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Potential Use of Trans-Sumatra Railway Through Seamless Integration Service with Online Transportation

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ABSTRACT

This research aims to determine the initial stage of the process series and estimate the level of travelers' desire from Padang to other cities on the Sumatra Island using the trans-Sumatra railway transportation mode planned by the government to operate in 2024. Due to the enormous cost of development investment, data was obtained by observing potential users through a preliminary survey and by distributing questionnaires to residents of Padang city. This was carried out to determine the public's interest in the railway mode, which has been served by flexible transportation modes, such as Inter-City Inter-Provincial buses and planes. Furthermore, the analytical method was used to determine whether the community wants to use the trans Sumatra rail mode and the implementation of new services to integrate with a Seamless system in train operations. Studies have not been previously conducted on a Seamless door-to-door service. The result showed a need for new service attributes in the rail transportation mode by making the train flexible with door-to-door service and the implementation of a Seamless Service with 1 ticket.

1. INTRODUCTION

The Indonesian government in collaboration with the National Railway Master Plan (RIPNAS), intends to realize the Trans Sumatra Railways as well as ensure that the existing lines, including those in the provinces of Aceh, Lampung, North, West and South Sumatra, become a network of interconnected railways by 2030 [1]. However, the realization of this plan is possible only when various aspects relating to the economy, environment and the existing conditions of railroad operations in Sumatra Island have been considered. The current state of railway operations shows that the trans-Sumatra was initially accommodated by the road transportation mode, which possesses more flexible operational characteristics and door-to-door services based on 3 (three) scales of origin-destination (near, medium and far) using different types of large, and medium buses including standard passenger cars, in addition, it also offers various services. Consequently, another transportation mode that serves and connects cities on the island, although not as common as the road transport system, is air transportation, which covers middle and long distances.

Therefore, enormous costs, discreet and accurate studies need to be carried out to realize the inter-city or province train operation on the trans-Sumatra rail network.

The train's potential use to convey passengers both on a national or regional scale (Inter City Inter Province and Inter City in Province) has characteristics and attributes dissimilar to the other means of transportation, namely cars, motorcycles, buses, tractors or trucks, including airplanes. One of its characteristics is that its services are inflexible because passengers are only stopped at the train station and need to use road transportation to get to their final destination.

Figure 1. Map of the Trans Sumatra Railway plan
(Source: Directorate General of Railways, Ministry of Transportation RI, 2011 [1])

In order to enhance the plan for the operational development of the cross-Sumatra railroad, a scientific basis is needed to examine the extent to this means of transportation to travelers departing from Padang city to other regions on the island. However, because trains have empirically influenced travelers' behavior in the community, their service needs to be enhanced beyond the existing transportation modes. According to Khan [2], the service attributes of transportation modes that affect travelers are the time spent in the vehicle during the trip and its value. Neely [3] stated that socioeconomic factor such as,

the duration, and cost of the trip influences travel behavior. Meanwhile, Li et al. [4] reported that certain variables such as speed, distance and comfort in the vehicle are factors that influence passengers' choices of transportation modes.

One of the steps involved in responding to the procurement of trans-Sumatra railroad transportation mode is the need to research to ascertain whether the indigenes of Padang prefers to travel to cities on the Sumatra island Jakarta using the rail transportation mode. The new service attributes scheduled to become operational as early as 2023 need to certify that this transportation mode is optional in the community. This research is intended to ensure that the cross-Sumatra railroad transportation mode's potential use implements new service attributes in the form of seamless integration, which involves the acquisition of an online ticket system.

The observation of travelers is limited to departing from Padang to the major cities on the island, which is intended to be connected to the cross-Sumatra railroad service network, as shown in Figure 1.

2. LITERATURE REVIEW

2.1 Travel needs and transportation mode

Travel needs are based on the travelers' demands, and it is caused by various community activities relating to the most prominent sectors such as the economy, agriculture, industry, social, culture, and religion, tourism, politics, government, etc. These activities are spatially separated in accordance with a certain scale ranging from brief (local), medium (regional) and far (national and international) distances and they are also carried out at different times [5].

Furthermore, when individuals travel due to these activities that occur at different times, they are bound to use existing transportation modes. In addition, transport providers offer various service characteristics, technical and geographic conditions, such as road vehicles, riverboats, lakes, crossings and sea, planes, trains either above or below the ground. Travel needs arising from the community's socioeconomic activities are served by the provision of various modes of transportation, starting from the local, regional, national and even international levels with different characteristics of their respective services. However, dissimilar service characteristics greatly affect the amount or number of trips carried out using the available transportation modes.

According to Wheeler [6], transportation mode is defined as a means by which people travel to their desired destination based on their respective activities. Each type has a fundamentally different technology, some of them require separate environments, possess personal infrastructure, and their operations often have unique regulations, including diverse advantages and disadvantages.

The differences in characteristics also significantly influence the choice of the travelers in selecting from the various available modes of transportation, thereby creating an opportunity for the market share of some of them to seem attractive.

2.2 Characteristics of transportation mode services as determining variable

The various transportation modes that aids in conveying passengers and goods from the departure point to their destination have their respective characteristics. According to Hakim [7], they are reported as conditions and forms of services provided by a particular transportation mode, namely, travel and waiting time at the terminal, costs, security, comfort and ease to reach departure and transit locations.

Several studies have been carried out in order to ascertain the enormous potential travel needs in using this alternative mode of transportation in numerous countries, including Indonesia, both local trips within cities (Inter City in Province) or between provinces (Inter City Inter Province). Conversely, each of these studies generally adopted independent variables that describe the service attributes of certain modes of transportation, namely time, travel costs, comfort, security, the accuracy of departure schedules, etc.

While Abdulsalam Bin et al. [8] carried out a research to determine the factors that influence inter-city travelers inLibya and the reasons for selecting between public buses and private cars. Therefore, it was concluded that travelers are influenced by standard variables such as travel time, costs, comfort, weather conditions and other characteristics. In estimating the number of travel needs involved in utilizing urban railroads in Britain also included variables that arealways present in each service attribute, such as total travel time and departure schedule [9].

Gokasar and Gunay [10] related to the modeling behavior of passengers traveling to the airport in Istanbul their choice of integrated transportation mode, is also based on adopting variables that are common to each service attribute, namely ownership of private car, availability of public transport, destination and employment status.

Meanwhile, in Japan, inter-city travelers select the available modes of transportation, irrespective of the fact that intangible factors or variables were adopted, such as Travel Time Punctuality, Security, Smoothness, Length of loading baggage [11]. Furthermore, a study was carried out by [12] to estimate the number of inter-city travelers that use the fast train mode in Germany. The research reported that travel time, costs, departure frequency and travelers' socioeconomic characteristics were observed. A similar study centered on transportation mode choice was carried out by [13]. They stated that the development of inter-city mode selection models in Saudi Arabia using a disaggregated approach adopted travel time, and costs including economic characteristics as a variable that influences the travelers.

2.3 Railway transportation mode and some of its service characteristics

The Railway Transport Mode is a form of transportation that involves vehicles running on tracks (rails or railroads) made of steel, constructed above ground level, and referred to as an elevated railroad. On the contrary, an underground rail path is constructed beneath the ground, and both consist of a series of carriages, usually for local transit in urban or interurban areas. This mode of transportation has its operating characteristics, which are reflected in its advantages and disadvantages. It is assumed that they indirectly influence the travel community's decisions in their choice of utilizing certain transportation modes that are interpreted as service attributes.

Some of its advantages and disadvantages also serve as a determining factor that influences travelers' choice, which is generally defined as service attributes. In addition, some of its advantages and disadvantages are reported as follows.

The advantages of the training include

a) Offers fast and reliable services
b) A lot of goods are transported
c) Suitable for the transportation of passengers, cheap, comfortable, safe, particularly for distances <500 km
d) Offers good access along the track, additionally, railways tend to serve as industrial magnets
e) It is a type of transportation that is clean and energy-efficient.

Disadvantages:

a) High operational and maintenance costs
b) The cost is expensive for short distances.
c) Services are rigid because routes are not easily diverted. Although assuming there is a course for it to be changed, it needs to go through the station.
d) The route needs to be rotated.
e) It does not accommodate inappropriate loads.
f) An old-line carries an extremely large spatial load.
g) Interferes with other types of transportation, for example, roads.

Physically, this mode of transportation does not serve passengers door to door. It requires another means of transport with a higher level of convenience or integration of two other modes of transportation, namely vehicles on the scenario or in 1 service package. Therefore, there is a need to carry out a research to determine whether it is applied to boost the existing transportation modes' services. The implementation of the integration between railway and road transportation modes needs to be consistent with the basis for determining and calculating the cost for passenger as regulated in articles 7, 8 and 9 of Regulation of Transportation Minister Transportation No. 28, 2012 concerning Guidelines for the Calculation and Determination of Person Transport Cost by Train and comparing it with other regions, where this flexibility has been implemented.

Figure 2. Implementation of 2 modes integration of railway transportation – Damri bus, Palembang – Jakarta route with 1 ticket
(Source: Indonesia Railways Corporation, 2018 [14])

One of the areas that have implemented the integration of railway and highway transportation modes with one ticket is the Palembang – Jakarta route. The Damri bus was integrated with the railway transportation mode in one ticket, as shown in Figure 2 (Indonesia Railway Corporation, [14]).

The enhancement of transportation modes with seamless services is realized by combining five sub-integrations in the form of travelers' locations, timetable, tickets, information and functions such as policies, administration and government institutions [15]. The technical implementation of door-to-door intermodal seamless services is designed by combining all operational aspects of the railway with road transportation modes in an integrated system similar to that which was implemented in Korea [16];

1. Sub Integration of Services (Policy, Administration and Institutional Government).
2. Sub Integration of Location and Passenger Data
3. Sub Integration of timetable.
4. Sub Integration of Information.
5. Sub Integration of Fare

The design of the earlier reported five Sub Integration was carried out by inputting the data of passengers that haveordered and paid for tickets such as their Names and Addresses to the Application-based Operational Systems and connectingit to the Transportation Services, thereby providing Highway Transportation Modes. Subsequently, after the connection, the Integrated Transportation provider picks up the passenger's address that has been inputted by Railway Corporation. According to the integrated departure information, creates an entire system, as shown in Figure 3.

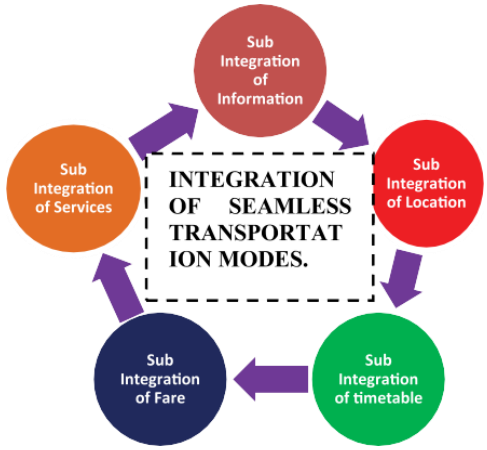

Figure 3. Framework for seamless transportation mode integration system
(Source: [16])

Figure 4. The model of the connection between travelers with multi modes of transportation integrated into mobile service
(Source: [16])

Each of the sub-integrations contained in the overall integration shown in Figure 3 is connected to the travelers using the train as well as all the other modes of transportation involved in generating a seamless integration system through the mobile information technology service which has an application installed as shown in Figure 4 [16].

3. METHODOLOGY

The method used to determine the potential users of railroad transportation modes across Sumatra, was operated according to new service attributes in the form of seamless integration with online transportation is a simple approach that involves the distribution of questionnaires using the Google form

survey application. Sorensen et al. [17] reported that several alternative methods are used in calculating the number of railway trips, namely manually (simple), sensor measurement tools, ticket systems and mobile phones. This research adopted a simple approach in the form of a manual survey with the technicality of distributing questionnaires using the Google application survey form. Furthermore, this is consistent to the studies carried out by Sorensen et al. [17], and Cerna et al. [18], which stated that in estimating the potential use of logistic modes of transportation namely road, rail, water and air transportation in Slovakia, a subjective approach based on the distribution of questionnaires designed to contain various service attributes that affect freight forwarding companies was adopted.

To estimate whether the cross-Sumatra railway transportation mode is the preferred choice for travelers plying between cities and provinces, there is a need to implement an integrated online seamless service of one ticket. However, an initial observation was carried out by distributing questionnaires to the community, particularly the city of departure, Padang. The questionnaire is designed by inputting information related to the respondent's profile and the factors presumed to influence the traveler's decision in selecting the most appropriate mode of transportation used to travel between cities and provinces, such as the conditions and service attributes directly attached to the available transport system and those that need to be provided namely total trip costs, and travel time, frequency of departure schedules etc.

Furthermore, the questionnaire distribution survey was carried out on a predetermined sample of 200 respondents from Padang city regardless of their location, which simply means that the questionnaire was distributed randomly.

4. RESULT AND DISCUSSION

Table 1. Respondents' profile and their composition

Respondents' profile	Composition (%)
1. Age	
> Below 20 years	9.5%
> 20 to 35 years	9.5 %
> 36 to 45 years	28.6 %
> 46 to 65 years	47.6 %
> over 65 years.	4.8 %
2.Gender	
> Male	80%
> Female	20%
3. Purpose of Travel.	
> For social/family purposes	42.7%
> For business/ work purposes.	42.9%
> For Trade purposes	0%
> For other interests	
* Social/family affairs.	4.8%
* Service Affairs.	4.8%
4. Respondent's latest education	
> Elementary School	0%
> Junior High School	0%

The survey results show information related to the respondents' profile and the use of railroad transportation modes a trans Sumatra. The profile includes several data such as gender, age, the purpose of travel, educational background and occupation. The compositions of the five profiles are illustrated, as shown in Table 1. Meanwhile, based on the use of an alternative mode of transportation, information such as the respondents' opinion (response) on the implementation of the trans-Sumatra railway transportation mode, their preferences of the new attributes in the form of seamless services, the means of transport system commonly used to travel between cities and provinces on the islands and Jakarta, as well as factors that affect their selection and the availability of train ticket prices and preferred schedule as shown in Table 2.

Table 2. The use of alternative transportation modes

Use of mode and considered factors	Composition (%)
1. Respondents' Opinions on Integration of Railway Transportation by Online through seamless service (in 1 ticket);	
> Strongly agree or support.	38.1%
> Agree/Support.	52.4%
> Abstain/Neutral.	4.8%
> Disagree/Not Support.	4.7%
> Strongly Disagree/ not support	-
2. The desire to use the Trans Sumatra Railway Transportation Mode in accordance with the integration of new Seamless services related to online transportation based on the price of 1 ticket;	
> Definitely Use.	43.7%
> Maybe use	56.3%
> Maybe not be used.	
> Definitely not used.	-
3. Transportation modes commonly used during this time to travel Inter City Inter Province (ICIP) on the Sumatra islands and Jakarta;	
> Plane	61.9%
> ICIP Public Bus	4.8%
> Travel	19%
> Public Bus and Airplane	4.8%
> Airplane/car/ bus	9.5%
> Travel/plane/ship	-
4. Factors considered by respondents in selecting the mode of transportation to use when traveling.	
> Travel Time.	52.4%
> Fares/ticket prices	23.8%
> Ease of reaching the departure location from home.	14.3%
> Other factors (conditions, rates and travel times).	9.5%
5. Respondents' willingness to obtain train ticket prices of IDR 200,000 for the nearest route (Padang-Pekanbaru).	
> Willing	95%
> Unwilling	5%
6. The total travel time desired by respondents on the Padang-Pekanbaru route using the trans-Sumatra train.	
> 7 hours.	1%
7. The number of departure schedules that the respondent desire regarding the trans Sumatra railway transportation mode.	
> Once a day	2%

>	Senior High School	19%
>	Undergraduate degree	47.6%
>	Graduate/Post Graduate degree	3.4%

5. Residence.

>	Within the Padang city	90.5%
>	Outside the Padang city	9.5%

(Source: Primary Survey Results, 2020)

>	Twice a day	88%
>	Three times a day	10%

8. The preferred departure time of the respondents using the trans-Sumatra railway transportation mode;

>	Morning at 09.00 am	56.3%
>	In the afternoon at 05.00 pm	25%
>	09.00 pm in the evening	18.7%

(Source: Primary Survey Results, 2020).

In terms of the 200 respondents' profiles, 80% were males, while the most responsive were those within the age range of 46 to 65 years (47.6%). Generally, respondents who traveled between cities and provinces based on business or work intentions and family interests were 42.9% and 42.7%. The educational background was mostly dominated by undergraduate degree (47.6%), and the majority (90.5%) were domiciled in Padang city.

Based on the use of trans-Sumatra railway transportation mode with the new service attribute in the form of seamless integration regarding the price of one ticket online, over 50% (52.4%) of the respondents agreed and supported the operation of the cross-Sumatra railway transportation while 38.1% strongly approved or supported it, in addition, the rest are either neutral (4.8%) or disagrees (4.7%). Furthermore, the desire to use the cross-Sumatra railway transportation mode with new services in the form of seamless integration concerning the price of 1 ticket online shows that 56.3% of the 200 respondents tend to use, however, it is definitely utilized by 43.7%.

Conversely, a survey regarding the transportation mode that respondents usually use to travel to cities on Sumatra islands and Jakarta shows that 61.9% of them use planes, while 19% use travel and the rest 4.8%, 4.8% and 9.5% utilizes public Inter City Inter Province buses, planes (mixed), private cars and public buses (mixed) respectively.

5. CONCLUSION

In conclusion, the trans-Sumatra railway transportation mode's operation implemented new services, which are seamlessly integrated with application-based selling of 1 ticket as an attribute that is greatly demanded by the people residing in Padang city in order to travel within cities and between provinces (Inter City Inter Province). Although this railway transportation mode is not yet functional, the respondents support implementing this transportation mode, as shown in Table 2. Additionally, 52.4% of the 200 respondents agree with the functionality, while 56.3% were not certain about its utilization. This respondent's statement is quite reasonable because the trans-Sumatra railway transportation mode with this new service attribute is still in the planning stage and yet to be functional.

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