

The Acceptance Factors of the Traffic Jam Assistance System in Jakarta

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Abstract

The purpose of this study is to investigate the impact of Technology Acceptance Model (TAM) factors, which consist of perceived ease of use and usefulness, and their impact on attitudes and intentions to use Traffic Jam Assistance (TJA) among Jakarta car owners. The survey method is quantitative using non-stochastic sampling methods and convenient sampling methods. 220 samples were analyzed using the SEM-PLS analysis technique. The results of the study confirm that all hypotheses have been proven. Perceived ease of use and perceived usefulness have been found to positively and significantly influence attitudes. Moreover, the attitude has a positive and significant impact on the intention to use TJA. This research may be the basis for applied research for creating TJA prototypes and research development for TJA productions.

Keywords: Ease of use, Usefulness, technology acceptance, Traffic Jam Assistance, ADAS.

I. INTRODUCTION

Based on the notice of the National Police regarding the number of traffic accidents at the end of 2020, DKI Jakarta was ranked 5th with a total of 73 cases. Compared to DKI Jakarta, Central Java is in first place with 336 cases. East Java in second place with 332 cases, West Java in third place with 180 cases, and followed by Yogyakarta with 91 cases (Ahdira, 2020). The Ministry of Communication and Information Technology reports that three people die in car accidents per hour. According to the news, the factors causing traffic accidents are 61% due to human factors related to the skills and personality of drivers, 30% due to infrastructure and environmental factors, and only 9% due to the feasibility of the vehicles used (KOMINFO, 2017).

From that, 61% of road accidents are caused by driver skills and behavior. Interestingly, DKI Jakarta Province is in the fifth place for traffic accidents. The first place is Central Java with 336 cases. Many amateur drivers in Jakarta use the Advanced Driver Assistance System (ADAS). This may be the reason the accident

rate is lower than Central Java, East Java, West Java, and Yogyakarta.

The use of vehicles requires a Traffic Jam Assistance (TJA) system in and around DKI Jakarta. This city has a very dense traffic density and congestion. Currently, not all in Jakarta and its surrounding areas are equipped with this TJA system. Therefore, if you have a developer who wants to take the opportunity to create a mobile congestion assistant in the form of an application system that can be installed on your smartphone, a driver that does not have ADAS-TJA might be interested. Before developing the system, market research must be conducted to determine the general public's interest in using TJA.

A number of other researchers who tested the Technology Acceptance Model (TAM), such as Bakhsh et al. (2017) proved that perceived ease of use has a significant effect on attitudes towards technology. Although Brandon-Jones & Kauppi (2018) did not prove the effect of perceived ease of use on attitudes, other researchers such as Karahoca et al. (2018) and Purwanto & Tannady (2020) proved the significant influence of perceived ease of use on attitudes to technology.

Bakhsh et al. (2017) also proved that perceived usefulness has a significant effect on attitudes in technology. The influence of perceived usefulness on attitudes to the technology is also proved by Karahoca et al. (2018), Brandon-Jones & Kauppi (2018), and Purwanto & Tannady (2020).

Bakhsh et al. (2017) proved that attitudes to certain technologies are the driving force of people's intention to use these technologies. This is also proved by Karahoca et al. (2018), Brandon-Jones & Kauppi (2018), Singh et al. (2020), and Purwanto & Tannady (2020).

Based on the phenomena, theories, and research gaps, the Mobile Traffic Jam Assistance (TJA) user intention test will examine the Technology Acceptance Model (TAM). There are three factors adopted from TAM, namely perceived usefulness, perceived ease of use, and attitude to use.

2. LITERATURE REVIEW

2.1. Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) was developed by Davis (1989). According to this theory, the acceptance of a person or consumer for a particular technology product or innovation is influenced by attitude towards the technology (attitude towards), ease perceived by the user (perceived ease of use) and benefits perceived by the user (perceived usefulness) are two factors that will create a positive attitude towards technology and then motivate to use it.

Previous studies that used TAM is the research by Lok (2015) that examined TAM related to the acceptance of e-payment systems in Hong Kong. Bakhsh et al. (2017) examined TAM related to the acceptance of mobile learning among students in Pakistan. Purwanto & Tannady (2020) examined TAM related to the acceptance of e-learning among students in Jakarta, Indonesia. Karahoca et al. (2018) examined TAM related to the acceptance of IoT healthcare in Turkey. Hubert et al. (2019) examined TAM related to the acceptance of smart home applications in Germany. Brandon-Jones & Kauppi (2018) examined TAM related to the acceptance of e-procurement in the Netherlands. Singh et al. (2020) examined TAM related to the acceptance of Blockchain among companies in

India. Moreover, Shaikh et al. (2020) examined Islamic FinTech TAM in Malaysia.

TAM has been examined for several objects, except ADAS, especially Traffic Jam Assistance (TJA). Thus, testing the acceptance of Traffic Jam Assistance (TJA) using TAM will be a novelty of this study. Previous research in various countries has examined TAM in the context of receiving e-payments, mobile learning, e-learning, smart home applications, e-procurement, Blockchain, and Islamic FinTech. However, There is no research in the context of receiving ADAS, especially Traffic Jam Assistance (TJA).

2.2. Perceived Ease of Use

Perceived ease of use is defined as the perception of the extent to which a person believes that using a particular system or technology will facilitate his or her efforts in using the system or technology (Shaikh et al., 2020). People's perception in general regarding the use of technology is that the ease and convenience of technology is the main expectation for the user (Bakhsh et al., 2017). According to Agarwal and Prasad, perceived (1998) ease of use indicates the user's perception of the amount of effort (i.e. time and resources) required to use a system or to introduce or update a certain technology.

2.3. Perceived Usefulness

Perceived usefulness is the first construct that becomes a source of inspiration towards technological acceptance and adaptation. This perceived usefulness is defined as a person's belief that using a particular system or technology will benefit him or her or be useful in improving the performance (Bakhsh et al., 2017). According to Agarwal and Prasad (1998), perceived usefulness refers to the user's perception of the extent to which the use of technology will improve his or her condition.

2.4. Attitude toward

The attitude in TAM refers to the user's perception of his/her desire to use a particular information system application (Chen Ying et al., 2015). According to Agarwal and Prasad, (1998) attitude is a person's affective response to using new technology. In general, user satisfaction is seen as a response based on evaluation and expressed during the process of

utilizing the technology (Agarwal & Prasad, 1998).

2.5. Behavior Intention

Behavior intention refers to motivational factors that influence certain behaviors, and the stronger the intention to perform an action, the more likely it is to be performed (Purwanto & Loisa, 2020). Intention is basically defined as the people's effort to be willing to work and the determination to take action. Behavior intention refers to a person's subjective potential to perform a particular action (Mamman et al., 2016).

2.6. The Effect of Perceived Ease of Use on Attitude toward Technology

Bakhsh et al. (2017) proved that the ease in using m-learning technology affects the attitude of students in Pakistan. Karahoca et al. (2018) also proves that the ease in using IoT healthcare has a significant effect on the attitude of the community in Turkey. Brandon-Jones & Kauppi (2018) proved that the ease in using the e-procurement system has a significant effect on the attitude of companies in the Netherlands. Purwanto & Tannady (2020) proved that the ease in using e-learning technology affects the attitude of students towards Google Meet. Then this study will examine the effect of ease of using ADAS-Mobile Traffic Jam Assistance.

Based on the results of previous studies, the fifth hypothesis can be concluded as follows:

H1: There is a positive and significant effect of Perceived Ease of Use on attitudes to using mobile-TJA among car riders in Jakarta.

2.7. The Effect of Perceived Usefulness on Attitude toward Technology

Bakhsh et al. (2017) proved that perceived usefulness has a positive and significant effect on student attitudes in Pakistan related to use of m-learning. Karahoca et al. (2018) also found a positive and significant effect of perceived

usefulness on the attitudes of Turks on IoT healthcare. Brandon-Jones & Kauppi (2018) found a positive and significant effect of perceived usefulness on the attitude of Dutch people towards e-procurement. Purwanto & Tannady (2020) found a positive and significant effect of perceived usefulness on the attitude of Indonesian students in the implementation of e-learning during the COVID-19 pandemic.

Based on the results of previous studies, the fourth hypothesis can be concluded as follows:

H2: There is a positive and significant effect of Perceived Usefulness on attitudes to use mobile-TJA among car drivers in Jakarta.

2.8. The Effect of Attitude on Behavior Intentions

Bakhsh et al. (2017) proved that a positive attitude towards m-learning technology affects the intentions of students in Pakistan to use the technology. Karahoca et al. (2018) also proved that a positive attitude towards IoT healthcare has a significant effect on the intentions of people in Turkey to use it. Brandon-Jones & Kauppi (2018) proved that a positive attitude towards e-procurement systems has a significant effect on the intentions of companies in the Netherlands to use the system. Singh et al. (2020) proved that a positive attitude towards Blockchain affects the intentions of companies in India to use it. Purwanto & Tannady (2020) proved that a positive attitude towards e-learning influences students' intention to use Google Meet. This study will examine the effect of attitude in intention using ADAS-Mobile Traffic Jam Assistance.

H3: There is a positive and significant effect of attitudes towards the intention to use mobile-TJA among car drivers in Jakarta.

Based on the basis or foundation of the theory, the conceptual framework of this research can be seen in Figure 1.

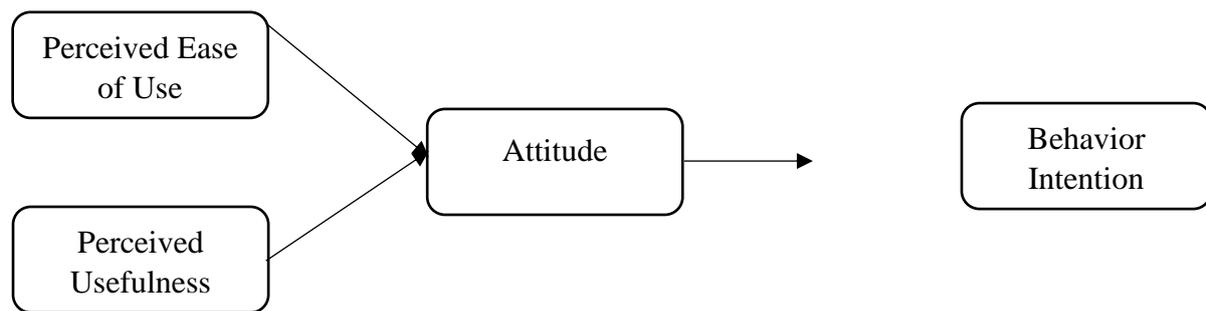


Figure 1. *Conceptual Framework*

3. RESEARCH METHODS

3.1 Research Location

The survey was conducted in Jakarta. Jakarta was chosen because it is the city with the densest traffic jams and vehicles that are not using ADAS-TJA requires traffic assistance hours (TJA).

3.2. Population and Sample

The population of this study are drivers in Jakarta who do not have a TJA system. The sampling method uses non-probability sampling to obtain a determined number of samples from a population that does not know the exact number. The number of samples collected in this study was 220.

3.3. Sampling Techniques

The sampling method used in this study is non-probability sampling using the convenience sampling method. According to Sekaran dan Bougie (2016), if the number of populations is unknown and not all members of the population have the same chance of being selected as a sample, then a sample design with non probability is selected. The population of this survey is vehicle or car users in Jakarta. Therefore, it is difficult, even impossible, to find the exact number of population. In terms of accessibility, it will be more difficult to reach all car users selected as a sample in Jakarta. For this reason, this study uses non-probability sampling.

3.4. Research Instruments

The measurement of perceived usefulness adopted from 4 items from Hoque et al. (2016; Purwanto & Tannady, 2020). Measurement of perceived ease of use adoption of 4 items from Hoque et al. (2016; Purwanto & Tannady,

2020). The measurement instrument for attitude variables adopts 5 items from (Renny et al., 2013) The measurement instrument for the intention variable adopts 3 items developed by Hoque et al. (2016; Purwanto & Tannady, 2020).

3.5. Data Analysis Techniques

This study uses PLS-SEM analysis technique with SmartPLS version 3.0 software. Data analysis using SEM-PLS measures external model scores to test reliability and validity, and evaluates structural or internal models to measure R² and T-statistics or hypothesis tests (J. F. Hair et al., 2011). The test results were analyzed in detail to find the results of the study.

According to Hair et al. (2012), PLSSEM has been developed as an alternative to CB-SEM that emphasizes prediction while mitigating data specification requirements and relationships. Hair et al. (2012) explains that CB-SEM estimates model parameters, estimates differences between covariance matrices, and indicates that samples are minimized. While PLS-SEM maximizes the deviation described by potential endogenous variables by understanding the sub-model relationship in the order of repetition of Ordinary Least Squares (OLS) regression. An important feature of PLS-SEM is to expect deferred variable scores as a linear combination of related manifest variables. PLS-SEM is used to test complex models that can occur in CBSEM.

4. RESULTS AND DISCUSSION

4.1. Outer Model Evaluation

Table 1 shows that all indicators of the Perceived Ease of Use variable are greater than

0.70, which is the outer loadings value of EOU1: 0.833, EOU2: 0.898, EOU3: 0.891, and EOU4: 0.884. Thus, all of these variable indicators have proven to be reliable or have met the reliability indicator requirements. All indicators of the Perceived Usefulness also proved reliable because all of them had an outer loadings value of more than 0.70. The outer loadings values of UF1: 0.906, UF2: 0.917, UF3: 0.931, and UF4: 0.899 (Table 1). Thus, all of these variable indicators have proven to be reliable or have met the reliability indicator requirements.

Table 1. *Outer Loadings*

	ATT	ITU	EOU	UF
ATT1	0.932			
ATT2	0.948			
ATT3	0.936			
ATT4	0.939			
ATT5	0.923			
EOU1			0.833	
EOU2			0.898	
EOU3			0.891	
EOU4			0.884	
ITU1		0.925		
ITU2		0.916		
ITU3		0.932		
UF1				0.906
UF2				0.917
UF3				0.931
UF4				0.899

As shown in Table 1, all indicator values of the Attitude variable are greater than 0.70 as the threshold of the indicator value, which values are ATT1: 0.932, ATT2: 0.948, ATT3: 0.936, ATT4: 0.939, and ATT5: 0.923. Thus all indicators of the Attitude variable have met the reliability indicator.

Table 1 shows that all indicators of the Intention to Use variable have an outer loadings value greater than 0.70, so it proves reliable. The values of each outer loadings indicator are as follows, ITU1: 0.925, ITU2: 0.916, and ITU3: 0.932. Thus, all indicators of the variable have met the reliability indicator.

Table 2. *Construct Reliability and Validity*

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Attitude	0.964	0.972	0.875
Intention to Use	0.915	0.946	0.855
Perceived Ease of Use	0.900	0.930	0.769
Perceived Usefulness	0.934	0.953	0.834

Table 2 shows that the Composite Reliability value for each variable is greater than 0.70, and the Cronbach's alpha value for each variable is greater than 0.70. Therefore, all variables are considered reliable and meet the composite reliability (Purwanto, 2016). Table 2 also shows that the Average Variance Extracted (AVE) value for each variable is greater than 0.50. Therefore, all variables are valid (Purwanto et al., 2021a). Table 3 shows that the AVE value of the latent construct is greater than the square correlation. Therefore, this study met the discriminant validity.

Table 3. *Discriminant Validity*

	Attitude	Intention to Use	Perceived Ease of Use	Perceived Usefulness
Attitude	0.936			
Intention to Use	0.769	0.925		
Perceived Ease of Use	0.628	0.615	0.877	
Perceived Usefulness	0.820	0.700	0.635	0.913

4.2. R Square

Hair et al. (2011) said that the R² values of 0.75, 0.50, or 0.25 for endogenous latent variables in the structural model can be described respectively as substantial, moderate, or weak. Table 4. shows that the R Square value of the Attitude variable is 0.691 and the Intention to Use variable is 0.701. Therefore, it is said to be high or substantial.

Table 4. *R Square*

	R Square	R Square Adjusted
Attitude	0.691	0.688
Intention to Use	0.701	0.699

4.3. Inner Model Evaluation

In the SEM-PLS test the threshold value of T-statistic must be above 1.96 and P-Value must

be below 0.05 to be able to accept the hypothesis, or proven to be significant (see Hair et al., 2011; Purwanto et al., 2021b).

Table 5. *Path Coefficients*

	Hypothesis	Original Sample (O)	T Statistics ((O/STDEV))	P-Values	Status
H1	Perceived Ease of Use - > Attitude	0.180	3.292	0.001	Accepted
H2	Perceived Usefulness - > Attitude	0.705	13.594	0.000	Accepted
H3	Attitude - > Intention to Use	0.432	6.056	0.000	Accepted

The effect of Ease on Attitude in TJA is also proven to be positive and significant as shown in Table 5, where the T-statistics value is $3.292 > 1.96$, and P-value is $0.001 < 0.05$. Thus, H4 is accepted.

Table 5 also shows that the effect of Perceived Usefulness on Attitudes on TJA proved to be positive and significant because the T-statistics value is $6.126 > 1.96$, and P-value is $0.000 < 0.05$ (Table 5). Therefore, H2 is accepted.

The effect of Attitude on Intention to Use using TJA was also proven to be positive and significant as shown by T-statistics value is $6.056 > 1.96$, and P-value is $0.000 < 0.05$. It can be concluded that H3 can be accepted.

The indirect effect of Perceived Ease of Use and Perceived Usefulness on Intention is not included in the hypothesis submitted for testing. However, the results of Smart-PLS processing will automatically display the results of indirect effects. In Table 6, the indirect effect of Perceived Ease of Use in using TJA on Intention to Use using TJA is also positive and significant as shown by the T-statistics value is $2.557 > 1.96$, and P-value is $0.011 < 0.05$. The indirect effect of perceived benefits on the intention to use TJA is also positive and significant, as indicated by the T-statistics value is $5.531 > 1.96$, and the P-value is $0.011 < 0.05$.

Table 6. *Total Indirect Effects*

	Original Sample (O)	Standard Deviation (STDEV)	T Statistics ((O/STDEV))	P-Values
Perceived Ease of Use - > Intention to Use	0.078	0.030	2.557 users	0.011
Perceived Usefulness - > Intention to Use	0.305	0.055	5.531	0.000

4.4. Discussion

This study confirms that the use of Technology Acceptance Model (TAM) to examine people's intention to use ADAS-TJA is also proven, which is characterized by both perceived ease of use and perceived usefulness proven to have a significant effect. The findings of this study are in line with Jun et al. (2019) that found that expectations of performance or benefits and effort or convenience had a positive and significant effect on the intention to use ADAS.

Thus, the results of this study support the research by Bakhsh et al. (2017) that perceived ease of use has a significant effect on one's attitude regarding the use of m-learning in

Pakistan. The results of previous studies by Brandon-Jones & Kauppi (2018) did not find the perceived ease of use on the positive attitude of the Dutch people towards the use of e-procurement, and Hubert et al. (2019) did not find that the perceived ease of use can have a significant effect on the desire of the German people to use smart home applications. The results of this study also support Karahoca et al. (2018) that the perceived ease of use has a significant effect on the attitude of the Turkish people on IoT healthcare. The results of this study supported by Singh et al. (2020) found that perceived ease of use can have a significant effect on the desire of Indian people to use Blockchain. The results of this study also supported by Shaikh et al. (2020) found that

perceived ease of use has a significant effect on the desire of the Malaysian community to use Islamic FinTech. Finally, the results of this study support the research by Purwanto & Tannady (2020) that found that perceived ease of use has a significant effect on the desire of Indonesian students to use E-learning.

The results of this study support the research by Bakhsh et al. (2017) that perceived usefulness has a significant effect on one's attitude regarding the use of m-learning in Pakistan. The results of this study also support Karahoca et al. (2018) that the perceived usefulness has a significant effect on the attitude of the Turkish people on IoT healthcare. The results of this study support Hubert et al. (2019) that found the perceived usefulness have a significant effect on the desire of the German community to use smart home applications. The results of this study also support the research by Brandon-Jones & Kauppi (2018) that found that the perceived usefulness has a significant effect on the positive attitude of the Dutch people regarding the use of e-procurement. The results of this study also support the research by Singh et al. (2020) that found that the perceived usefulness can have a significant effect on the desire of Indian people to use Blockchain. The results of this study also supported by Shaikh et al. (2020) that found perceived usefulness has a significant effect on the desire of the Malaysian community to use Islamic FinTech. Finally, the results of this study support the research by Purwanto & Tannady (2020) that found that perceived usefulness has a significant effect on the desire of Indonesian students to use E-learning.

The results of this study support the research by Bakhsh et al. (2017) that found attitudes have a significant influence on m-learning intention in Pakistan. The results of this study also support Karahoca et al. (2018) that found the attitude of the Turkish people on IoT healthcare has a significant effect on their desire to use it. The results of this study also support the research by Brandon-Jones & Kauppi (2018) that found a positive attitude towards e-procurement has a significant effect on the desire of the Dutch people to use it. The results of this study support the research by Singh et al. (2020) that found the positive attitude of Indian people on Blockchain has a significant effect on their desire to use it. The results of this study support Purwanto &

Tannady (2020) research that found the positive attitude of Indonesian students on e-learning has a significant effect on their desire to use it.

5. CONCLUSION

The results of this study prove that all hypotheses have a positive and significant effect. Therefore, this study is proven to use the Technology Acceptance Model (TAM) test to find the factors that encourage people to use Traffic Congestion Assist (TJA).

The effect of perceived ease of use on attitudes to use mobile-TJA among car drivers in Jakarta is proven to be positive and significant, which is shown by the T-statistic value of $3.292 > 1.96$, and the P value of $0.001 < 0.05$. The results of this study prove that people's perception of the ease of using certain technologies, or in this case mobile-TJA offered, creates a positive attitude of the community towards the mobile-TJA product.

The effect of perceived usefulness on attitudes to use mobile-TJA among car drivers in Jakarta is proven to be positive and significant, which is shown by the T-statistic value of $13.594 > 1.96$, and the P value of $0.000 < 0.05$. The results of this study prove that the perceived usefulness of the community towards mobile-TJA can prevent traffic accidents and create a positive attitude towards the mobile-TJA offered.

The effect of attitude on the intention to use mobile-TJA among car drivers in Jakarta is proven to be positive and significant, which is shown by the T-statistic value of $6.056 > 1.96$, and the P value of $0.000 < 0.05$. In relation to the fourth and fifth conclusions, the results of this study prove that the perceived ease of use and perceived usefulness of mobile-TJA that create a positive attitude also evoke their intention to use mobile-TJA.

This research has generated a lot of interest in the use of TJA. However, until now there are only a few cars equipped with TJA. The brands and models currently installed in TJA are Wuling Almaz RS, Daihatsu Rocky, Toyota Raize, and New Honda HRV.

The results of this study can be a market research for automotive companies on the need to embed the TJA system. Therefore, the suggestion for automobile producers is that they should equip

the TJA system and other ADAS features in every type of car produced. Because TJA systems are in the public interest, it is likely that the demand for the product will be high. In addition, startups and technology companies can also take the opportunities to develop TJA systems that can be sold on the market, especially to automotive users who are not using ADAS-TJA.

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