways, Ministry of Transportation RI, 2011 [12]

2. LITERATURE REVIEW

To study and observe how big and how many the number of trips both spatially or activity location and the means of transport (mode of transportation) used is very determined by factors or variables that are considered closely related with the occurrence of the number of trips such as, population, number of the population's activities, the time of activity and the characteristics of the population transportation services that are not the same between the same modes of transportation to with others [13].

Regarding the form of transportation that serves a trip generation number population that arises in a city or region, various forms mean of transportation will be faced by residents as travelers.

According to Wheeler [14], transportation modes are a way of how do people to make their way to a place pat what they want according to the activities they are in, which is this mode of transportation has fundamental technology different; some modes may require different environments. separate, has its own infrastructure, vehicles, and operations as the ring has unique rules that have advantages and rigidities own room.

The differences in the characteristics of the various modes of transportation have a significant influence on the traveling community to decide choice in choosing one of the various increases in available modes of transportation thereby increasing the market share certain modes of transportation have the opportunity to be popular and maybe not.

Koppelman and Bhat [15] stated that user satisfaction is the basis or foundation of theories related to only the choice of the user or consumer either individually - individuals or groups in choosing something to consume signal.

As users of goods or services, each consumer, either individually or in groups, will choose the goods and services they will use that can provide maximum satisfaction among their choices.

Maximum satisfaction in using goods and services is an indicator for each user, both individually and in groups, in assessing the goods and services they will use [16].

Furthermore, stated that maximum satisfaction in using goods and services in the alternative choice set, is a function

of several attributes of the goods and services that they will choose from some alternative goods and services in the choice set, which in this case also includes services or modes of transportation that transport people and goods from origin to destination.

Each type of transportation mode in serving and moving passengers and/or goods from origin to destination has several attributes that reflect their own service characteristics that are different from each other [17].

According to the study [18], the characteristics of a mode of transportation can be interpreted as the conditions and forms of service that can be provided by a particular mode of transportation to travelers, such as travel time, waiting time at the terminal, costs or transportation rates from origin to destination, safety, comfort, and convenience. to reach departure and transit locations to change modes. All of these characteristics are called service attributes.

One aspect that reflects the desire of the object being transported for the means of transportation that will be provided to serve the movement of the object being transported is the motivation of the object being transported, especially humans who travel from their place of origin to their destination, to use a particular means of transportation (a particular mode of transportation).

If the same origin-destination route and the same routes are served by alternative means of transport that provide more competitive services, of course the means of transport that will be provided (in this case the trans-Sunatera Railway), needs to be carried out. assessment, analytical review of the possibility (opportunity) of potential users (potential market) as a reflection of the object's desire to use a particular means of transport which will be held as part of the transportation planning process.

Studies related to potential travel needs using certain modes of transportation are observations or observations about the behavior of users of transportation modes (trip maker behavior), where this user behavior is in the form of user decisions in choosing 2 or more alternative modes of transportation that they will use which are in 4 stage transportation planning process including the mode choice stage. The decision will be to choose a mode of transportation that can provide a higher level of satisfaction. This level of satisfaction is empirically influenced by several variables that describe several service attributes of the available transportation modes and other characteristics such as the socio-economic characteristics of the user community, travel characteristics and conditions of the area served [19].

There is a lot of research in estimating the size of potential needs for travel several, whether travel or between cities within provinces and Inter Province). All adopt 4 characteristics above, including which reflect the service characteristics of transportation modes such as time, travel costs, and so on, all of these variables are indeed a common thing when using a mode Certain transportation means dealing with travel time, transportation costs, the presence of a group of forms of service such as comfort, security, accurate departure schedules and other attributes that exist in certain modes of transportation.

According to Shibata et al. [20], in his research, the determining factors used as independent variables in choosing the mode of transportation they will use, between public buses and private cars, concluded that trip makers using public buses and private cars are influenced by general variables such as travel time, travel costs, comfort, weather conditions and trip

maker characteristics. All the variables mentioned are variables that are always present in the journey.

Using rail transportation, usually transportation mode service attribute, namely where these two variables are services that are always is in the mode of transportation.

Other research in modeling choosing the mode of transportation, namely Mode-Mixed Transport (MMT), also adopted variables that are common to each service attribute of the chosen mode of transportation, namely private car ownership, availability of public transportation, type of travel destination and employment status [21].

In another study to estimate the number of inter-city trips that will use the fast train mode in Germany, Mandel et al. [22] still looked at the variables of travel time, travel costs, frequency of departure, and socioeconomic characteristics of travelers or still does not include the continuous service integration variable for train modes in its observations and their analysis to estimate the number of inter-city trips that will use the fast train mode in Germany, still observe the variables of travel time, travel costs, departure frequency and socioeconomic characteristics of travelers or still do not include continuous service integration variable for the train mode in his observations.

Meanwhile, travelers inter cities and provinces in choosing the available modes of transportation for tourist trips in Japan, even though they have included intangible factors (variables), still adopt variables that are still commonplace in the characteristics of transportation modes and travelers such as variables of travel timeliness, security, smoothness, baggage loading time [23].

Another research that is similar to this research is research conducted by the study [23], which examines whether there is a potential for travelers on the Malang - Surabaya route to use Inter City in Province public buses to the train mode which only adopts traveler characteristics variables, the frequency of train departure schedules, travel time, travel costs and the combined attributes of the two modes and if traced, have not yet adopted the continuous service variable (seamless service).

Another study of transportation mode choice that is similar to this research was that conducted by the study [24], who examined the development of a model for inter-city mode choice in Saudi Arabia using a disaggregate approach, still adopting the variables of travel time, travel costs, and economic characteristics of travelers. as a variable that influences travelers in choosing a mode of transportation.

The substance of this research is to find out whether the community or residents traveling from the city of Padang to the city of Pekanbaru will switch to using the cross-Sumatra train mode which is not yet operational but is planned to operate on the Padang - Pekanbaru route which is already served by the Inter City Inter Province bus transportation mode and Little Passenger Car (LPC) services are flexible from door to door, while the trans-Sumatra Rail Way or train transportation mode picks up and drops off passengers at stations, which means that travelers have to go to the station first to use this train.

The rail transportation mode is one of several existing forms of transportation, based on steel railroads, constructed either above ground, elevated railroads or underground with means of transport in the form of a series of carriages. Like other modes of transportation, rail transportation also has its own operational characteristics which are reflected in its advantages and disadvantages. Some of the advantages of this mode of rail transportation include large (mass) carrying

capacity, fast, economical, and environmentally friendly, while the disadvantages are high operational, maintenance and construction costs, inability to serve door to door, and depends on other transportation in it's a highway. Taking into account the shortcomings of this rail transportation mode, it creates a dilemma for operation and a big challenge to be competent with the existing transportation modes serving people's trips in the Padang - Pekanbaru corridor, namely the Inter City Inter Province Bus and Little Passenger Car (LPC) road transportation modes. Therefore, it is necessary to add a service attribute for the trans-Sumatra Railway or train mode, which is not available for the Inter City Inter Province Bus and LPC road transportation modes, namely the latest model of intermodal integration services.

Semler and Hale [25] stated that access to and from stations can increase the number of train passengers at certain stations, but which access is best to implement, so that users have the opportunity to choose the train transportation mode as their means of transport from origin to destination. This research will try to offer a higher level of access than the access recommended by, namely continuous integration (seamless services). The continuous integration that will be implemented in rail passenger transit from road transportation modes will be used as a new variable in this research as well as to fill the gap in previous similar research.

In several similar studies reviewed, no one has yet adopted the attribute of continuous integration services (seamless services) in the form of pick-up services to homes or other locations where potential train passengers are using online transportation such as Go-Car, Grab, Maxim, and others. etc. for free because online transportation costs are included in the train ticket price, so the characteristics of train services are conditioned as door-to-door.

From the research above, the service attributes of integrating two modes of rail transportation with online transportation as a whole through a single payment ticket system or method do not seem to have been studied, whether it has an effect on inter-city and inter-provincial travelers in choosing the Inter-City Bus transportation mode Province, travel (mode that is already operating) by train trans-Sumatera Rail Way or TSRW (mode that will be operated). So, in this research, this service attribute will be studied as an independent variable in influencing mode users [26].

How the technical implementation of the new service attribute of continuous integration between TSRW and online transportation operating on the highway with a one-ticket system will be explained in detail in the simulation through the following stages.

Stage 1:

Identifying the actors involved in the system of integrating rail transportation modes with sustainable service patterns. For each actor that has been identified, a numerical code is given 1, 2, ..., and so on. The actors involved in this intermodal integration system are as follows:

1. People who travel to the main cities in the island of Sumatra which is planned to be passed by the TSRW mode of transportation starting from Pekanbaru, Jambi, Medan, Banda Aceh, Palembang, Bengkulu, Bandar Lampung and Jakarta on the island of Java, is given the code number 1.

2. The provider of inter-city inter-provincial modes in this case is Train Indonesia company which provide transfer and transportation services Transport to the cities you plan to stop by The TSRW transportation mode is coded number 2.

3. The providers of mode-integrating transportation that serve business actors roads from the City of Padang to the main cities on the island of Sumatra and Jakarta on the island of

Java which acts as a service provider move from home or hotel according to the data entered into Train Indonesia Company when buying a ticket to the departure station and application-based, coded number 3.

Stage 2:

It is a flow of work procedures in a continuous service integration system sequentially with the following steps.

Actor 1 has decided to travel from Padang to the planned destination city using train transportation by purchasing tickets either manually at the departure station or online with e-tickets such as, tiket.com, Agoda, Pegipegi.com, etc. by entering data in the form of name, cellphone number and address of residence or hotel where you are staying. Data from actor 1 has automatically been collected by actor 2 as the database holder. To regulate the work process, actor 2 has the authority to set a time limit for purchasing tickets no later than 6 hours before the scheduled train departure on the same day. The database containing data on the name, cellphone number, and address of perpetrator 1, by perpetrator 2, is used as information distributed to perpetrator 3 via the online transportation application.

Stage 3:

Actor 3 contacts actor 1 according to the data received from actor 2 to carry out the pick-up service according to the data provided receive from actor 2 (address or location of the hotel where actor 1 is staying) on a certain train departure schedule to the location according to the data and take it to the departure station, the stages are completed as in the workflow Figure 2.

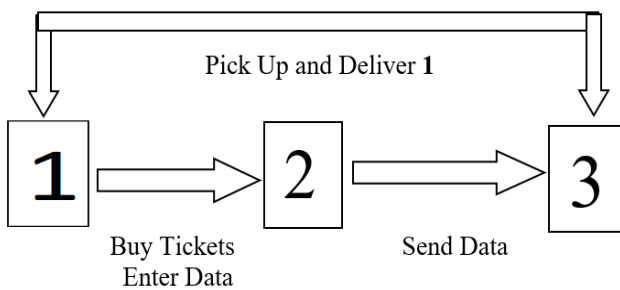


Figure 2. Moda continuous integration system workflow train with online road transport

3. METHODOLOGY

In this research, as a first step, a review or literature review of similar studies was carried out relating to the analysis of the choice of transportation modes by travelers, especially the service attributes of transportation modes which were used as variables that were hypothetically considered to influence the behavior of travelers in choosing certain modes of transportation in journey from origin to destination.

As we already know, traveler satisfaction using alternative modes of transportation available on a particular corridor is influenced by travel costs (fares), vehicle travel time from the origin terminal/station to the destination terminal/station,

departure frequency, safety, comfort, and characteristics. traveler's socioeconomic status. So, in this research, after reviewing studies with the same analysis, the variables that influence travel behavior in the form of service attributes of transportation modes, so far have not included sustainable service attributes in train transportation modes because physically the train transportation mode is not flexible or not flexible. With continuous service through the integration of train transportation modes with online transportation, the continuous service variable in the form of integration of train transportation modes with online transportation modes with a continuous service system is included in the satisfaction function equation as an independent variable that also influences traveler's satisfaction in choosing the train transportation mode TSRW which will be operated with existing transportation modes such as buses, passenger car little (road) and flights (air) as in the following Eq. (1).

$$U_i = f(TC, TTT, DF, SS) \tag{1}$$

where,

- U_i = Traveler's satisfaction value in choosing transportation;
- TTC = Total Cost during travel by mode transportation i ;
- TTT = Total time during travel by mode transportation i ;
- DF = Departure frequency per mode day transportation i ;
- SS = Seamless service (Integration Continuation) or Seamless Service for TSRW mode.

After the model was formed by including a new variable for the train transportation mode continuous services with Go-Car, Maxim and Grab modes, a primary survey was conducted with the respondents being people in the three provinces of West Sumatra, Riau and Jambi using the stated preference approach method by distributing a questionnaire form. already prepared beforehand.

Furthermore, the results of this survey will be analyzed using a multiple linear regression statistical analysis tool which has included a new variable of sustainable service in the rail transportation mode to determine the satisfaction of travelers using the train transportation mode, as in Eqs. (1)-(3). Then, from the satisfaction that has been obtained, it can be estimated the opportunity for the rail transportation mode to be used as the preferred transportation mode using model (4) as a basis for determining policy [27, 28].

In general, the form of the analysis model for user satisfaction with transportation services using a linear regression equation approach that includes unobserved variables (error) is as follows.

$$Y = Constanta (a) + \sum b X + e \tag{2}$$

where,

- Y = Traveler's satisfaction using a mode (TSRW/Train).
 - X = Independent variable in the form of service attributes Transportation mode.
 - b = Regression Coefficient.
 - a = Constanta.
 - e = represents variables not included (error/not observed).
 - \sum = Some the independent variables (service attributes).
- Slovin [29] says that the traveler's satisfaction function in Eq. (3), can be expressed in the form of an econometric model that describes satisfaction choosing preferred as in the following utility equation:

$$U_{ci} = \alpha + \sum_{k=1}^k \beta_k X_{cki} \quad (3)$$

where,

U_{ci} = Trip maker satisfaction using the mode of transportation choice;

α = Constant;

X = Many k service attributes transportation mode affecting traveler satisfaction choose the mode of transportation.

Furthermore, to determine how big a chance the TSRW transportation mode will be used by the trip-maker public from the city of Padang to the city of Pekanbaru as a case study and representing other cities on the islands of Sumatra and Jakarta, it can be determined by entering the satisfaction value that has been obtained from the Eqs. (1)-(3) into the probability model that a mode of transportation will be selected/used as follows.

$$P = \frac{\exp(Y_{mi})}{\sum_{h=2}^M \exp(Y_{hi})} \quad (4)$$

where,

P = Opportunity of the TSRW mode used by travelers;

$Y_{TSRW/mi}$ = Railway mode satisfaction value (to be held);

$Y_{ICIPBUS/hi}$ = Bus mode satisfaction value;

$Y_{TRA/hi}$ = LPC mode satisfaction value.

3.1 Survey method design

The design of the survey method begins by creating a survey form (questionnaire form) with a stated preference approach because one mode of transportation, namely the Trans Sumatra Rail Way (TSRW), is not yet operational, which means that the service attributes of this TSRW mode are a scenario, this scenario of service attributes of transportation modes that are not yet operational (TSRW), how these service attributes are attractive to travelers so that travelers choose and like the TSRW transportation mode.

The service attributes of each mode of transportation, Inter City Inter Province Bus (ICIP Bus), Little Passenger Car (LPC) and TSRW, are rated in two categories, namely High and Low as in Table 1.

Based on the classification/levels and attribute values as in Table 1, the number of alternative scenarios is $24 = 2 \times 2 \times 2 \times 2 = 16$ scenarios, where this number according to the study [29], is the number of scenarios that are suitable for conducting a survey on respondents, namely 9 to 16 scenarios and of course we don't need to reduce it further.

After we have grouped the four alternative transportation mode service attributes into levels and given a value for each level according to the operational facts of the transportation modes that are already in operation, the next step is to differentiate each level of the four transportation mode service attributes by giving a minus sign (-). on service attributes with high value, namely total travel time and total costs during the trip and the opposite is a plus sign (+). Meanwhile, the 2 departure frequency attributes and the new sustainable service attribute for the mode of transportation that will be operated are the TSRW with a minus (-) sign at a low-value level and a plus (+) at a high-value level.

Table 1. Level and value of alternative transportation mode service attributes

Mode Service Attributes	Level	Value
1.Total Travel Time (hours) – TTT	Hight	11 (ICIP Bus) - 9 (LPC) -11 (TSRW)
	Low	12 (ICIP Bus) - 10 (LPC) - 12 (TSRW)
2.Total Travel Costs (Ticket and other costs (IDR)) – TTC	Hight	250th (ICIP Bus) - 200th (LPC) - 200th (TSRW)
	Low	300th (ICIP Bus) - 250th (LPC) - 250th (TSRW)
3. Departure Frequency (time) – DF	Hight	2 (ICIP Bus) - 10 (LPC) - 3 (TSRW)
	Low	1 (ICIP Bus) - 9 (LPC) - 2 (TSRW)
4. Pick-up service with Online Transportation without paying (1 to 6) – Seamless Service / SS.	Hight	1. Integrated with transportation online- 6 (for the TSRW only). 2. Special LPC pick up – 5 (for LPC) 3. Special Travel not pick up – 4 (for LPC).
	Low	4.Located near the train station-3 5.ICIP Bus (if picked up) – 2 (for ICIP Bus) 6. Go alone to the transportation departure point – 1

Source: Beginning survey, 2021

Table 2. Population of West Sumatra, Riau and Jambi provinces in 2022

No.	Province	Number of Population (Person)	Number of Sample per Province
1.	West Sumatera	5,640,629	35%
2.	Riau	6,614,384	42%
3.	Jambi	3,677,894	23%

Source: Central Bureau of Statistics Provinces of West Sumatra, Riau and Jambi in 2022

After the situation choice scenarios have been determined, namely 16 scenarios/situations, the next step is to create a questionnaire form which will be distributed to respondents by first reducing it, so that the survey is easier and more practical, to half or 50 percent of the 16 scenarios to 8 scenarios which will be included on the questionnaire form, which is by what was suggested by the studies [29-31] using NGene version 1.2.1 software, so that the choice scenarios become 8 (eight) scenarios/situations listed on the questionnaire form with a stated preference approach.

This survey form with 8 (eight) scenarios/situations was distributed to respondents, where the respondents were residents who live in locations crossed by the planned TSRW to be built and operated along the Padang – Pekanbaru and Jambi corridor. The survey method used is a survey that visits individual respondents to the location where they are (home interview), with a random sample whose population is the total population in the provinces of West Sumatra, Riau, and Jambi.

The sample determination for this research used the method [32] with a confidence level of 5%, so the sample size was 398 respondents rounded up to 400 respondents.

Apart from that, the proportional method was also used using the table of the study [33] with the same results, namely 399 respondents increased to 400 respondents. A total of 400 copies of the survey form were prepared, containing 3 sections,

each of which is the characteristics/profile of the respondent, mode selection with 8 scenarios/situations and a statement of service attributes in the TSRW mode.

If classified by province, the sample size of 400 respondents is divided again proportionally according to the population of each province as in Table 2.

4. DISCUSSION AND ANALYSIS

The survey data that has been obtained can be presented at the beginning of this article, where in its presentation, it can be differentiated according to; firstly, how to obtain it and secondly how to handle it further, whether the data merely provides an overview, as input for analysis in determining policy, or as input to achieve the objectives and output of the research.

Regardless of the purpose of this data, it depends on how it is collected, where the data is collected, in general it is known, namely primary data and secondary data. Secondary data in this research was obtained through bodies or organizations related to the achievement of the results of this research, which in this case are of course companies providing inter-city, inter-provincial (ICIP) transportation services, which in this research are ICIP bus modes and LPC modes that are already operating, where the data needed here to measure the service attributes of the two modes of transportation is the fare or ticket price plus other costs that must be incurred by the Padang - Pekanbaru traveler, departure frequency and travel time for the two modes of transportation plus time outside the vehicle.

The three values or magnitudes of service attributes for the modes of transportation that are already in operation (ICIP Bus and LPC), can be presented in Table 3 below.

Table 3. Basic values of ICIP bus and LPC transport mode service attributes (Ticket price, departure frequency and travel time)

No.	Mode of Transportation that are Already Operating (Padang – Pekanbaru)	Ticket Price (IDR/pass)	Travel Time (hour)	Frequency (time)
1	ICIP Bus	150,000	8	1 or 2
2	LPC Mode	220,000	7	10

Source: Transportation service provider company, 2023

Analysis of survey data, according to the questionnaire form, is divided into 3 analysis parts, namely; analysis of characteristics/profiles of respondents, analysis of satisfaction functions and service attributes that most influence respondents in making choices, followed by analysis of the opportunities for each mode of transportation chosen by respondents and the third part is analysis of respondents' statements regarding the service attributes that will be applied to the TSRW transportation mode, if desired. operated later.

We can review and observe the characteristics or profiles of respondents from matters relating to survey locations in the three provinces of West Sumatra, Riau and Jambi, gender, highest level of education, occupation, monthly income (in millions of rupiah) and trip purpose to destination. purpose of using public transport.

The observation locations were carried out in three provinces, West Sumatra, Riau and Jambi. In accordance with the largest population, Riau province, the largest sample of respondents was in Riau province, namely 168 respondents, West Sumatra 140 and Jambi only 92 respondents.

In each of these provinces, if we look at the gender characteristics, there are more males than females. Meanwhile, the highest education level for respondents from each province was Senior High School (SHS)/Vocational School (VS). Then the largest number of jobs in each province are also students.

Meanwhile, regarding respondents' income, there were slight differences between the observed provinces, where for West Sumatra province the highest were respondents with incomes of 1.5-3 million, while for Riau and Jambi both the highest were respondents with incomes <1.5 million. Likewise, the characteristics of respondents' travel intentions to destination cities using public transportation, in each province observed, are also not the same, namely the highest are respondents with recreational travel intentions in the provinces of West Sumatra and Riau, while in Jambi province the respondents' travel intentions are the most is Visiting Family.

The entire description of the characteristics/profiles of these respondents can be seen more clearly through the graphs shown in Figures 3-8.

The next section is an analysis of the choice of transportation modes and influencing factors. The data analyzed in selecting this mode is data obtained from the survey results of the questionnaire form part B (Option Form) which measures overall (generalize value) four service attributes of the three selected modes of transportation where 2 modes are already operating (ICIP Bus and LPC mode) and 1 mode does not yet exist (TSRW mode) in the form of:

1. Total Travel Time (symbol TTT).
2. Total Cost during the Trip (TTC symbol).
3. Number of scheduled departures (symbol DF).
4. Continuous Integration Services/seamless service (symbol SS).

Where service attribute number 4, namely continuous integration service/seamless service, is a new variable that has not been researched by researchers in previous similar studies which is planned to be implemented specifically for the TSRW transportation mode.

These four service attributes are used as factors (variables) which are considered to have a significant influence on travelers in determining the choice of transportation mode they will use when traveling Padang - Pekanbaru.

On the other hand, the traveler's choice is used as a dependent variable which is considered to be determined by the four service attributes above.

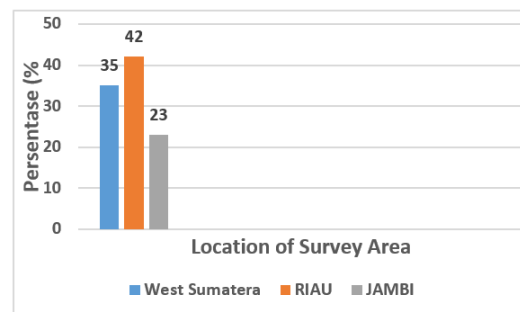


Figure 3. Survey location (Questionnaire form distribution place)

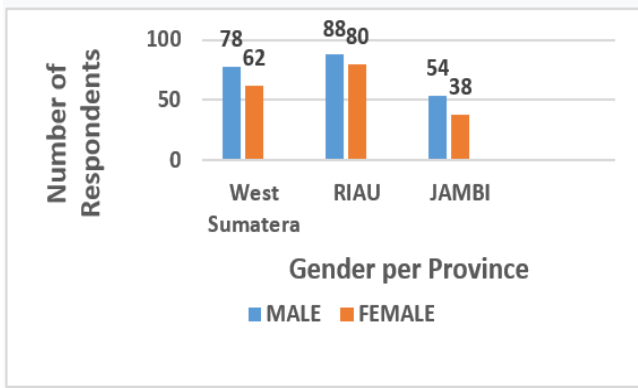


Figure 4. Gender of respondents in each province

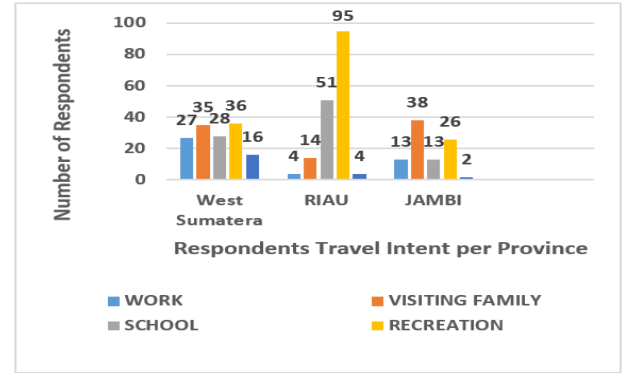


Figure 8. Intent travel to the destination city

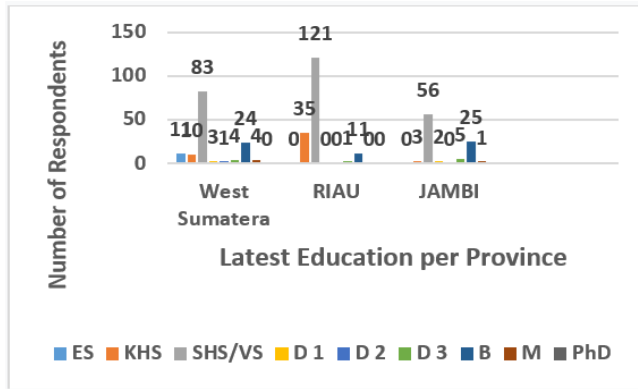


Figure 5. Respondents last education

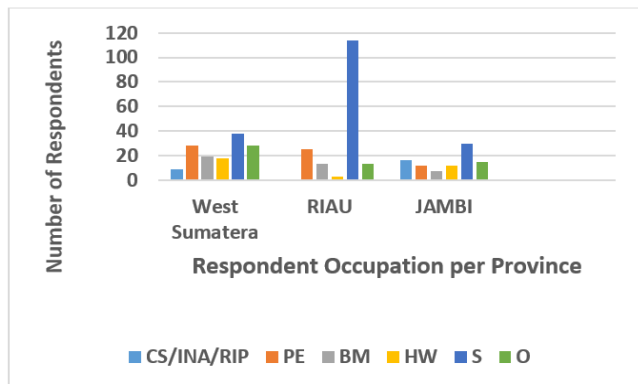


Figure 6. Respondent's occupation

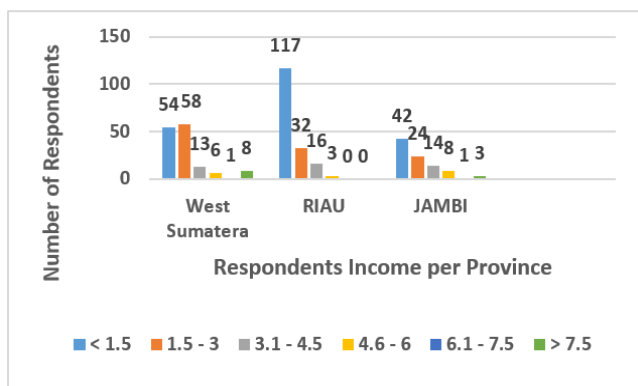


Figure 7. Respondent's income per month (in million IDR)

4.1 Estimated user satisfaction of alternative modes

After all questionnaire forms were collected from 400 respondents, the data was recapitulated in a Microsoft Excel file with a total of 3,200 observations (n), for 1 respondent, there were 8 situations (scenarios), which were then input into the statistical data processing program Nlogit version 8 (Limdep 11) as in the example in Table 4.

Through data processing tools for the survey results in Table 4, with a total of 9600 observations (n=9600) using the Nlogit version 8 tool, the independent variable parameter values were obtained which are service attributes for each mode of transportation, as in Table 5 below.

Overall, the four the preferred mode of transportation have a strong relationship with the dependent variable in the form of determining the traveler's choice to choose one mode, whether ICIP Bus, LPC or TSRW mode which is conditioned by attributes such as ICIP Bus and LPC. which means that these four independent variables are valid to be used as influential factors in the multinomial logit (MNL) model because the three independent variables, namely TTT, TTC, and DF.

Table 4. Data from the 1st respondent survey with 8 observation scenarios

Alt.	Choice	Time	Cost	Freq.	SEM/SS
1	0	11	250000	2	2
2	0	9	200000	10	5
3	1	11	200000	3	6
1	0	11	250000	1	1
2	0	9	200000	9	4
3	1	11	200000	2	6
1	0	11	300000	2	2
2	0	9	250000	10	5
3	1	11	250000	3	6
1	0	11	300000	1	1
2	0	9	250000	9	4
3	1	11	250000	2	6
1	0	12	250000	2	2
2	0	10	200000	10	5
3	1	12	200000	3	6
1	0	12	250000	1	1
2	0	10	200000	9	4
3	1	12	200000	2	6
1	0	12	300000	2	2
2	0	10	250000	10	5
3	1	12	250000	3	6
1	0	12	300000	1	1
2	0	10	250000	9	4
3	1	12	250000	2	6

Source: Primary survey results 2022 to 2023

Table 5. Parameter estimation

No.	Service Attribute Mode as Independent Var.	Degree of Freedom	Coefficient Value	t Calculated	Sig.F	% Sig.	R and R ²	SE
1	(Const.)	9595	0.104	1.29	0	0.05		0.08
2	TIME	9595	-0.02	-1.75	0	0.05	0.75	0.01
3	COST	9595	-0.03	-3.07	0	0.05	and	0
4	FREQ	9595	-0.5	-33.87	0	0.05	0.56	0
5	SEM/SS	9595	0.74	83.2	0	0.05		0

Source: SPSS data processing results, 2023

Likewise, the correlation of all independent variables simultaneously shows a strong relationship, namely 0.75. Meanwhile, the R² value is 0.57, indicating that simultaneously all the service attributes of the transportation modes entered into the model determine the decision to choose a competent transportation mode, which according to statisticians [34] are the four influential independent variables. to the traveller’s decision to choose alternative modes of transportation in the moderate category (ranging from 0.50 to 0.74).

The next step, to see which service attributes for each mode of transportation in the choice set have the biggest influence on determining the choice of traveller respondents in choosing a mode of transportation, we can enter the data processing output results in Table 5 into the functional relationship equation model (1) as follows:

$$U_c = 0,104 - 0,02TIME - 0,03COST - 0,50FREQ + 0,74SEM \tag{5}$$

where,

U_c = Satisfaction using the chosen mode of transportation (ICIP Bus, LPC or TSRW);

TIME = Total time using each mode;

COST = Total Cost of using each mode;

FREQ = Number of Departures for each mode;

SEM = Continuous Integration Service Level Each mode, specifically TSRW has the most levels high, as a new service attribute;

0.104 = Constanta;

0.02, 0.03, 0.50 and 0.74 = regression coefficient parameters.

The regression coefficient in the satisfaction function equation shows that the continuous integration service attribute (SEM) has the greatest influence on traveller satisfaction compared to the TIME service attribute. COST and FREQ are 0.74, which means that the service attribute that has the highest scale is 6 for the TSRW transportation mode. If increased from a scale of 1 to 6, it has an effect on increasing user satisfaction of the mode by 0.74.

For the satisfaction function of respondents using modes of transportation whose parameter values are known, we can determine the amount of satisfaction (utility) for each mode by entering the service attribute values as in Table 3 above into the satisfaction function in Eq. (5).

4.2 Opportunities for alternative transportation modes selected by user

The respondent's satisfaction value in using each of these selected transportation modes can be used to determine the opportunity or share of which transportation mode has a greater proportion to be chosen by users using the multinomial logit (MNL) equation model in Eq. (4).

Through Eq. (5), the user satisfaction value in using the chosen mode of transportation, which in this case is the ICIP Bus, LPC (transportation mode that is already operating), and the Trans-Sumatera Railway or TSRW (to be operated) can be used as follows; TIME, COST, FREG and SEM have t-calculated values greater than the t-table (1.60).

$$P_{(ICIP Bus)} = \frac{e^{-4.876}}{e^{-4.876} + e^{-7.376} + e^{-3.176}} = \frac{0.008}{0.008 + 0.002 + 0.042} = \frac{0.008}{0.052} = 0.15384615 = 0.15 \text{ (15 \%)}$$

$$P_{(LPC)} = \frac{0.002}{0.052} = 0.03846154 = 0.04 \text{ (4 \%)}$$

$$P_{(TSRW)} = \frac{0.042}{0.213} = 0.80769231 = 0.81 \text{ (81 \%)}$$

4.3 Analysis of respondents’ statements on mode service attributes TSRW

In the third part of the questionnaire form, it is devoted to the Trans Sumatera Rail-Way or train transportation mode (TSRW) only, where in this section respondents are asked to provide their statements regarding the service attributes that will be applied to the Trans Sumatera Rail-Way transportation mode (TSRW), if they are operated simultaneously with existing modes of transportation, namely ICIP Bus and LPC.

The service attributes that will apply to this TSRW mode are:

1. Trans-Sumatra Rail-Way (TSRW) with new service attributes in the form of pick-up to locations where passengers are in the Padang city and other cities in the provinces of West Sumatra, Riau and Jambi which are planned to be crossed by the trans-Sumatra railway area with online transportation (Go-Car, Grab and Maxim) without paying (included in the train ticket price) is planned to be implemented.

2. If the Tariff (Ticket Price) for the TSRW train is applied, it includes a pick-up service to your location using online transportation (Go-Car, Grab or Maxim) with the same amount as the ICIP Public Bus or LPC, with:

1). Lowest: Padang – Pekanbaru: IDR 200,000

2). Highest: Padang – Pekanbaru: IDR 300,000

3. If the total travel time for the TSRW was faster from ICIP Public Bus or LPC, with:

- 1). Shortest: Padang – Pekanbaru: 7 hours
- 2). Longest: Padang – Pekanbaru: 9 hours
4. If the number of departures for the TSRW is from departure city, set 3 times a day:
 - Morning time: 09.00
 - Afternoon time: 14.00
 - Night time: 21.00

Respondents (400 samples) were asked to determine their statements regarding the 4 (four) service attributes above that would be implemented specifically for the TSRW transportation mode that would be built and operated. Respondents statements were divided into 5 (line) levels, namely; 1. Strongly Agree (Weight 5), 2. Agree (Weight 4), 3. Neutral (Weight 3), 4. Disagree (Weight 2), and 5. Strongly Disagree (Weight 1).

As a result of data collection using the questionnaire survey form, data was obtained on respondents' statements regarding the 4 service attributes that will be applied to the KALS transportation mode that will be planned to be built and operated as in Table 6 following.

Of the 4 (four) service attributes used as independent variables in the relationship model between the dependent variable (respondents' choice of alternative modes of transportation), and the independent variable (mode service attributes), in general, the service attribute has the highest percentage of total respondents who stated Strongly Agree (SA), Agree (A), Neutral (N), Disagree (D) and Strongly Disagree (SD), we can judge that these service attributes are the ones that are most in demand by respondents as users of the preferred mode of transportation.

In accordance with the results of the primary survey data recapitulation related to the respondents' statements (preferences) presented in Table 6, the Continuous Integration

service attribute (pick-up to locations where passengers are within the city of Padang and other cities along the cross-railway track Sumatra in Riau and Jambi to the city of Pekanbaru with Online Transportation (Go-Car, Grab and Maxim) without paying (included in the train ticket price planned to be implemented) or Seamless Service (SS) saw the highest percentage of Strongly Agree statements (SA), compared to other service attributes, the TSRW tariff that will be applied, the Total TSRW Travel Time and the TSRW Departure Frequency that will be applied. As explained above, the continuous integration attribute that is applied to this TSRW mode is a service attribute (new variable) that this means it can be said to be novelty in this research. Graphically, the data recap in Table 6 can also be explained in Figure 9 on this research.

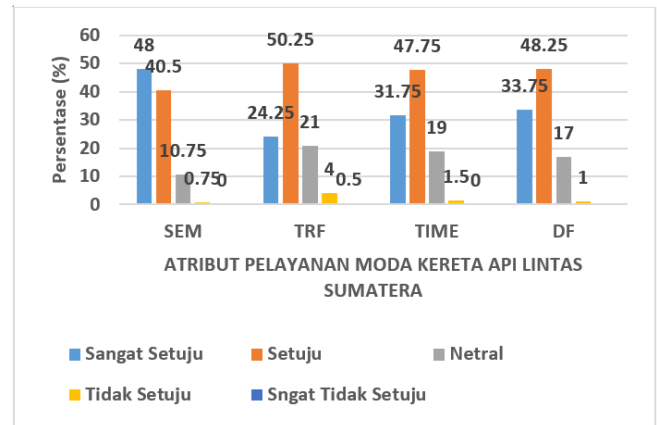


Figure 9. Distribution of respondents statements regarding service attributes TSRW transportation mode

Table 6. Recap of respondent statement data (preferences) for 4 service attributes in TSRW transportation modes

No.	Service Attribute TSRW Mode (Variable)	Notation	SA	A	N	DA	SD	Total
1	Continuous Integration (Pick up to the location where the passenger is within the departure city are using online transportation (Go-Car, Grab and Maxim) without paying (include in train ticket price planned to be implemented).	SEM	192 (48%)	162 (40.55%)	43 (10.75%)	3 (0.75%)	0 (0%)	400 (100%)
2	Basic Fare (ticket price) that will apply to TSRW Mode: 1. Lowest: IDR 200,000; 2. Highest: IDR 300,000	TRF	97 (24.25%)	201 (50.25%)	84 (21%)	16 (4%)	2 (0.5%)	400 (100%)
3	TSRW Total Travel TIME is faster than ICIP Bus or LPC, with: 1. Padang-Pekanbaru 7 hours; 2. Oldest: Padang-Pekanbaru 9 hours.	TTT	127 (31.75%)	191 (47.75%)	76 (19%)	6 (1.5%)	0 (0%)	400 (100%)
4	The number of TSRW departures, from the departure city, is set at 3 time a day: 1. Morning Time: 09.00 AM. 2. Afternoon Time: 02.00 PM. 3. Night Time: 09.00 PM	DF	135 (33.75%)	193 (48.25%)	68 (17%)	4 (1%)	0 (0%)	400 (100%)

Source: Primary survey, 2022 to 2023

5. CONCLUSION

As stated in the introduction, this research aims to estimate the potential of this TSRW mode, which will be used by the trip maker public by presenting an attribute of trains with online road transportation in a seamless service integration form (train ticket prices are already including the cost of online transportation that picks you up at home/hotel where the traveling public is along the railway corridor that connects the city of origin, Padang, to the destination city of Pekanbaru).

Based on the results of the analysis that has been carried out,

several conclusions can be drawn as follows;

1. In this research, the service attributes used as influencing factors or as variables in the satisfaction function model are total travel time (TTT), total travel costs (TTC), number of scheduled departures (FREQ) and new service attributes that have not been researched in previous research, namely continuous integration between the trans-Sumatra railway mode (TSRW) with road transportation modes, namely transportation modes with online applications (Go-Car, Grab-Car and Maxim-Car, etc.) with 1 ticket that is embedded in the train ticket, which means train passengers who have purchased

a free ticket are picked up at the pick-up point to be taken to the train departure station by Go-Car, Grab-Car and Maxim-Car transportation modes without having to pay again (Seamless Service/SEM). The four independent variables in the form of service attributes, obtained from statistical data processing using SPSS version 26 are:

1. TTT = - 0.02.
2. TTC = - 0.03.
3. FREQ = - 0.50
4. SEM = + 0.74.

This means that this new service attribute (SEM) is the factor that has the biggest influence on the decision of the traveling public in choosing three modes that will take them to their destination city. This new service attribute is planned to be applied to the trans-Sumatra Railway (TSRW) transportation mode.

2. The next statistical result is the partial correlation coefficient (R) (each service attribute), obtained as follows:

1. R TTT with CHOICE = 0.28
2. R TTC with CHOICE = 0.31
3. R FREQ with CHOICE = 0.23
4. R SEM with CHOICE = 0.61

These results prove that the new service attribute (SEM) has a strong correlation with the decision of the traveling public in choosing a mode of transportation that will take them to their destination city.

3. Satisfaction value through the satisfaction function of each mode of transportation, shows that the train transportation mode across Sumatra (KLAS) has the highest value relative to the AKAP Bus and Travel modes, namely - 3.176. Meanwhile, the AKAP Bus and Travel modes respectively have values of - 4,876 and - 7,376.

4. This satisfaction value in the satisfaction function of using each mode of transportation is used to determine the opportunity for each mode of transportation to be selected by potential users using the multinomial logit (MNL) model, with the following results;

1. Bus Transportation Mode AKAP = 15%.
2. Travel Transportation Mode = 4%.
3. Trans-Sumatra Railway Transportation Mode (to be operated) = 81 %.

Based on the research results that have been obtained, the following can be put forward several recommend as a follow-up, namely;

1. Recommend for further research

The new service attribute of intermodal integration at locations where public transport (transit) is changed modes continuously with one ticket (seamless service) can also be carried out for other modes where the location where the mode is changed is a long distance in kilometers from the location of the potential user, such as the bus mode. ICIPP at terminals, inter-island ships, ferry, rivers and lakes at ports and aircraft modes at airports. What this means is, if the user uses a plane, boat or bus, they can be picked up at the user's location and taken to the departure location as mentioned above with 1 bus, boat or plane ticket using online transportation (Go-Car, Maxim, Grab) directly. free because the cost is included in the ticket price.

2. Recommend for service providers

Trials can be carried out to see the interest of potential users in the modes of transportation provided, so that people who are potential users will certainly choose more of the modes of transportation provided.

3. Recommend for the government

As the party that makes policies and regulates the implementation of public transportation, the government can follow up on these new service attributes by formulating them through regulations, decisions or the like.

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