ANALYSIS OF INTERCITY BUS PUBLIC TRANSPORT SAFETY PERCEPTION MODELING USING CONJOINT

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Public transport safety is still an issue that needs to be studied by bureaucrats and researchers. This is because public bus accidents are still quite high. This is because many families, involved in traffic accidents, are shocked by the accident. Therefore, the problem of perception of a safe bus needs to be studied. The purpose of this study was to determine the perception model of a safe public bus. Mathematical modeling based on the parameters that have been studied was selected first. While the second objective was to determine the importance value of the parameters that are an indication of the perception of the safety of intercity bus public transportation. This research is a type of perceptual one where the data is taken from the relevant respondents. The method of data collection was carried out using a questionnaire with respondents from bus company owners, drivers, and passengers in the province of East Java, Indonesia. Respondents were asked to answer questions related to the variables of income, speed, comfort, and safety. The method of conjoint analysis is used. The first stage is the result of modeling the perception of a safe bus. Further analysis is carried out to obtain the importance value of the parameters. The result of this research is a utility model for the perception of a safe bus, which is expressed by the equation U, where the variables include income, speed, comfort, and safety. The highest level of importance is income 33.29 %, followed by the security variable with a weight of 25.39 %. This shows that the income factor is a top priority for drivers and management of bus company owners, while road safety is second only to income. In other words, respondents' perceptions are more concerned with income, while safety is still a non-priority factor

Keywords: modeling, bus, intercity, transportation, safety, traffic, conjoint analysis, accident, perception, respondents

1. Introduction

The safety of intercity bus public transportation is often the center of attention of the general public. This is very reasonable because public bus transportation is a transportation service that is easily accessible by the community by means of a transportation network system that connects between cities, both within provinces and across provinces. In addition, the cost of public transport buses is considered relatively cheap for the general public. The performance of bus public transportation is often a problem related to service quality, comfort and safety [1] who investigated bus accidents on the highway. [2] stated that bus accidents are influenced by various factors and mathematically an accident model can be made. [3] stated that enforcement of vehicle speed is very necessary in an effort to reduce the number of accidents.

Therefore, accident prevention efforts are an important factor to be carried out immediately. [4] state where the enforcement of vehicle speed is very necessary as an effort to reduce the number of accidents. This is also very relevant to the research conducted by [5] on training programs as an effort to reduce the occurrence of accidents. Various efforts with various backgrounds and perspectives, it is necessary to make efforts to equalize perceptions to take policy steps related to realizing safety.

The study aims to determine the extent of the perception of the parties, involved in activities in the field for intercity bus public transport operations. By knowing the perceptions of the actors, involved with intercity bus public transportation, the steps to improve management and personnel development as well as government policy making can lead to the mainstream towards road traffic safety. In more detail, this study aims to determine whether the safety aspects of intercity bus public transport have been prioritized by the company's management.

Based on previous research, the discussion only revolves around the accident factor in one or two factors. While research related to factors causing accidents based on a combination of several factors does not yet exist. Therefore, it is necessary to conduct research on the extent of the perception of the parties, involved in activities in the field towards the implementation of intercity bus public transportation.

2. Literature review and problem statement

Intercity bus public transportation is a transportation that is widely requested by the general public. This is because public transport buses have the characteristics of being able to reach between cities at a low cost and relatively close schedules, so that at any time people can travel. In addition, bus public transportation is also able to provide fast service for intercity travel compared to other modes of transportation. However, the issue of public bus transportation services often arises in polemics among the public and researchers.

[6] states that bus public transport services are an important factor for bus passengers. [7] state that the satisfaction of public transport users is also a consideration for owners of bus public transport companies. [8] stated that to increase the trust of public transportation services, it is necessary to do a good schedule, so that passengers can get certainty about the departure schedule. The results of these previous studies indicate that users of bus public transportation are needed by the general public.

However, the results of this study also found that the performance of public transportation still needs to be improved, especially regarding safety. [9] who examined the quality of bus services, associated with bus company owners and drivers, stated that the quality of bus services was still considered unsatisfactory for users and he gave recommendations that performance should be improved.

Psychological review, [10] tried to see the relationship between the behavior of depressed drivers at low vehicle speeds. [11] who also reviewed the psychological aspect stated that fatigue will trigger dangerous driver behavior while on the road.

The safety of intercity bus public transportation is a major factor that passengers pay attention to. Although speed is also a consideration, passengers will not be able to ignore the safety factor. Therefore, owners of public transportation companies must burden themselves to be able to provide safety assurance with a good and systematic approach to safety management systems. This effort certainly cannot be separated from the responsibility of the government, which regulates the service and safety of public transportation.

The results of research conducted by [12] show that public opinion about bus safety performance is influenced by several factors that are always related to the management of bus transportation companies. [13] conducted a research on intercity bus public transportation in East Java Province, Indonesia. The results of this study indicate that the performance of intercity bus public transport drivers is still low, thus triggering accidents. [14] conducting a study in Thailand also described how the bus situation was when an accident occurred. [15] conducted a study on risk factors for collisions, also stated that more accidents were caused by driver factors.

To identify accident problems and find solutions, there are various approaches, taken by previous researchers. [16] conducted research in China by modeling bus safety at bus stops. [17] created a model to predict common bus accidents. This research is a finding that can be used to evaluate, estimate and solve the problem of bus accidents.

The results of these previous studies in general can be drawn an illustration that the safety problem of intercity bus public transportation is still a major problem. Problems can come from various aspects, both regarding the management of bus public transportation companies, drivers, passengers, and regulators from the government. Therefore, all parties who are responsible parties need to make maximum efforts to overcome these problems.

In relation to bus safety services and performance, [18] has created an intercity bus safety performance index using the Exploratory Factor Analysis Approach method. In the study it was stated that many factors affect the bus safety performance index, which of course is related to the level of risk of bus accidents that may occur.

An illustration of the condition of the bus related to the safety issue of intercity buses is shown in Fig. 1.

a

b

Fig. 1. Bus public transportation and safety issue:
a — new bus; *b* — the bus has had an accident

Fig. 1 shows when the bus was new and after having an accident. This is a serious problem, between management and the workforce, especially the driver. When there are rampant road traffic accidents, involving bus public transportation, various responses appear that accuse the bus management of not paying attention to the welfare of the bus crew. The operational management model that relies

on a deposit system causes bus crews to run their buses recklessly on the road. The safety factor is no longer "considered" because once sitting behind the steering wheel, the driver's head is how to find as many passengers as possible to catch up with the deposit. Another accusation that often arises is usually still related to the company's management, namely inadequate fleet management which is suspected to have caused many bus fleets to be unfit. For reasons of savings, many bus companies may carry out careless maintenance of their fleets. Whereas on the other hand the Government in the framework of development has issued a minimum standard on how to operate the bus fleet management.

Therefore, it is necessary to model for the perception of the safety of intercity bus public transportation, one of which is using the conjoint model.

3. The aim and objectives of the study

The aim of the study is to determine the perception model of a safe public bus.

To achieve this aim, the following objectives are accomplished:

– produce a modeling of the safety perception of intercity bus public transportation;

– determine the most important factors among the parameters that affect the safety of intercity bus public transportation.

4. Material and Method

4. 1. Modeling method

The perception of intercity bus public transportation is seen from the actors, associated with bus operations, this is done because they understand the characteristics of bus travel. Therefore, for this study, 3 main respondents were used, namely the owner of the bus company, the driver, and the passenger. The three respondents are the main actors, associated with buses. Various questions, designed in this questionnaire form, are directed at the perceptions of these respondents.

The variables, asked to the respondents, include income, speed, comfort and security. The selection of variables is expected to be able to generate a more constructive perception of a safe bus.

A flow chart illustration of the data collection and analysis process to determine the perception of safe public bus transportation is shown in Fig. 2. It can be explained, that the data search was obtained from respondents including bus companies, drivers, and passengers. While the questions, posed to respondents, include aspects of income, speed, comfort and safety.
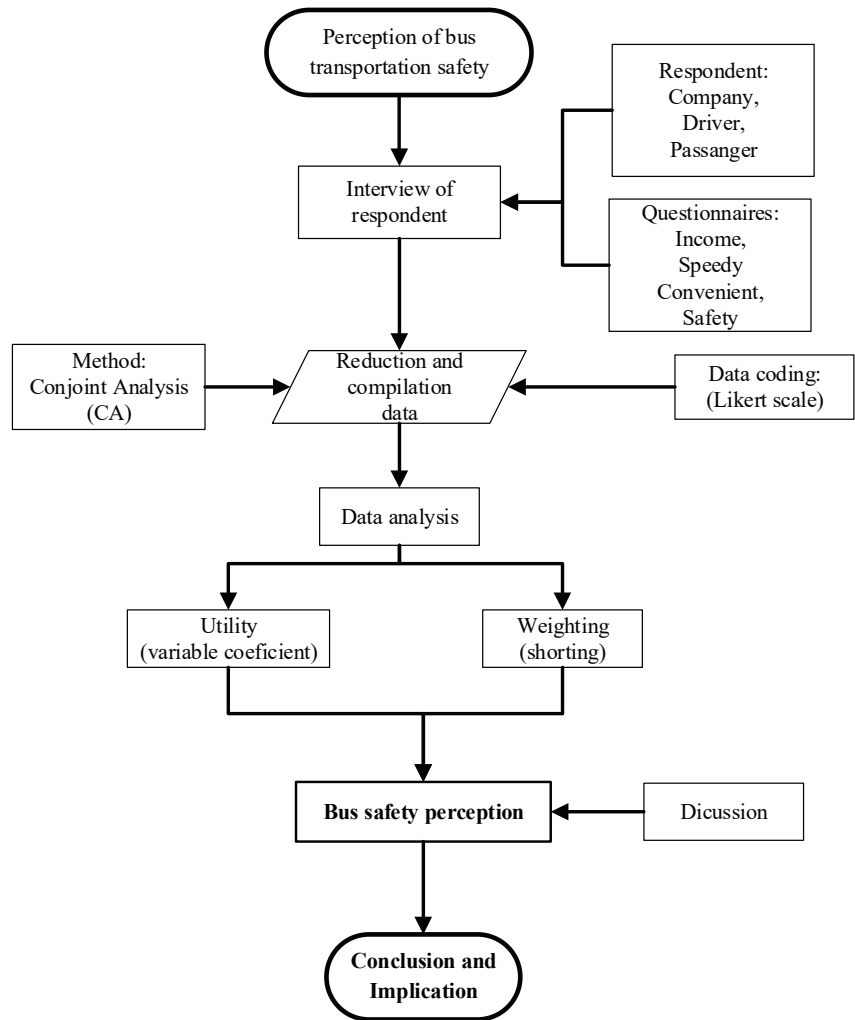

Fig. 2. Flowchart for conceptual frame of research

Furthermore, a discussion of the findings of this study is carried out. Furthermore, discussions were also held by comparing the results of this study with previous studies, as well as identifying the implications of this research for follow-up. The model, produced as the output of this analysis, has various limitations related to data collection and analysis. Respondents were drawn from three types of groups, namely passengers, drivers and company owners. The total number of respondents as 301 people. The location of the respondent's area is in the Province of East Java, Indonesia.

Using the conjoint analysis method to find out how respondents' perceptions of the safety of intercity bus public transportation are more specific on the most important variables. In this section there are two categorical variables. This analysis is an extension of the cross tabulation and in one part of the analysis it produces a plot map that depicts the specific relationship of the two variables.

The two categories are comparing the similarity (likeness) of the two categories of the first qualitative variable (row) based on a number of the second qualitative variable (column). Comparing the similarity (likeness) of the two categories of the second qualitative variable (column) based on a number of the first qualitative variable (row). Furthermore, knowing the relationship between one row variable category with one column variable category. Presenting each category of row and column variables from the contin-

gency table in such a way that they can be displayed together in a small-dimensional vector space optimally. Correspondence analysis will produce outputs that include:

1) category variables and indicator matrices;
2) correspondence matrix;
3) row and column profile matrix;
4) row center and column center;
5) coordinate axis;
6) coordinate rows and columns.

More specifically, this conjoint analysis will produce a utility estimate, utility equation and importance value. The three outputs can explain which variable has the highest level of importance by looking at the weighting of each variable. The data collection method begins with designing a questionnaire that will be delivered to the respondents. As stated in the conceptual framework of the study, where there are three respondents, namely the owner of the bus company, the bus driver, and the bus passengers.

The design of the questionnaire was made with the same questions to all respondents. This is intended to obtain views from various respondents on the same issue. In addition, statistical analysis requires the same form of data, stated in the questionnaire for all respondents. Actually this is a question that is not yet fully competent to be answered by respondents because they have different backgrounds. However, the analytical method requires uniformity in the form of the data as a way to carry out the analysis.

Furthermore, respondents were asked about the attitude towards the choice of bus public transport conditions. Aspects of the answers provided consist of income earned, speed of travel, comfort for passengers, and safety. The answer choices for each aspect of the question vary in stages and based on a Likert scale system.

Questions about income provided a choice of three levels, namely high, medium, and low. Nominally there is no limit on the amount of money in the hope that the value is based on the respondent's perception, however, respondents are given directions that the estimated regional minimum wage can be used as a reference.

For the question of speed, respondents were asked to choose three types of levels, namely high, medium and low. It is considered as normal or moderate speed if the vehicle is traveling at the allowable speed limit. While the comfort variable, respondents were given good and bad choices. Statements of good or bad criteria related to comfort are very qualitative so that it is completely left to the respondent's perception. The same thing in terms of data collection characteristics is also found in safety. There are only two choices, given to respondents, namely prioritizing safety or not prioritizing safety. Respondents' statements about safe buses are also very relative and the decision is largely determined by the respondent's perception. This is the rationale why this study uses the term perception because its size is really determined by the perception of the respondent.

Furthermore, to get a one-sentence question, the choice of 4 variables with various variants of qualification options is carried out in combination. Thus, the number of choices available to respondents is 3×3×2×2 or 36 choices. From the 36 combination choices, the respondent makes an attitude or perception towards the choice. There are options to answer the combination based on a Likert scale, namely 1

for strongly dislike, 2 for dislike, 3 for sometimes, 4 for like, and 5 for strongly like.

To process the data, the Conjoint Analysis method is used. Furthermore, the data with a Likert scale was entered into the SPSS software program. The results of the processing obtained utility models from the conjoint analysis, utility equations, and importance values. Furthermore, from the data, the analysis of the results of data processing was carried out and compared with the results of previous studies.

4. 2. Importance Value Analysis

The importance value analysis is done by determining the weight of each parameter. With the help of SPSS software, the weight of each parameter can be generated. This weight as a whole has a value of 100 %.

With a total weight of 100 %, the actual weight of each parameter is proportional to the existing parameters. Visualization of the weighting used a bar graph. By looking at the visualization of the weights on the graph and the weighting values, it can be determined which one has the highest weight.

The importance value is found by looking at the level of importance among the existing parameters. The most important parameter has the highest weight. This is followed by a parameter that has a weight at the next lower level. By comparing these weights, it can be seen which parameters are the most important and which are not.

5. Results of Modelling of Public Transport Safety

5. 1. Data Processing for Modelling

The Combination of questions to respondents relates to Income, Speed, Convention and safety. While the answers on a Likert scale, Strongly disagree (1), Disagree (2), Doubt (3), Agree (4), Strongly agree (5). The results of the interview recapitulation with respondents are arranged in a form as shown in Fig. 3.

It should be noted, that the interview data consists of 36 types of questions, which are a combination of 4 variables and qualification options. In Table 1 only part of the data is presented, however, the number of respondents that can be collected is 301 respondents. In addition, it was explained, that the number of questions was 36 kinds, which were a combination of qualifications for each variable. Then the respondent has a choice of 5 alternative types, which are Likert scales from values 1 to 5. By obtaining interview data in a Likert scale format, the data is ready to be entered in data processing software.
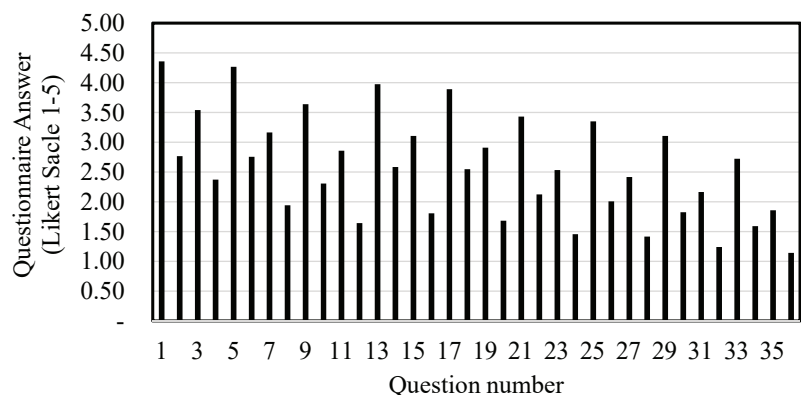

Fig. 3. Questionnaire Answer using Likert Scale

Data processing is done by entering data from interview respondents as many as 301 questionnaires. The results obtained are 3 main types of output, which include utility estimates, model equations and importance values. These three results were analyzed based on the characteristics of the resulting output.

The utility estimate model of conjoint analysis results is as shown in Table 2. This explains that the four variables, consisting of income, speed, comfort, and safety, have a depth of qualification according to the research design. Thus, each variable and its qualifications have a utility estimate value and standard error.

Judging from the utility estimate value, there are positive and negative values. This value indicates that a positive value means that it has a supportive contribution to the variable, while a negative value means that it has a contra toward that variable. To give deeper meaning to the utility estimate results, it is to look at large values where the cut off value is more than 0.5.

Based on Table 2, two variables have a utility estimate of more than 0.5, namely Income-Low with a value of -0.603 and Income-High with a value of 0.524. Meanwhile, utilities that are close to the absolute value of 0.5 are Priority of safety with a value of -0.474 and Not priority of safety with a value of 0.474.

Meanwhile, other variables, such as Speed and Comfort, have utility estimates far below 0.5, meaning that the two variables are relatively insignificant to the contribution of interest in this model.

The interpretation of the utility results can be explained that the most prominent of the four variables is only the Income variable. This means that the most important interest in the perception of a safe bus is more inclined to how to get a high income. Of course, this is relevant to the company's management pattern where the company is required to get as much profit as possible.

Table 1

Utility estimate model of conjoint analysis results

Variable	Qualifications (symbol)	Utility Estimate	Std. Error
Income	Low ($X11$)	-0.603	0.031
	Medium ($X12$)	0.079	0.031
	High ($X13$)	0.524	0.031
Speed	Low ($X21$)	-0.329	0.031
	Medium ($X22$)	0.060	0.031
	High ($X23$)	0.270	0.031
Comfort	Uncomfortable ($X31$)	-0.422	0.022
	Comfortable ($X32$)	0.422	0.022
Safety	Priority of safety ($X41$)	-0.474	0.022
	Not priority of safety ($X42$)	0.474	0.022
	(Constant)	2.607	0.022

Based on the results of data processing as contained in Table 1, a mathematical equation can be drawn up, which is the result of a model based on conjoint analysis. The general form of the equation, expressed in utility, is a function of all existing variables.

The utility equation is formed by making the utility estimate result as the variable coefficient and the existing variables as constituents in the equation. The results of mathematical modeling that describe the perception of a safe
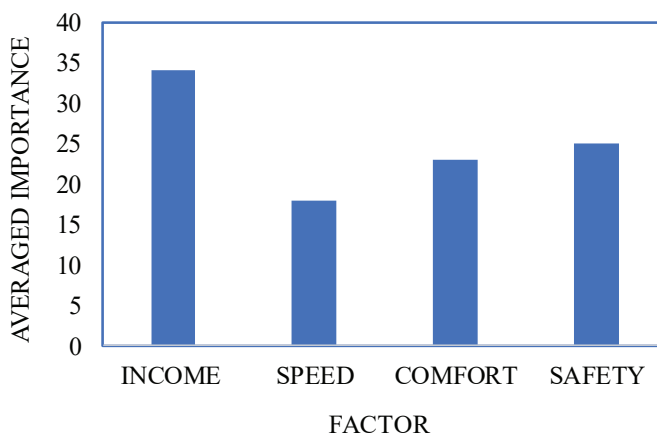
bus can be shown in (1). In this equation, a constant of 2.607 is obtained and a variable of 10 kinds. The types of variables include $X11, X12, X13, X21, X22, X23, X31, X32, X41$, dan $X42$.

$$U=2.607-0.603X11+0.079X12+$$
$$+0.524X13-0.329X21+0.060X22+$$
$$+0.270X23-0.422X31+0.422X32-$$
$$-0.474X41+0.474X42. \tag{1}$$

A more in-depth analysis in conjoint analysis is importance values. This is an overview of the contribution profile of each variable. Importance value is the level of importance among the existing variables. The importance value is expressed in the form of the weight of each variable, where a high weight indicates a high level of importance as well.

5. 2. Data Processing for Importance Value

The next step after getting the modeling is to determine the importance value. The determination of the importance value is based on pre-determined parameters. There are four parameters as factors that affect the safety of intercity bus public transportation. These parameters include income, speed, comfort and safety.

The calculation of importance value is done by means of the percentage of each parameter. Each parameter is summed as a whole and then the percentage of each parameter is made to the total sum. Importance value is expressed in the form of a percentage of each parameter, so that if you add up the importance values of all parameters, you will get a value of 100 %. The results of data processing obtained the most important factor among the four existing factors. The highest level of importance is income, which is 33.29 %, then in the next order is safety (25.39 %), comfort (22.58 %), and speed (18.73 %).

The results of the importance value analysis in this conjoint analysis are as shown in Fig. 4.

The importance value is expressed in the percentage of each variable, meaning that the total of all importance values will reach 100 %. From the table, the highest importance value is the income variable with a value of 33.29, and followed by the safety variable with a value of 25.39. Meanwhile, the importance value of other variables is in the next order, namely the comfort and speed variables. This shows that the highest level of interest is in income and the next interest is safety. This shows that the income factor is a parameter that is considered the most important among other factors. In other words, it can be stated, that the income parameter is still more prioritized than the safety of intercity bus public transportation.

Fig. 4. Importance values

6. Discussion of the Modelling Public Transport Safety

The results of the model using conjoint analysis found that the most prominent variable is the income variable. This finding indicates that the respondents perceive that income is the most important factor. This can be said to be quite rational because as a company, profit is a factor that needs to be prioritized.

In this research, the analytical methods and objects are the same as those, carried out by [19]an estimated 1.2 million people were killed in road crashes and as many as 50 millions were injured. Projections indicate that these figures will increase by about 65% over the next 20 years unless there is new commitment for prevention. Road accidents cost countries between one and three percent of annual Gross Domestic Product (GDP, namely the object of bus public transportation. [20] focuses more on bus service corridors, while [21] focuses more on the management aspects of bus companies. Meanwhile, the research conducted is different from previous researchers in terms of the focus studied, where this study focuses more on perceptions of bus public transport actors, which include bus companies, drivers and passengers.

Another finding in this study that is more specific and different from previous researchers is that there is an equation model about the perception of safe intercity buses. The utility model for the perception of a safe bus is expressed by the equation as contained in (1). With the findings of this equation, the utility to determine the perception of a safe bus can be obtained easily. The way to get the utility value is to enter the value of each utility variable in the equation.

The next finding in this research is that the importance value is obtained, which shows the variables that become the main priority in respondents' perceptions. The results showed that income is the main priority variable with a weight of 33.29 %. The results of this study when juxtaposed with research, conducted by [22]we developed an index that measures individual user satisfaction with the public transport service in the metropolitan area of Lisbon and subsequently identified the possible determinants of satisfaction by means of a regression tree model. The results achieved unveil a hierarchical partition of the data, highlighting the diversified level of satisfaction among public transport users that is reflected in the distribution of the index. The managerial implications of the findings for the public transport service are addressed.","author": [{"dropping-particle":"","family":"Vicente","given":"Paula", "non-dropping-particle":"","parse-names":false,"suffix":""}, {"dropping-particle":"","family":"Suleman","given":"Abdul","non-dropping-particle":"","parse-names":false,"suffix":""}, {"dropping-particle":"","family":"Reis","given":"Elizabeth","non-dropping-particle":"","parse-names":false,"suffix":""}],"container-title":"Sustainability (Switzerland, allow to say that the occurrence of accidents on bus transportation shows that safety is still a factor that has not become a major concern for the parties involved. The same thing was also expressed by [21] where the manager of public bus transportation is still less concerned about safety. This can be seen from the variable weight of 25.39 %, which is below the income variable level.

Therefore, based on the perception of the parties related to intercity buses, income is the main thing for bus crews or bus companies, their motivation for intercity bus transportation services, while safety is the second priority. Meanwhile, passengers also expect to go at high speed, so they can get to their destination quickly. This is the cause of intercity bus public transport accidents that still occur frequently.

This study makes modeling and determines the importance of intercity bus public transport factors. There are still limitations to the results of this study, namely the limitations of the types of respondents, and the difficulty of getting respondents from the elements of the company owner. The implementation of the survey to the company encountered problems where the management did not want to be open with information on the safety of the bus transportation company owned.

The topic of intercity bus public transport safety is very interesting because accidents are always the center of public attention. For the development of further research, it is recommended to take a persuasive approach to the owner of the transportation company in order to obtain more accurate information. In addition, further research can also be developed with the study area not only in the province, but also in several provinces that have almost similar characteristics.

7. Conclusions

1. Obtained modeling of public transport safety with utility which is a function of income, speed, comfort, and safety. The results of this modelling can be seen from the standard error indicator, where the income and speed parameters have a standard error of 0.031. While the indicators for the comfort and safety parameters have a standard error of 0.022.

2. The importance value factor in the perception of the safety of intercity bus public transport is income. This can be seen from the weight of the income parameter of 33.29 %. Furthermore, at the second level, the importance value is occupied by the safety parameter. This result shows that income is more important than safety.

Acknowledgement

References

1. Porcu, F., Olivo, A., Maternini, G., Barabino, B. (2020). Evaluating bus accident risks in public transport. Transportation Research Procedia, 45, 443–450. doi: https://doi.org/10.1016/j.trpro.2020.03.037

2. Mohanty, M., Gupta, A. (2015). Factors affecting road crash modeling. Journal of Transport Literature, 9 (2), 15–19. doi: https://doi.org/10.1590/2238-1031.jtl.v9n2a3

3. Sudaryanto, Kartikasari, R. (2007). The Measurement of the Service Quality of Transjakarta Public Transportation. Proceeding, International Seminar on Industrial Engineering and Management.

4. Casado-Sanz, N., Guirao, B., Attard, M. (2020). Analysis of the Risk Factors Affecting the Severity of Traffic Accidents on Spanish Crosstown Roads: The Driver's Perspective. Sustainability, 12 (6), 2237. doi: https://doi.org/10.3390/su12062237

5. Tubis, A. A., Skupień, E. T., Rydlewski, M. (2021). Method of Assessing Bus Stops Safety Based on Three Groups of Criteria. Sustainability, 13 (15), 8275. doi: https://doi.org/10.3390/su13158275

6. Shah, S., Ahmad, N., Shen, Y., Pirdavani, A., Basheer, M., Brijs, T. (2018). Road Safety Risk Assessment: An Analysis of Transport Policy and Management for Low-, Middle-, and High-Income Asian Countries. Sustainability, 10 (2), 389. doi: https://doi.org/10.3390/su10020389

7. Suraji, A., Harnen, S., Wicaksono, A., Djakfar, L. (2017). Driver Performance Problems of Intercity Bus Public Transportation Safety in Indonesia. IOP Conference Series: Materials Science and Engineering, 267, 012026. doi: https://doi.org/10.1088/1757-899x/267/1/012026

8. Zuraida, R., Abbas, B. S. (2020). The Factors Influencing Fatigue Related to the Accident of Intercity Bus Drivers in Indonesia. International Journal of Technology, 11 (2), 342. doi: https://doi.org/10.14716/ijtech.v11i2.3792

9. Rajsman, M., Horvat, R., Rajsman, M. (2014). Public Urban Passenger Transport as Important Factor in the Development of Cities. Journal of Traffic and Logistics Engineering, 2 (3). doi: https://doi.org/10.12720/jtle.2.3.172-175

10. Bener, A., Yildirim, E., Özkan, T., Lajunen, T. (2017). Driver sleepiness, fatigue, careless behavior and risk of motor vehicle crash and injury: Population based case and control study. Journal of Traffic and Transportation Engineering (English Edition), 4 (5), 496–502. doi: https://doi.org/10.1016/j.jtte.2017.07.005

11. Prayitno, P., Rulianah, S., Zamrudy, W., Susilo, S. H. (2021). An analysis of performance of an anaerobic fixed film biofilter (AnF2B) reactor in treatment of cassava wastewater. Eastern-European Journal of Enterprise Technologies, 1 (10 (109)), 6–13. doi: https://doi.org/10.15587/1729-4061.2021.225324

12. Al-Mekhlafi, A. A., Isha, A. S. N., Naji, G. M. A. (2020). The relationship between fatigue and driving performance: A review and directions for future research. Journal of critical reviews, 7 (14), 134–141. doi: https://doi.org/10.31838/jcr.07.14.24

13. De Oña, J., de Oña, R. (2015). Quality of Service in Public Transport Based on Customer Satisfaction Surveys: A Review and Assessment of Methodological Approaches. Transportation Science, 49 (3), 605–622. doi: https://doi.org/10.1287/trsc.2014.0544

14. Eboli, L., Mazzulla, G. (2012). Performance indicators for an objective measure of public transport service quality. European Transport \ Trasporti Europei, 51, 1–21.

15. Suraji, A., Djakfar, L., Wicaksono, A. (2021). Analysis of bus performance on the risk of traffic accidents in East Java-Indonesia. EUREKA: Physics and Engineering, 3, 111–118. doi: https://doi.org/10.21303/2461-4262.2021.001820

16. Yaya, L. H. P., Fortià, M. F., Canals, C. S., Marimon, F. (2014). Service quality assessment of public transport and the implication role of demographic characteristics. Public Transport, 7 (3), 409–428. doi: https://doi.org/10.1007/s12469-014-0099-7

17. Wickens, C. M., Smart, R. G., Mann, R. E. (2014). The Impact of Depression on Driver Performance. International Journal of Mental Health and Addiction, 12 (4), 524–537. doi: https://doi.org/10.1007/s11469-014-9487-0

18. Taneerananon, P., Somchainuek, O. (2005). Bus Crash Situation in Thailand: Case Studies. Journal of the Eastern Asia Society for Transportation Studies, 6, 3617–3628. doi: https://doi.org/10.11175/easts.6.3617

19. Tanwanichkul, L., Taneerananon, S., Iamtrakul, P., Srisakda, L., Sataphan, A. (2007). Bus safety situation in Thailand: Bus driver experiences and attitudes. 30th Australas. Transp. Res. Forum.

20. Kral, P., Janoskova, K., Kliestik, T. (2018). Key determinants of the public transport user's satisfaction. Administratie si Management Public, 31, 36–51. Available at: https://www.researchgate.net/publication/331180185_Key_determinants_of_the_public_transport_user's_satisfaction

21. Vicente, P., Suleman, A., Reis, E. (2020). Index of Satisfaction with Public Transport: A Fuzzy Clustering Approach. Sustainability, 12 (22), 9759. doi: https://doi.org/10.3390/su12229759