International Journal of Science and Research Archive

eISSN: 2582-8185

Cross Ref DOI: 10.30574/ijsra

Journal homepage: https://ijsra.net/

(RESEARCH ARTICLE)

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Analysis factors affecting the acceptance of multi-lane free flow in Indonesia

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International Journal of Science and Research Archive, 2024, 12(01), 2199–2204

Publication history: Received on 23 April 2024 revised on 02 June 2024; accepted on 04 June 2024

Article DOI: https://doi.org/10.30574/ijsra.2024.12.1.1021

Abstract

The study investigates the adoption of the Multi Lane Free Flow (MLFF) system in Indonesia, focusing on factors influencing user acceptance and usage. Utilizing the Technology Acceptance Model (TAM), the research examines the perceived ease of use (PEOU) and perceived usefulness (PU) of MLFF, as well as their impact on behavioral intention to use (BI) and actual system use (ASU). The results indicate that while users encounter difficulties due to lack of guidance and socialization, the perceived usefulness of MLFF significantly influences behavioral intention to use it. Therefore, to enhance the adoption of MLFF, it is recommended that service providers improve user education and highlight the system's benefits. These efforts can increase user understanding and acceptance of MLFF, ultimately driving its effective usage on toll roads in Indonesia.

Keywords: Multi-Lane Free Flow (MLFF); Technology Acceptance Model (TAM); Toll Road; Behavioral Intention to Use; Perceived Ease of Use; Perceived Usefulness.

1. Introduction

The increase in the number of vehicle users in Indonesia has caused significant traffic congestion, especially in densely populated urban areas. Many people choose to use toll roads as an alternative to reach their destinations faster, particularly when driving four-wheeled or larger vehicles, as toll roads offer smoother traffic flow compared to regular roads. However, the smoothness of traffic on toll roads is often affected by the transaction time at toll gates. This leads to long queues, especially during rush hours in major cities, due to the lengthy transaction times [1].

To expedite transaction times, the government has issued a policy outlined in the Regulation of the Minister of Public Works and Public Housing Number 16/PRT/M/2017 concerning non-cash toll transactions. This policy encourages the use of electronic cards for toll payments, known as e-Toll [2]. The e-Toll card contains electronic money with sufficient balance according to the travel distance, and payments are made by tapping the card at automated toll gates. This system was implemented simultaneously in October 2017. However, the e-Toll system still faces some drawbacks. The Secretary of the Toll Road Regulatory Agency of the Ministry of Public Works and Public Housing, Triono Jasmono, stated that the implementation of the electronic toll system (e-Toll) on all toll roads in Indonesia still causes losses amounting to IDR 4.4 trillion per year. This is due to the approximately 5-second queues that still occur when road users make non-cash payments at toll gates [3]. To address this issue, the government is designing a new innovation called Multi Line Free Flow (MLFF).

Multi Lane Free Flow (MLFF) is a technology system that allows toll users to make payments without stopping their vehicles. MLFF can detect every car that passes through the toll gate and can speed up the transaction management process for toll road payments [4]. This system is expected to reduce the length of queues when entering or exiting toll booths. MLFF has already been implemented in several countries, such as Malaysia, Hungary, Japan, Taiwan, and Germany.

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MLFF has also been implemented in several places in Indonesia, one of which is the Trans Sumatra Toll Road. There is research that has compared public perceptions of the use of e-Toll and MLFF. The research states that the MLFF system provides convenience for its users. The MLFF payment system is also considered more attractive by the public compared to the e-Toll system when implemented [5].

However, the implementation of the MLFF system is not yet widespread in Indonesia and is still under development. Therefore, this research aims to understand the public's view, especially in the Jakarta area, on the implementation of MLFF and to identify the factors that determine the behavior or intention to use the Multi Lane Free Flow payment system on toll roads in Indonesia. The results of this study can be used as an evaluation of the MLFF payment system for further development. Table 1 below lists several previous research regarding the use of social media for E-Wallet brand awareness.

2. Literature Review

2.1. Multi-Lane Free Flow

Multi Lane Free Flow (MLFF) is a toll payment method that allows users to pay without stopping, so they do not have to stop their vehicles at the toll gate. The MLFF payment system uses an RFID sticker attached to the front of the vehicle [5]. With the MLFF system, users do not need to open their windows to tap an e-Toll card. This system utilizes Global Navigation Satellite System (GNSS) technology and conducts transactions through the Cantas application, which is integrated with ERI (Electronic Registration and Identification) data or vehicle ownership data held by the Traffic Corps of the Indonesian National Police [6].

Multi Lane Free Flow offers many advantages compared to other payment methods. Travel time can be faster and more efficient, there are no queues or delays at toll gates, it is environmentally friendly, and it can speed up the mobility of goods and services delivery [7].

2.2. Technology Acceptance Model

The Technology Acceptance Model (TAM) is a model developed by Davis to analyze and understand the factors influencing the adoption of technology [8]. TAM describes the cause-and-effect relationships between individuals' beliefs about the benefits of a technology or information system, the ease of its use, user behavior, and the actual purposes of using that technology or information system. Researchers have widely utilized the TAM model to assess behavioral intentions and user satisfaction with new information systems. The variables in TAM include Perceived Usefulness, Perceived Ease of Use, Behavioral Intention to Use, and Actual System Use [9].

Perceived Usefulness signifies the extent to which an individual holds the belief that utilizing a system will enhance their performance. This concept encapsulates the degree to which technology is perceived as beneficial by its users. When a system becomes increasingly user-friendly, it leads to an elevated inclination for its utilization, consequently increasing the likelihood of its adoption [10].

Perceived Ease of Use is defined as the extent to which an individual believes that using a particular technology does not require significant effort. If a system becomes easier to use, the intention to use it will increase, and the likelihood of the system being used will also increase [11].

Behavioral intention to Use refers to the tendency to continue applying a technology. The level of use of computer technology by an individual can be predicted from their attitude and attention towards the technology [12].

Actual system usage refers to the real-world application of a system. An individual will likely be satisfied using the system if they believe it is easy to use and demonstrably enhances their attitude and attention towards the technlogy [12].

3. Methodology

Technology Acceptance Model (TAM) will be utilized to analyze the factors influencing the acceptance of Multi-Lane Free Flow in Indonesia. Based on the explanation of the research variables, the TAM model is illustrated in Figure 1 [9]. This study employs a quantitative method by distributing online questionnaires to respondents. The target respondents are individuals in Jakarta who have previously used the Multi-Lane Free Flow system.

The population size is unspecified, so to determine the sample size, this research uses the calculation method from Hair et al. When the population size is unknown, the number of research respondents can be determined by multiplying the number of indicators by 5 [13]. In this study, there are 12 indicators, which results in a sample size of 60 respondents.

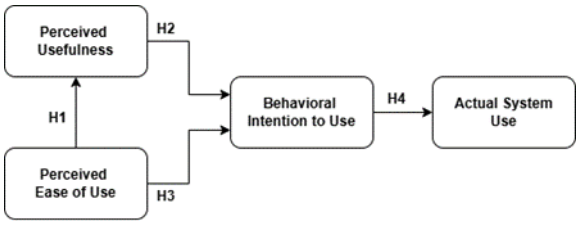

Figure 1 Technology Acceptance Model (TAM) Model**.**

The picture above can be concluded that the hypothesis in this study is as follows:

Table 1 Hypothesis Summary

Hypothesis	Description
H1	Perceived Ease of Use (PEOU) has a significant influence on Perceived Usefulness (PU)
H2	Perceived Usefulness (PU) has a significant influence on Behavioral Intention to Use (BI)
H3	Perceived Ease of Use (PEOU) has a significant influence on Behavioral Intention to Use (BI)
H4	Behavioral Intention to Use (BI) has a significant influence on Actual System Use (ASU)

4. Result and Discussion

4.1. Demographic Respondent

This research produced 150 respondents. However, only 120 respondents met the criteria of having used the Multi-Lane Free Flow system. There were 30 respondents who had never used the Multi-Lane Free Flow system. Therefore, the results of this study only utilize data from the 120 respondents. Below is a summary of the demographic information of these respondents.

Table 2 Respondent's Demographic

Characteristic	Category	Amount	Percentage
Gender	Woman	56	58.3%
	Man	94	41.7%
Age	< 17 Years Old	1	0.9%
	18 – 25 Years Old	78	85.2%
	26 – 45 Years Old	48	12.2%
	> 46 Years Old	23	1.7%
How many times have you used Multi-Lane Free Flow services?	1 – 3 Times per Week	28	85.2%
	4 – 6 Times per Week	50	10.4%
	> 6 Times per Week	72	4.3%

4.2. Data Analysis

The first step in this data analysis is the validity test, which includes calculating the loading coefficient for each variable. Each indicator in the Outer Loading (OL) must have a minimum value of 0.70 [14].

Table 3 Outer Loading Result

Indicator	OL	Indicator	OL
PU1	0.812	BI1	0.840
PU2	0.805	BI2	0.932
PU3	0.916	BI3	0.813
PEOU1	0.823	ASU1	0.817
PEOU2	0.876	ASU2	0.921
PEOU3	0.903	ASU3	0.847

Table 3 indicates that all indicators in this study are above 0.70, suggesting that these indicators adequately represent the variable. The subsequent step in the validity test for this study is to assess the Average Variance Extracted (AVE) value, which should exceed 0.5 [14]. Following the validity assessment, this study will also evaluate reliability. Reliability can be measured in two ways: through Cronbach's alpha value and composite reliability. Cronbach's Alpha (CA) and Composite Reliability (CR) values ranging from 0.6 to 0.7 are considered acceptable in exploratory research, while values between 0.7 and 0.9 are seen as meeting a satisfactory level [14].

Table 4 Reliability and Validity Result

Variable	AVE	CA	CR
PU	0.712	0.754	0.866
PEOU	0.825	0.811	0.783
BI	0.731	0.782	0.944
ASU	0.807	0.722	0.849

Table 4 demonstrates that each variable's value can be considered valid and reliable (AVE > 0.5, CA > 0.7, CR > 0.7). The subsequent step involves evaluating the relationships between various constructs in the research, including the interrelationships of latent variables. This model comprises several testing stages, including R-Square and Q-Square testing.

Table 5 R-Square and Q-Square Result

Variable	R-Square	Q-Square
PU	0.529	0.653
BI	0.614	0.531
ASU	0.554	0.413

A model is considered strong if the R-Square value reaches 0.75, moderate if it reaches 0.50, and weak if it reaches 0.25. A Q-Square value greater than 0 indicates that the model has predictive relevance, while a Q-Square value smaller than 0 indicates a lack of predictive relevance [15].

According to Table 5 the variables Perceived Usefulness, Behavioral Intention to Use, and Actual System Usage are in the "Moderate" category. This indicates that the model has predictive relevance. Subsequently, the research tested the hypotheses using the bootstrapping method. In this hypothesis testing, a two-tailed test with a significance level of 5% was used. A hypothesis is considered accepted at a significance level of 5% if its t-statistic value exceeds the critical t-table threshold, which is 1.96 [14].

Table 6 Hypothesis Result

Hypothesis	Path	T-Statistics	P-Value
H1	PEOU → PU	0.061	0.090
H2	PU → BI	3.157	0.001
H3	PEOU → BI	0.021	0.075
H4	BI → ASU	2.412	0.000

H1 : Perceived Ease of Use (PEOU) has a significant influence on Perceived Usefulness (PU). Based on the research results in Table 6, the T-statistics value of 0.061 is smaller than 1.96, and the P-value of 0.090 is greater than 0.05, indicating that H1 is Rejected. The results of this study indicate that users still encounter difficulties in using the MLFF system. This is due to the lack of guidance, socialization, and introduction to how to use MLFF. Therefore, users still find it difficult to understand the MLFF system. Consequently, Perceived Ease of Use (PEOU) does not have a significant influence on Perceived Usefulness.

H2 : Perceived Usefulness (PU) has a significant influence on Behavioral Intention to Use (BI). Based on the research results in Table 6, the T-statistics value of 3.157 is greater than 1.96, and the P-value of 0.001 is smaller than 0.05, indicating that H2 is accepted. The results of this study indicate that the MLFF system can facilitate users in toll payment. This MLFF payment system can improve their effectiveness and productivity. Therefore, Perceived Usefulness (PU) has a significant influence on Behavioral Intention to Use (BI).

H3 : Perceived Ease of Use (PEOU) has a significant influence on Behavioral Intention to Use (BI). Based on the research results in Table 6, the T-statistics value of 0.021 is smaller than 1.96, and the P-value of 0.075 is greater than 0.05, indicating that H3 is rejected. The results of this study indicate a lack of interest in using the MLFF system due to its complexity. Users still lack knowledge and experience in using the MLFF system. Therefore, Perceived Ease of Use (PEOU) does not have a significant influence on Behavioral Intention to Use (BI).

H4 : Behavioral Intention to Use (BI) has a significant influence on Actual System Use (ASU). Based on the research results in Table 6, the T-statistics value of 2.412 is greater than 1.96, and the P-value of 0.000 is smaller than 0.05, indicating that H4 is accepted. These results suggest that when users have a strong intention to use the MLFF system, they are more likely to actually use it. This finding highlights the importance of user intentions in driving actual system use and emphasizes the role of perceived

5. Conclusion

Based on this study, the analysis results indicate that the factors influencing the acceptance and usage of the Multi Lane Free Flow (MLFF) system in Indonesia are the perceived ease of use (PEOU), perceived usefulness (PU), as well as the intentions and behaviors of users (Behavioral Intention to Use/BI and Actual System Use/ASU). Although PEOU does not significantly influence PU and BI, PU has a significant impact on BI. This suggests that despite users experiencing difficulties in using MLFF, the benefits derived from using the system can influence users' intentions to use it. Therefore, it is recommended that MLFF service providers enhance socialization and education for users to improve understanding and acceptance of the MLFF system. Additionally, emphasizing the benefits of using MLFF should be increased to encourage user intention to use the system.

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