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Analysis of Customer's Continuous Use of Maritime Transportation Mobile Ticketing Application

Adeilla Rahmi Anggraini[a], Nila Armelia Windasari[b]
[a]School of Business and Management, Institut Teknologi Bandung, adeilla_anggraini@sbm-itb.ac.id
[b]School of Business and Management, Institut Teknologi Bandung, nila.armelia@sbm-itb.ac.id

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Abstract
Smartphone and internet connectivity advancements have led travellers to demand quicker and smoother purchasing processes. In response, a passenger shipping company in Indonesia launched its mobile ticketing app in 2018. However, despite closing offline ticketing booths in late 2023, the app adoption remains low. This research investigates factors influencing user adoption and usage of the app, by using a modified UTAUT model. A quantitative approach utilizes questionnaires, data analysis using SPSS and PLS-SEM, and cluster analysis to identify user segments and pain points. The research analysis finds that only performance expectancy, social influence, voluntariness of use, system quality, and system quality with a moderating variable frequency of app use impact the user's intention to continue using the app. These results are further clustered into four categories based on the DOI theory. These findings can be used by the company and other maritime transportation companies seeking to leverage mobile technology for improved customer experience and ticketing efficiency.
Keywords: *Maritime mobile ticketing app, UTAUT model, cluster analysis, DOI theory*

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INTRODUCTION

The rapid advancement of technology is bringing about a significant transformation in the transportation sector, presenting new opportunities for passengers worldwide to efficiently plan and book their journeys [1]. This shift is also evident in maritime travel [2], especially in countries like Indonesia, made up of many islands, where dependable ferry services are vital for connecting the islands. Research in Indonesia has shown a notable increase in the use of online booking platforms, reflecting a global trend [3].

The move towards digital ticketing corresponds with broader industry changes. Mobile ticketing applications have become a crucial innovation, simplifying the ticket purchasing process and improving customer convenience [3]. These apps offer a range of advantages, including real-time updates, easier payment options, and reduced reliance on physical tickets. However, the adoption and continuous use of these technologies depend on several factors that influence user behaviour and satisfaction.

With more than 17,000 islands, Indonesia still depends on ships and ferries as the main mode of transportation between its islands. Companies in maritime transportation play a crucial role in this system, moving millions of passengers and goods every year [4]. To meet evolving customer needs and keep up with the digital transformation, a passenger shipping company created a ticketing mobile app in 2018, allowing passengers to book tickets remotely. To further digitalize the overall ticketing process, the company decided to close its offline ticketing booths in its main port area, such as Jakarta, Surabaya, and Makassar, in November 2023. However, despite these efforts, the actual app adoption remains low and various reported issues have shown a gap between technology implementation and user satisfaction [5].

The Unified Theory of Acceptance and Use of Technology (UTAUT) has been extensively used to analyze technology adoption in different contexts [6],[7],[8],[9],[10],[11]. The original model consists of factors like performance expectancy, effort expectancy, social influence, and facilitating conditions [12]. A study has been conducted in a different app, also in the maritime sector, using UTAUT model [7]. Additionally, other research has explored different approaches to app adoption during COVID-19 pandemic, underscoring the need for a comprehensive analysis during the current post pandemic situation [13].

Understanding user behaviour and satisfaction is crucial for improving the mobile ticketing experience. The adoption and ongoing use of mobile applications in the transportation sector have been influenced by various factors according to previous studies [7],[9],[10], such as perceived ease of use, perceived usefulness, user experience, and trust in

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the system. This study aims to integrate these findings with the modified UTAUT model to comprehensively analyze the factors that impact the continuous use of maritime transportation mobile ticketing applications in Indonesia.

To further examine respondent behaviour and identify distinct user segments, cluster analysis can be utilized. This analytical approach enables the discovery of patterns and trends within the data, offering deeper insights into user preferences and behaviours [14]. The users are categorized into distinct clusters based on the diffusion of Innovation (DOI) theory, which can provide more tailor insights on how to improve the mobile ticketing application to better meet the needs of different user groups.

As companies strive to enhance customer experience and operational efficiency, understanding the drivers of technology adoption becomes increasingly important. This research aims to provide valuable insights into the factors driving the continuous use of mobile ticketing applications. These insights will inform strategies to enhance user satisfaction and promote the widespread adoption of digital ticketing solutions, ultimately contributing to the efficiency and reliability of maritime transportation in Indonesia.

RESEARCH METHODS

A quantitative method was used in this research by distributing questionnaires to collect information and statistical insights regarding app usage (see Figure 1). The data collected is analyzed using statistical techniques to uncover significant patterns and relationships. The responses are measured on a five-point Likert Scale, with 1 indicating “strongly disagree”, 2 indicating “disagree”, 3 indicating “neutral”, 4 indicating “agree”, and 5 indicating “strongly agree” [15],[16].

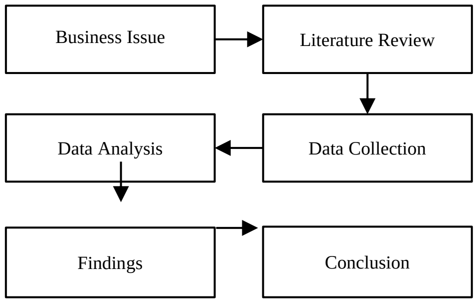

Figure 1. Research Framework

In this study, a modified UTAUT model is constructed based on the business issue (see Figure 2). It is hypothesised five latent variables are being considered affecting the behavioural intention of users to continue using the app (CU), which are performance expectancy (PE), effort expectancy (EE), social influence (SI), voluntariness of use (VU), and system quality (SQ). While the actual use of the app (AU) is influenced by facilitating conditions (FC) and the continuous use (CU). There is also a moderating variable frequency of use (F).

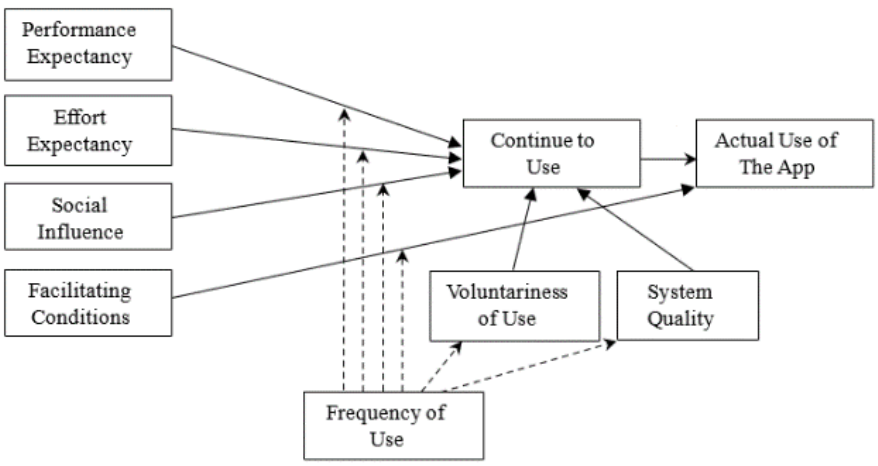

Figure 2. Constructed model

Based on the constructed model thirteen hypotheses are developed.

Table 1. Research hypothesis

Hypo-thesis	Description
H1	PE has a significant effect on CU.
H2	EE has a significant effect on CU.

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Hypo-thesis	**Description**
H3	SI has a significant effect on CU.
H4	FC has a significant effect on AU.
H5	VU has a significant effect on CU.
H6	SQ has a significant effect on CU.
H7	CU has a significant effect on AU.
H8	The effect of PE on CU is moderated by F.
H9	The effect of EE on CU is moderated by F.
H10	The effect of SI on CU is moderated by F.
H11	The effect of FC on AU is moderated by F.
H12	The effect of VU on CU is moderated by F.
H13	The effect of SQ on CU is moderated by F.

In Table 2, twenty-six items are formed based on previous research in the context of the UTAUT model, adapted to the research-specific context of the online and mobile ticketing platform [14],[17],[18],[19],[20], [21],[22].

Table 2. Construct measurement

Item	**Description**
PE1	The app is very useful in the purchasing process.
PE2	The app saves me time.
PE3	The app increases my efficiency.
EE1	It is easy to learn how to use the app.
EE2	The app is easy to use.
EE3	It is easy to become skilful at using the app.
SI1	Important people persuade me to use the app.
SI2	Familiar people persuade me to use the app.
SI3	People who influence my behaviour think that I should use the app.
SI4	People whose opinions I value think that I should use the app.
FC1	I have the necessary resources.
FC2	I have the necessary knowledge to use the app.
FC3	I feel comfortable using the app.
FC4	Help is available when I have a problem.
VU1	Using the app is not mandatory.
VU2	I use the app voluntarily.
VU3	Other activities do not require me to use the app.
SQ1	The user interface (UI) is interactive
SQ2	The app response is quick.
SQ3	The app has good performance with no errors.
SQ4	The app provides security.
CU1	I intend to continue to use the app in the future.
CU2	I will use the app first for my next purchase.
CU3	I plan to continue using the app more.
AU	How often do you use the app to purchase tickets?
F	How often do you open the app?

Several tools and software are used for data analysis, such as Google Spreadsheet and Google Form to collect respondent data, SPSS for data validation and cluster analysis, and PLS-SEM using SmartPLS 4 software for inner and outer evaluation.

RESULTS AND DISCUSSION

The first step is to measure the questionnaire items before further testing. Using SPSS, it was obtained that each item was variable and reliable. The validity test is tested using Pearson Correlation and Cronbach's Alpha to test the variable reliability. If the Pearson Correlation result is significant at 0.01 level, then the item is valid. If the Cronbach's Alpha result is greater than 0.06, by the rule of thumb the item can be considered as reliable. The result in Table 3 shows that all items were valid and reliable for further testing.

A total of 205 responses were sampled during the collection period. Age-wise, most respondents are 25 to 40 years old (42%), followed by 41 to 55 years old (27.9%), 17 to 24 years old (25.4%), and the rest are more than 55 years old. Males accounted for 47.3% of the sample population and females for 52.7%.

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Table 3. Data validity test result

Variable	Item	Pearson Correlation	Cronbach's Alpha
PE	PE1	0.77	0.92
	PE2	0.73	
	PE3	0.75	
EE	EE1	0.76	0.93
	EE2	0.78	
	EE3	0.76	
SI	SI1	0.65	0.95
	SI2	0.65	
	SI3	0,72	
	SI4	0.69	
FC	FC1	0.69	0.89
	FC2	0.72	
	FC3	0.84	
	FC4	0.78	
VU	VU1	0.38	0.68
	VU2	0.69	
	VU3	0.31	
SQ	SQ1	0.72	0.88
	SQ2	0.78	
	SQ3	0.79	
	SQ4	0.77	
CU	CU1	0.79	0.829
	CU2	0.79	
	CU3	0.70	
AU	AU	0.340	-

To gain a better understanding of the respondent's demographic background, it is also questioned the respondent's educational background and income. The educational background is represented as follows: 42.4% own a bachelor's degree, 36.6% own a high school degree, 14.1% own a diploma degree, 5.4% own a post-graduate or doctorate, and the rest with primary or junior high school degree. The respondents monthly income are varied from IDR 3 to 5 million (27.8%), IDR 5 to 10 million (24.4%), IDR 1 to 3 million (19.5%), more than IDR 10 million (16.1%), and the rest are less than IDR 1 million.

Based on this analysis, it is obtained that the majority of the app users based on respondents' demographic background are people of working age with higher educational degrees and are in the middle-income class.

Next, several tests are conducted to evaluate the outer and inner models using SEM-PLS. Figure 3 shows the constructed structural model and path diagram built in the SmartPLS 4 software.

Outer Model Evaluation

To evaluate the outer model, the convergent validity and discriminant validity are tested. Table 4 presents the result of convergent validity testing using AVE and Composite Reliability. All latent variables must have an AVE score ≥ 0.5 and Composite Reliability ≥ 0.7.

Table 4. Convergent validity test result

Variable	AVE	Composite Reliability	Convergent Validity
PE	0.87	0.95	Good
EE	0.87	0.95	Good
SI	0.88	0.97	Good
FC	0.73	0.92	Good
VU	0.57	0.79	Good
SQ	0.74	0.92	Good
CU	0.75	0.90	Good

To test the discriminant validity of all variables, the Fornell-Larcker Criterion value must be greater than the correlation between the constructs. Table 5 shows the result of this test with the value of the Fornell-Larcker Criterion shown in bold. The result is aligned with the criteria, indicating that the discriminant validity of the model is good.

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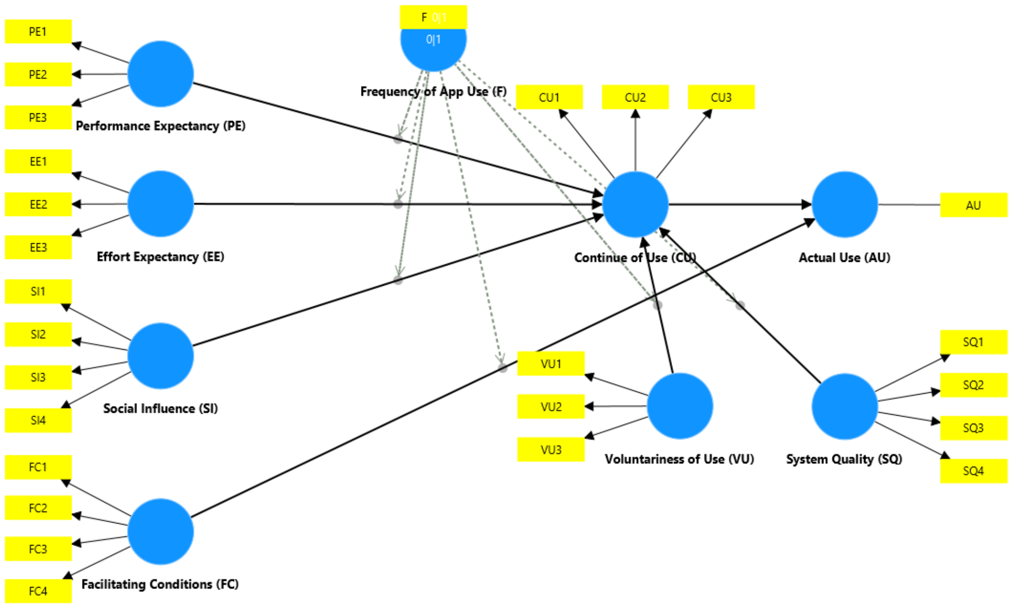

Figure 3. Structured model and its path diagram

Table 5. Discriminant validity test result

	AU	CU	EE	FC	F	PE	SI	SQ	VU
AU	**1.00**								
CU	0.21	**0.86**							
EE	0.19	0.70	**0.93**						
FC	0.19	0.82	0.78	**0.85**					
F	0.74	0.35	0.33	0.35	**1.00**				
PE	0.15	0.72	0.70	0.78	0.30	**0.93**			
SI	0.30	0.56	0.42	0.50	0.35	0.44	**0.94**		
SQ	0.31	0.79	0.74	0.78	0.43	0.66	0.60	**0.86**	
VU	0.11	0.57	0.51	0.60	0.20	0.52	0.30	0.52	**0.75**

Inner Model Evaluation

The inner model evaluates the relationship between the various factors and user behaviours. Several tests are conducted, such as goodness of fit (GoF), effect size, and hypothesis test. For GoF, R square is used to indicate whether the model is strong (R square > 0.67), moderate (R square > 0.33), or weak (R square > 0.19) [23]. Changes in the value can be used to see whether there is a substantive effect of the exogenous latent variable on the endogenous latent variable.

Table 6. Goodness of Fit test result

Variable	R Square	R Square Adjusted	Relation
CU	0.44	0.43	Moderate
AU	0.73	0.72	Strong

The result in Table 6 shows that the simultaneous influence of exogenous variables: PE, EE, SI, VU, SQ, and these latent variables moderated by F on CU has an R square of 0.44 with an adjusted R square of 0.43, meaning the relationship between these exogenous variables and CU are moderate. Meanwhile the relationship

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of the simultaneous influence between FC, CU, and latent variable FC moderated by F on AU is strong, considering the R square is 0.73 with an adjusted R square 0.72.

In testing the effect size of a variable that may be affected by other variables, F square is used. The effect size is considered small when the F square is ≥ 0.02, medium when ≥ 0.15, and large when ≥ 0.35 [23].

Table 7. Effect size test result

	F-Square CU	**F-Square AU**	**Effect Size**
PE	0.09	-	Small
EE	0.01	-	No effect
SI	0.04	-	Small
FC	-	< 0.00	No effect
VU	0.05	-	Small
SQ	0.18	-	Medium
CU	-	< 0.00	No effect
F	< 0.00	0.67	No effect, large
F x PE	< 0.00	-	No effect
F x EE	< 0.00	-	No effect
F x SI	< 0.00	-	No effect
F x FC	-	0.01	No effect
F x VU	0.01	-	No effect
F x SQ	0.02	-	Small

The hypothesis test is conducted using the bootstrapping feature to know the relationships between the constructed paths. The researcher evaluated the significance of the path coefficient based on its p-value and t-value.

A one-tailed test is used instead of the two-tailed test due to the model directional paths, which only consider one direction. A one-tailed method path coefficient is considered statistically significant and thus supports the hypothesis if the p-value < 0.01 when the t-value > 2.33 or if the p-value < 0.05 when $1.65 < t$-value < 2.33.

Table 8. Hypothesis test result

Hypothesis	**Path**	**Path Coefficient**	***p*-value**	***t*-value**	**Result**
H1	PE → CU	0.29	< 0.00	3.30	Supported
H2	EE → CU	0.13	0.14	1.07	Rejected
H3	SI → CU	0.14	0.03	1.94	Supported
H4	FC → AU	- 0.05	0.27	0.62	Rejected
H5	VU → CU	0.19	< 0.00	3.25	Supported
H6	SQ → CU	0.28	< 0.00	2.71	Supported
H7	CU → AU	- 0.00	0.49	0.01	Rejected
H8	F x PE → CU	- 0.11	0.21	0.81	Rejected
H9	F x EE → CU	- 0.08	0.32	0.47	Rejected
H10	F x SI → CU	- 0.05	0.34	0.40	Rejected
H11	F x FC → AU	0.13	0.17	0.97	Rejected
H12	F x VU → CU	- 0.14	0.05	1.61	Rejected
H13	F x SQ → CU	0.31	0.03	1.85	Supported

The result from the path coefficient value revealed that if the app is easy to use (PE, EE), valued by people around (SI), enjoyable to use (VU), and has a good system quality (SQ),

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users are more likely to keep using it (CU). However, facilitating conditions (FC), which contribute to ease of use, might not directly translate to increased usage frequency. This suggests that while users may appreciate a user-friendly interface, it alone might not be enough to increase the potential habit of continuous app use (CU). This result aligns with a study where factors beyond facilitating conditions, such as service quality and user satisfaction, are critical for the continuous use of mobile travel booking services [24].

Additionally, the analysis found that frequency of use (F) moderates the effect of system quality (SQ) on the intention to continue using (CU) the app. The positive value of this moderating effect suggested that for users who already frequently use the app, system quality has an even stronger positive influence on their intention to keep using it.

The same result goes to the relationship between the effect of FC with the moderating variable F to the user actual use (AU) of the app were positive, indicating that users who are frequent users will be more likely to keep purchasing tickets from the app if the facilitating conditions of the app improve.

These result correlates with previous study in which for frequent users, high system quality and supportive facilitating conditions strongly correlate with the intention to continue using the app [24].

Table 8 also shows that out of thirteen hypotheses, only five were statistically significant and supported based on the one-tailed method criteria. These hypotheses are H1, H3, H5, H6, and H13. The first accepted hypothesis (H1) suggests that users who believe the app can help them achieve their goals (PE) are more likely to continue using (CU) the app. Similarly, users who are influenced by those around them (SI) to use the app (H3), those who feel in control (VU) of their app usage (H5), and who perceive a well-designed, user-friendly app (SQ) are more likely to keep using it (CU).

Also, the supported hypothesis, H13, indicates frequent use (F) interacts with system quality (SQ). This means that a positive user experience from a well-designed app is especially important for retaining users who already use the app regularly [26].

Cluster Analysis

To get a better insight into the respondents' answers to the items questioned, a cluster analysis is done to group the respondents based on their average score on each item [14]. The first step of this analysis is to find the number of clusters that can be made using hierarchical cluster analysis. Using the Dendrogram, a total of four clusters can be made based on the distance of the answers scores.

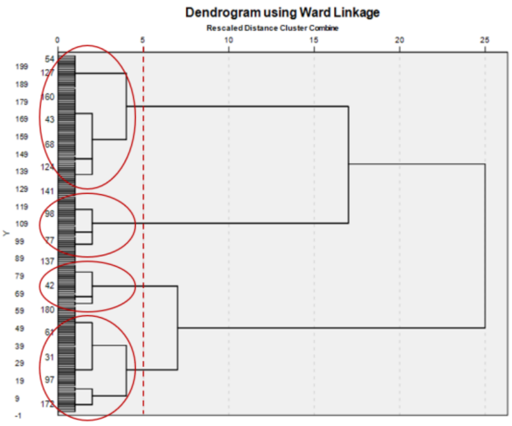

Figure 4. Dendrogram

The next step is to group respondents using k-means clustering. The respondents are grouped into a cluster based on the nearest mean to the other respondent's average score. Table 9 and Figure 5 present the overall result.

Table 9. K-means clustering result

Variable	Clusters Average Score				Sample Average Score
	1	2	3	4	
PE	4.79	4.72	4.10	2.87	4.35
EE	4.71	4.64	3.73	2.89	4.19
SI	3.86	4.34	3.40	2.63	3.70
FC	4.70	4.68	3.83	2.93	4.23
VU	4.23	4.26	3.59	3.05	3.91
SQ	4.26	4.57	3.55	2.69	3.94
CU	4.57	4.66	3.75	2.91	4.15

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Variable	**Clusters Average Score**				**Sample Average Score**
	1	**2**	**3**	**4**	
AU	1.23	3.98	1.66	1.57	2.03

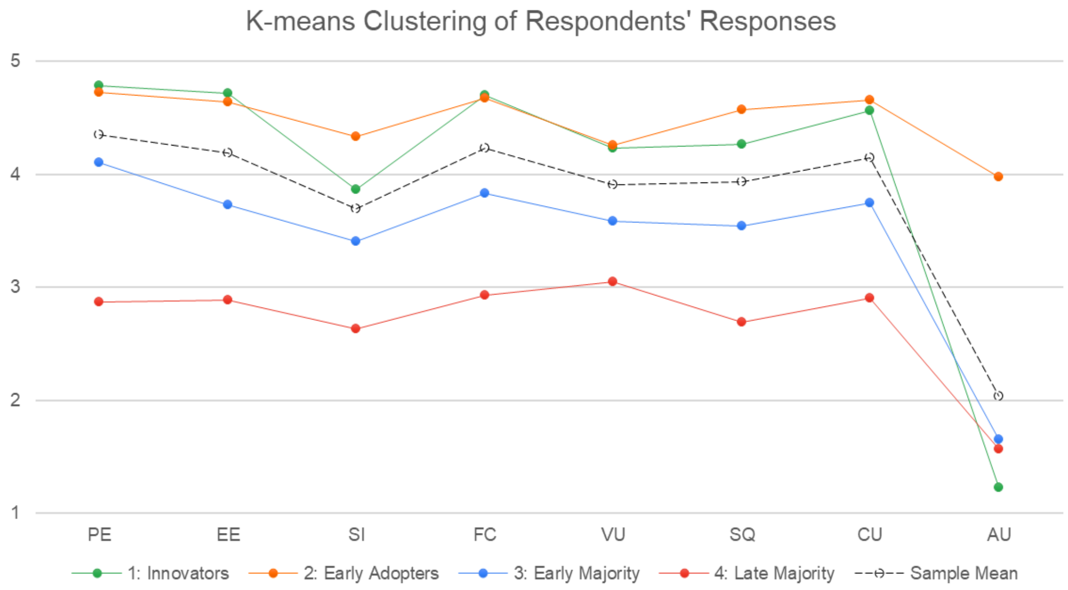

Figure 5. K-means clustering

Through the Diffusion of Innovation (DOI) theory the results are categorized based on the characteristics of this theory that are most aligned with [27],[28]. Cluster 1 falls within the "Innovators" category because the overall score resembles the innovators' characteristics. Respondents within this category have high scores in PE, EE, and FC, which demonstrate a venturesome spirit and openness to change. They are the first to embrace new ideas and innovations, even if it means taking risks and challenges. However, their low score in AU reflects their tendency to constantly explore and experiment, potentially moving on to the next big thing before fully utilizing the current innovation.

Cluster 2 aligns with "Early Adopters." This group, known as opinion leaders within their social circles, is the second wave of adopters. The respondents' high scores in SI, VU, CU, and AU suggest they leverage their experience to influence others. They are the ones driving the social adoption of the app by demonstrating its value through their app usage.

Cluster 3 bears the resemblance with characteristics of the "Early Majority." This average adopter segment is more cautious but still willing to try new ideas if they see them as beneficial. Their mostly third-place rankings across most items indicate a willingness to adopt the app, but not necessarily as the leader of pioneer. They follow the lead of the early adopters before fully integrating an innovation.

Lastly, Cluster 4 is labelled in the "Late Majority" category. These individuals are sceptical of new concepts and slow to embrace them. Their low average scores reflect their risk-averse nature. They will only adopt a new idea after it is widely accepted and gains mainstream popularity.

CONCLUSION

This research investigated the user adoption challenges hindering the ticketing mobile app success in Indonesia's dynamic maritime transportation landscape. By leveraging a modified UTAUT model and employing several tools, the study offers some insights that can be used for enhancing user experience and driving app adoption.

The findings reveal a critical gap between user expectations and the current app experience. While performance expectancy (PE) and effort expectancy (EE), social influence (SI), voluntariness of use (VU), and system quality (SQ) all positively influence a user's intention to continue using the app (CU), facilitating conditions (FC) alone might not directly translate to increased usage frequency. This suggests that a user-friendly interface, while important, is not enough to cultivate habitual app engagement.

However, the analysis found that for frequent users (F), system quality (SQ) emerges as a crucial factor for retaining their continued app usage for ticket purchases (AU). This highlights the importance of prioritizing a positive user experience through a well-designed and user-friendly platform, particularly for high-value, frequent users.

The cluster analysis, based on Diffusion of Innovation (DOI) theory, further segments respondents into four categories based on their app adoption behaviour. "Innovators" (Cluster 1) embrace the app readily but may not utilize it extensively. "Early Adopters" (Cluster 2), acting as opinion leaders, influence others through their positive user experience. "Early Majority' (Cluster 3) are cautious but receptive users, while "Late Majority" (Cluster 4) are slow to adopt new technologies.

From these analyses, some business strategies are recommended to implement to increase the app's user adoption and continuous usage, such as:

1. Prioritize user experience (UX) by focussing on continuous improvement of the app system quality (SQ) and facilitating conditions (FC) to create a user-friendly and efficient app experience.
2. Leverage social influence by encouraging user reviews and testimonials to harness the power of social proof and influence potential early adopters.
3. Target high-value users by implementing targeted campaigns to retain frequent users on the value proposition and superior user experience offered by the app.
4. Foster brand awareness by creating a strong brand image associated with innovation and convenience to attract new users across different segments.

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