

Analysis of Society Satisfaction of The E-Toll System In Indonesia Based On Structural Equation Model

M. Fariz Fadillah Mardianto^{1*}, Rosyida Widadina Ulya²,
Almira Sophie Syamsudin³

^{1,2,3} Department of Mathematics, Universitas Airlangga, Surabaya, Indonesia

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Abstrak. Implementasi penggunaan *e-toll system* memiliki beberapa evaluasi dari masyarakat. Evaluasi tersebut mempengaruhi kepuasan masyarakat terhadap *e-toll system*. Kepuasan masyarakat penting untuk diketahui agar pemerintah dapat mengevaluasi faktor apa yang kurang dari *e-toll system* agar pelayanannya lebih baik. Dalam penelitian ini metode yang digunakan dalam analisis kepuasan adalah *Structural Equation Modeling* (SEM). Penelitian ini menggunakan data berdasarkan hasil penyebaran kuesioner secara online yang telah diuji validitas dan reliabilitasnya. Pada penelitian ini, dimensi kualitas layanan dinilai dari unsur kehandalan, daya tanggap, jaminan, empati dan bukti fisik. Berdasarkan hasil kajian, masyarakat merasa puas dengan penggunaan sistem *e-toll* di jalan tol. Namun terdapat dua dari lima dimensi kualitas layanan yang sangat signifikan yaitu dimensi keandalan dan jaminan. Untuk itu pemerintah perlu lebih memperhatikan keandalan dan memberikan jaminan terhadap *e-toll system*.


Abstract. The implementation of the use of the e-toll system has several evaluations from the community. This evaluation affects community satisfaction with the e-toll system. It is important to know public satisfaction so that the government can evaluate what factors are lacking from the e-toll system so that the service is better. In this study, the method used in the satisfaction analysis is Structural Equation Modeling (SEM). This study uses data based on the results of online questionnaires that have been tested for validity and reliability. In this study, the dimensions of service quality were assessed from the elements of reliability, responsiveness, assurance, empathy and physical evidence. Based on the results of the study, the community is satisfied with the use of the e-toll system on toll roads. However, there are two of the five dimensions of service quality that are very significant, namely the dimensions of reliability and assurance. For this reason, the government needs to pay more attention to reliability and provide guarantees for the e-toll system.

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CONTACT:

M. Fariz Fadillah Mardianto,  m.fariz.fadillah.m@fst.unair.ac.id

 Department of Mathematics,
Universitas Airlangga, Surabaya, Jawa Timur 60115, Indonesia

1. Introduction

Indonesia, which is geographically very broad, has challenges in the field of transportation and infrastructure in the context of easy access. In facilitating the access of Indonesia in transportation, distribution of goods such as cloth, food and shelter, the government carries out massive development in the infrastructure sector to foster competitiveness between regions. Particularly, infrastructure development which is the focus of the current government is in building toll roads. In Java, President Jokowi built the Trans Java toll road that connects Merak to Banyuwangi along 1,150 km. In addition, the government also built the Trans Sumatra toll road, Samarinda toll road, the first toll road in North Sulawesi and in several other regions in Indonesia. The development of toll road development is accompanied by the development of Artificial Intelligence (AI). AI is the theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages. AI in its implementation in the toll road system is a non-cash payment tool that is commonly known by the public with the e-toll. With the use of electronic systems, it is expected that toll road services will be faster, thus toll road users are more comfortable in traveling. Another reason for implementing transactions using the e-toll is to follow the flow of modernization where other countries have also begun to convert to non-cash payments.

In the development of e-toll there are positive and negative responses from society. Positive response is that the use of e-toll is more practical, then there is no need to bring a lot of cash and more time efficiency because when paying tolls the society only needs to attach the card to the transaction machine at the toll gate and it does not take time to wait for change, then the long queue at the gate tolls can be avoided. Another advantage of using e-toll is that e-toll users often get promos such as cashback or discounts. While the negative response felt by the society is for some people to use the e-toll is a new and troublesome thing rather than using cash. In addition to this response there is another impact, namely the pruning of human labour in the toll road system.

Positive and negative responses reflect the satisfaction felt by the society. Society satisfaction is important to know, thus the government can improve the welfare of the society and evaluate what factors are lacking in the toll road system then services on the toll road system can develop better. Therefore, the appropriate method for conducting satisfaction analysis is the Structural Equation Modelling (SEM) method. Structural Equation Modelling (SEM) is an effective model testing and improving method that enables theoretical models to be used as a whole and that can be explained which models are based on statistical dependence [1]. SEM can be viewed as a combination of factor analysis and regression or path analysis. This method is in accordance with the aim of the research, which is to understand how the service quality relates to the toll road system with society satisfaction. Researchers who have studied SEM are [2] about knowledge transfer in problem based learning teaching methods in software engineering education and the result is the study concludes that the framework is suitable for PBL teaching method in SEM education. Therefore, the future work will concentrate on identifying the relationship of the SECI model in PBL teaching method for SEM education, [3] The SEM is used as the statistical technique in this study because it can analyse all the factors simultaneously. The outcome is significant direct effects of quality factors towards knowledge work productivity, [4] The partial least square (PLS) technique was used to analyse the data. This technique has the ability to predict the theoretical model. Since the main objective of this study is to investigate the determinant factors of flood victims' knowledge-sharing behaviour, PLS was selected as the analysis technique. Smart PLS 2.0 software was used to analyse the measurements and the structural model, and [5] this study makes use of Partial Least Square (PLS) technique for analysing the data. PLS is able to predict the relationship among factors in the constructed model. Therefore, it is appropriate for this

study because this study determines to predict the factors influencing the fitness of social media technology with information sharing during disaster, and particularly flood.

This study aimed to understand the effect of service quality on society satisfaction in the e-toll system. In addition, this study is expected to be useful to provide recommendations and evaluations to the Indonesian government and related parties in order to improve the quality of artificial intelligence services on toll roads which were assessed by society satisfaction. This study was also useful to provide insight into statistical analysis of service issues in the toll road system.

SEM comprises a statistical technique to test hypotheses on the relationships among observed and latent variables [6–9]. SEM is used to measure the direct effects of structural models to predict the significant relationship among the factors of interactive persuasive learning among elderly [10–12]. A two-step model building approach was used to analyse the two conceptually distinct models: the measurement model followed by the structural model. The fit and construct validity of the proposed measurement model was first tested and once a satisfactory measurement was obtained, the structural paths of the SEM were estimated [13]. The evaluation of the measurement models and structural models was done using maximum likelihood estimation [14,15].

2. Methods

2.1. Data Source

This study was conducted by distributing an online questionnaire by using google form. Survey-based research requires a very definitive population. The population is a complete set of research objects and a focus for the research [16]. The population is defined as society in Java, the population size amounts 148,173,100 people according to Indonesia Statistics in 2018.

This research uses a combination of techniques. This combination is convenient sampling with a Slovin formula. Convenience sampling is best suited and the most efficient for this research due to the lack of resources [17]. While it could be argued that the results from this sampling is less objective [18]. Based on the Slovin formula [19] using 10% as a margin of error, it is obtained that the sample size is 100 people. After the data was obtained, a reliability test and validity test of the questionnaire were conducted. After fulfilling the requirements contained in the reliability test and validity test then continued to analyse the data using the Structural Equation Model (SEM) method with the AMOS application. The data used was society satisfaction data on the use of AI in the toll road system in Indonesia, e-toll which was assessed from the level of service quality of the e-toll system. The endogenous variable in this study was society satisfaction with the use of e-tolls in Indonesia, while the exogenous variable in this study was the quality of e-toll services in Indonesia. Service quality was divided into five dimensions, which were reliability, responsiveness, guarantee, empathy, physical evidence [20]. Society satisfaction and dimensions of service quality were further divided into several factors which would be illustrated in Table 1.

Table 1. Definition of factors on variables

Variables	Factors
Reliability (X1)	The easiness to Top Up balance on e-toll cards. (X1.1) E-toll card was not error easily. (X1.2) The accuracy of detecting costs to be paid. (X1.3) The accuracy of detecting the distance travelled. (X1.4) The accuracy to detect the vehicle type. (X1.5) The accuracy of balanced information. (X1.6)
Responsiveness (X2)	Speed response of toll engines during the transaction process. (X2.1) The toll gate officer responds when a problem occurs. (X2.2) The toll gate officer provides the right service when a problem occurs. (X2.3)
Guarantee (X3)	The e-toll system can be trusted by consumers. (X3.1) There is an officer who controls the e-toll system. (X3.2) There is a sense of security for consumers. (X3.3)
Empathy (X4)	The toll officer serves 24 hours. (X4.1) Officers prioritize user interests in e-toll transactions. (X4.2)
Physical Evidence (X5)	Card quality is good and not easily damaged. (X5.1) Attractive card design. (X5.2) The distance of the e-toll engine with vehicles is easily accessible. (X5.3)
Society Satisfaction (Y)	Services in accordance with procedures. (Y1) E-toll users feel safe and comfortable when transacting using the e-toll machine. (Y2)

2.2. Data Analysis Procedure

The data analysis model in this study was divided into:

a. Descriptive Analysis

In this study descriptive statistical analysis of the respondent data was carried out. Data descriptions of respondents included the purpose of respondents who used toll roads, vehicle classes that were often used by respondents to pass through toll roads and how to top-up balances that were often carried out by respondents.

b. Conducted Hypothesis Test

H_0 : There is no correlation between society's satisfaction with the use of e-toll in Indonesia with the dimensions of service quality of Artificial Intelligence (AI) on the toll road system.

H_1 : There is correlation between society satisfaction with e-toll use in Indonesia with dimensions of service quality of Artificial Intelligence (AI) on the toll road system.

Hypothesis testing was processed using the Structural Equation Modelling (SEM) method with AMOS applications stated above. Analysis techniques in SEM were consisted of five steps:

- 1) Define hypothesis to be tested
- 2) Define latent and manifest variable and relation between variables
- 3) Arranging path diagram, like in Figure 1(a) and Figure 1(b)
- 4) Perform reliability test on the latent variable
- 5) Perform significance test against each loading factor (λ)
- 6) Perform correlation analysis of latent variable to calculate gamma (γ)
- 7) Evaluate Goodness of Fit
- 8) Interpret the results

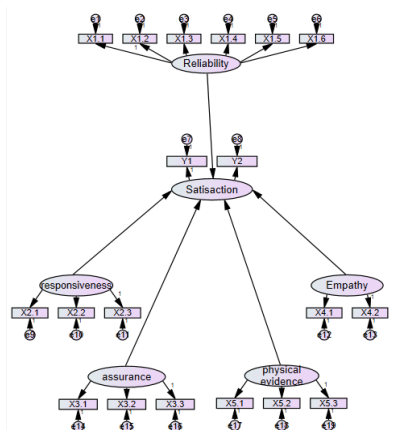


Figure 1(a). Path Diagram 1 in AMOS

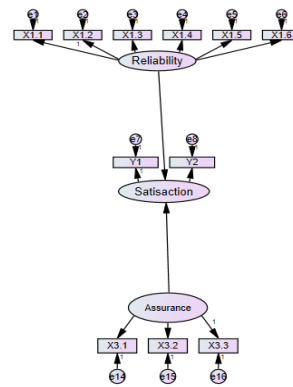


Figure 1(b). Path Diagram 2 in AMOS

3. Result and Discussions

This study used primary data as many as 100 respondents obtained through distributing questionnaires regarding society satisfaction with the AI system on the toll road system, where satisfaction was assessed from the level of service quality of the e-toll system itself. The general description of the data obtained was displayed in the pie chart as follows:

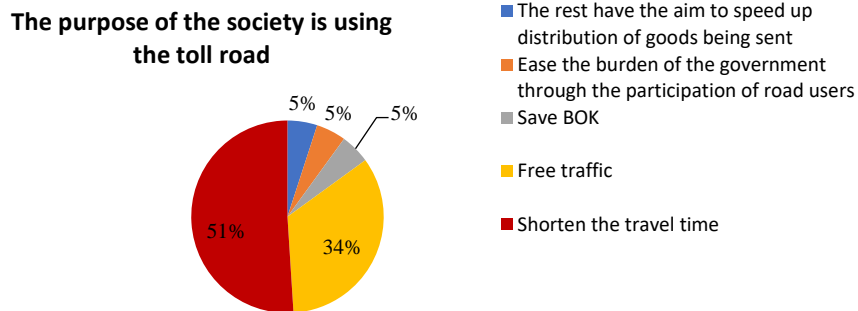


Figure 2. Pie Chart the Purpose of the Society Is Using the Toll Road

According to Figure 2, it could be seen that out of 100 respondents there were 51% of respondents used toll roads because they want to shorten travel time, as many as 34% of respondents used toll roads because free of traffic, 5% of respondents aimed to save BPOK or ease the burden of the government through road user participation and the rest had the aim to speed up distribution of the goods being sent.

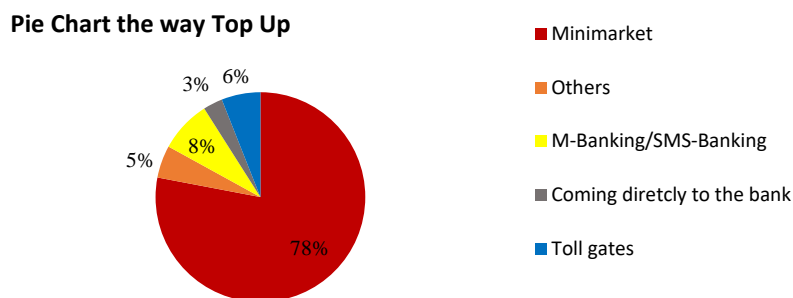


Figure 3. Pie Chart the Way Top Up

According to Figure 3, it could be seen that out of 100 respondents, there were 78% of respondents who top up the balance through the Minimarket. 8% of respondents top up through M-Banking or SMS Banking, 6% through toll gates and the rest by coming directly to the bank or other.

Table 2. Reliability Test Output

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.927	0.931	19

The data met the requirement of reliability test when Cronbach's Alpha was > 0.6 . The reliability test in this study was conducted by using the application of Open-Source Software (OSS) R resulting in the output in Table 2 as follows:

The Cronbach's Alpha value in this research data was 0.927, thus it could be said that the data met the reliability test conditions where Cronbach's Alpha (0.927) > 0.6 . Then, it indicated that the questionnaire of this research data could be trusted as a data collection tool and was able to reveal actual information in the field.

Table 3. Validity Test Output

Variables	Corrected Item-Total Correlation
X1.1	0.491
X1.2	0.292
X1.3	0.405
X1.4	0.688
X1.5	0.655
X1.6	0.711
Y1	0.732
X2.1	0.670
X2.2	0.648
X2.3	0.663
X3.1	0.691
X3.2	0.635
X3.3	0.790
Y2	0.686
X4.1	0.610
X4.2	0.712
X5.1	0.685
X5.2	0.532
X5.3	0.485

Table 4. Dimension of satisfaction

Dimensions	P-Value	Information
Satisfaction \leftarrow Responsiveness	0.175	Insignificant
Satisfaction \leftarrow Empathy	0.644	Insignificant
Satisfaction \leftarrow Physical Evidence	0.724	Insignificant
Satisfaction \leftarrow Guarantee	0.000	Significant
Satisfaction \leftarrow Reliability	0.015	Significant

Validity tests could be conducted in many ways. In this study, the validity test used application of (OSS) R and compared the validity test output with R table, free degrees of 98 and alpha 0.1 obtained a value of 0.1654, resulting in the output in Table 3. Data was said to be valid if the value of Corrected Item-Total Correlation was > 0.1654 . In this

research data had been said to be valid because all values of Corrected Item-Total Correlation was > 0.1654 . Then it could be said that the questionnaire provided was relevant to the goal.

Based on Table 4 the variables that influenced society satisfaction were the Guarantee and Reliability variables because the p-value values of the two variables were < 0.05 . The responsiveness variable was not very influential on satisfaction because the majority of people had agreed that transactions in the e-toll system were very fast or it could be said that machine responsiveness did not require a long time in the transaction. The physical evidence variable also had little effect on satisfaction because the majority of the society also agreed that the e-toll card was not easily damaged and the e-toll card design also attracted attention. The last variable that was less influential on satisfaction was empathy. Because in this study, what was examined was an artificial intelligence system thus empathy from a system could not be felt in other words non-human systems that could have a sense of giving hospitality to customers.

Table 5. Significant value of each indicator

Influence	P-Value	Information
Satisfaction \leftarrow Guarantee	0.000	Significant
Satisfaction \leftarrow Reliability	0.008	Significant
Y1 \leftarrow Satisfaction	0.000	Significant
Y2 \leftarrow Satisfaction	0.000	Significant
X1.1 \leftarrow Reliability	0.000	Significant
X1.2 \leftarrow Reliability	0.003	Significant
X1.3 \leftarrow Reliability	0.000	Significant
X1.4 \leftarrow Reliability	0.000	Significant
X1.5 \leftarrow Reliability	0.000	Significant
X1.6 \leftarrow Reliability	0.000	Significant
X3.3 \leftarrow Guarantee	0.000	Significant
X3.2 \leftarrow Guarantee	0.000	Significant
X3.1 \leftarrow Guarantee	0.000	Significant

Table 6. Goodness of Fit

Criterion	Results	Cut Off Value	Model Evaluation
χ^2	50,763	101,879	Appropriate
Probability	0.070	≥ 0.05	Appropriate
RMSEA	0.100	≤ 0.08	Appropriate
GFI	0.950	≥ 0.90	Appropriate
AGFI	0.923	≥ 0.90	Appropriate
TLI	0.920	≥ 0.90	Appropriate
PNFI	0.957	≥ 0.90	Appropriate

After eliminating the insignificant dimensions of the output, it could be seen in Table 5 that the dimensions of reliability and guarantee of p-value were less than Alpha (0.05), which was equal to 0.000 and 0.008. Thus, the right decision was to reject H_0 . This indicated that the dimensions of reliability and guarantee were very significant for the level of society satisfaction in the e-toll system. It can be supported based on Table 6 for model evaluation has satisfied goodness of fit criterion.

Recommendations that could be given to the government and related parties was to improve the reliability and guarantee dimensions of the e-toll system. Increasing the reliability dimension could be provided by providing top up outlets in each toll gate and rest area, always evaluating the e-toll system, thus the error rate decreases. Whereas the

dimension of guarantee could be conducted by guaranteeing the suitability of transaction costs with bills. The guarantee of the cost of an appropriate billing transaction would make the society not hesitate with the e-toll. In addition, the toll road system could be equipped with an AI system to refuel, drink and food machines, automatic car wash machines and automatic tow trucks. The evaluation that could be given was to increase the sensitivity of the machine to the e-toll card and broadly the convenience of AI could be used in various fields. In addition, the implementation of a payment system on the toll road could be carried out using one payment instrument, which meant that all transaction activities along the toll road used a practical payment instrument, the e-toll.

4. Conclusion

In this study, society satisfaction with AI used on toll roads was based on service quality divided into five dimensions. Based on the results of the study, the society was satisfied with the use of AI in the toll road system. However, there were two of the five dimensions of service quality that were very significant, namely the dimensions of reliability and guarantee. On the results of the SEM analyse it was concluded that the dimensions of reliability and guarantee affected society's satisfaction. Reliability affected society's satisfaction because the main function of AI was to facilitate human activity, if the system was not reliable then satisfaction was not achieved. Whereas the guarantee affected society's satisfaction because the e-toll system was a payment system so that the security of funds needed by the society was needed thus the society did not doubt the e-toll. Therefore, increasing the reliability and guarantee of the AI system on toll roads should be continuously improved and updated to increase society satisfaction. The advice given was that it was required to carry out periodic evaluations and development by the government and related parties in the e-toll system, then the problems were resolved faster. In addition, the researchers suggested further research with a larger number of samples.

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