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Development of a Software Usage Loyalty Model by Analysing the Causal Relationships between Software Quality, Customer Satisfaction, Trust, and Experience in the Access by KAI Application

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Abstrak

Kereta api merupakan salah satu moda transportasi jarak jauh yang populer di Indonesia karena keunggulannya dalam hal waktu tempuh, kenyamanan, dan keselamatan. Pada tahun 2023, jumlah penumpang kereta api meningkat sebesar 40,6% hingga mencapai 270 juta orang, dengan sebagian besar tiket dipesan melalui aplikasi seluler. PT Kereta Api Indonesia (KAI) menyediakan layanan pemesanan tiket secara daring melalui aplikasi Access by KAI, yang meskipun penggunaannya semakin meningkat, tetap memperoleh banyak ulasan negatif terkait kinerjanya di Google Play Store. Penelitian ini bertujuan untuk membangun model loyalitas penggunaan perangkat lunak dengan memanfaatkan sembilan variabel kualitas perangkat lunak berdasarkan ISO/IEC 25010:2023 product quality, serta menggunakan metode PLS-SEM (Partial Least Square-Structural Equation Modelling) untuk menganalisis hubungan kausal antara kualitas perangkat lunak, kepuasan pelanggan, kepercayaan, pengalaman, dan loyalitas. Hasil penelitian menunjukkan bahwa functional suitability dan keamanan memiliki pengaruh positif signifikan secara tidak langsung terhadap loyalitas pelanggan melalui kepuasan pelanggan. Selain itu, functional suitability, keamanan, kepercayaan, dan pengalaman pelanggan berpengaruh positif signifikan secara langsung terhadap kepuasan pelanggan, sedangkan kepercayaan dan kepuasan pelanggan berpengaruh positif signifikan secara langsung terhadap loyalitas pelanggan. Berdasarkan temuan tersebut, disusun rekomendasi prioritas untuk meningkatkan kualitas aplikasi Access by KAI.

***Kata kunci**: ISO/IEC 25010:2023, Mobile application, PLS-SEM, Text mining, Orange*

Abstract

Trains are a popular mode of long-distance transportation in Indonesia due to their advantages in travel time, comfort, and safety. In 2023, train passengers increased by 40.6% to 270 million people, with most tickets booked through mobile applications. PT Kereta Api Indonesia (KAI) offers online ticket booking services through the Access by KAI application, which, despite its increased usage, has received many negative reviews regarding its performance on the Google Play Store. This research aims to develop a model of software usage loyalty using nine software quality variables from ISO/IEC 25010:2023 product quality and the PLS-SEM (Partial Least Squares-Structural Equation Modelling) method to analyse the causal relationships between software quality, customer satisfaction, trust, experience, and loyalty. The results show that functional suitability and safety have a significant positive indirect effect on customer loyalty through customer satisfaction. Additionally, functional suitability, safety, customer trust, and customer experience have a significant positive direct effect on customer satisfaction, while customer trust and customer satisfaction have a significant positive direct effect on customer loyalty. Based on these findings, priority suggestions were developed to improve the Access by KAI application.

***Keywords**: ISO/IEC 25010:2023, Mobile application, PLS-SEM, Text mining, Orange*

1. Introduction

Trains are one of the popular means of transportation for long-distance travel due to their advantages, such as short travel time, high comfort, and good safety levels (Biomantara and Herdiansyah, 2019). In 2023, the number of train passengers in Indonesia increased by 40.6% to 270 million people (Central Bureau of Statistics, 2023). Every train ticket booking service is supported by software, and the Indonesian public has become accustomed to using mobile devices for train ticket bookings. In fact, Indonesia is among the top five countries for mobile application downloads in 2023 (CNBC Indonesia, 2024).

PT Kereta Api Indonesia (KAI) offers online train ticket booking services through the Access by KAI application. From early to mid-2023, 61.56% of train ticket sales transactions were conducted through the application, an increase from 52.16% in 2022 (Katadata, 2023). In 2021, 89.54% of ticket transactions were conducted online, but only 44.36% used the Access by KAI application. Traveloka is the most preferred and well-known ticket booking application (Alvara Research, 2019; Firjanabila et al., 2022).

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Unfortunately, the Access by KAI application on the Google Play Store has received a 2.3-star rating from 207,000 reviews, with many negative comments about its performance, including frequent errors and slow loading times. User reviews and ratings are important for developers and prospective new users (Vasa et al., 2012). In 2024, there were many negative reviews about the application's performance. Disruptions in the application became a trending topic on social media X, with users reporting being unable to book tickets, check tickets, and log in (Kompas.com, 2024).

Software quality is the fulfilment of explicitly documented functional and performance needs, the development of explicitly documented standards, and the expected implicit properties of a professionally built software (Dunn, 1990). Software quality can be considered good if its functions have been achieved and it meets non-functional needs, one of which is customer satisfaction.

Customer satisfaction is an important aspect to evaluate the success of mobile applications and increase application usage loyalty (Ranjitha and Agarwal, 2024). Satisfied customers are more likely to engage with the application regularly, make in-app purchases, and recommend the application to others. In line with Kumar et al.'s (2018) research, loyalty is defined as the consumer's intention to revisit or reuse the application for any transaction. Additionally, trust and user experience with the application influence customer satisfaction and loyalty (Malik et al., 2017). Previous research by Hamzah et al. (2021) showed that trust and customer experience affect customer satisfaction and loyalty. Research by Nirawati et al. (2020) and Yusiana et al. (2024) also concluded that trust and customer experience influence customer loyalty.

To measure software quality, this study uses the International Organisation for Standardisation (ISO) model, specifically ISO/IEC 25010 version 2023. This model assesses the extent to which software can meet customer needs to achieve goals effectively, efficiently, safely, and satisfyingly (Hussain and Mkpojiogu, 2015). According to the ISO/IEC 25010 document from 2023, there are nine software quality characteristics: functional suitability, performance efficiency, reliability, interaction capability, compatibility, security, maintainability, flexibility, and safety. This study uses the PLS-SEM (Partial Least Squares-Structural Equation Modelling) method to measure the causal relationships between variables, with high flexibility for regression research (Fernanda et al., 2022). This method allows for path analysis with latent variables (Rifai, 2015).

To develop the model in this study, a relevant reference model from previous research is required. Zahra and Kraugusteeliana (2019) used 8 ISO 25010: 2011 software quality variables, with work efficiency as the dependent variable. Lim et al. (2021) integrated the Technology Acceptance Model (TAM) and ISO 25010 to examine their relationship with application usage intention, using technology readiness as a mediator. Hamzah et al. (2021) explored how customer trust and experience impact loyalty, both directly and indirectly through customer satisfaction. Al-Salami, El-Zelawi, and Sultan (2023) demonstrated how e-banking service quality, measured by ISO 9126, influences customer satisfaction. Giraldo, Ramirez, and Piedrahita (2024) identified factors such as interactivity, convenience, and safety as influencing engagement, which in turn affects loyalty.

This study aims to develop a software usage loyalty model that is influenced by customer satisfaction, trust, and experience, with satisfaction also being influenced by software quality in the Access by KAI application. This study utilises the ISO/IEC 25010:2023 product quality variable to examine the indirect relationship between software quality and customer loyalty, mediated by customer satisfaction, as well as the direct relationships between trust, experience, and customer loyalty, and between software quality and customer satisfaction. The results will identify the software quality variables that affect customer loyalty and formulate suggestions based on customer reviews of Access by KAI on the Google Play Store.

2. Research Methods

This research is quantitative and uses data from questionnaires with structured questions from respondents. Data were collected through a survey using Google Forms. The targeted respondents are people who have booked long-distance train tickets through the Access by KAI application and are over 17 years old.

This research uses 11 independent variables: 9 software quality variables based on ISO/IEC 25010:2023 (functional suitability, performance efficiency, compatibility, interaction capability, reliability, security, maintainability, flexibility, and safety) and two supporting variables (customer trust and customer experience). The customer satisfaction variable acts as both an intervening and dependent variable, while customer loyalty serves as the dependent variable. The conceptual model in this study is shown in Figure 1.

Figure 1. Research Conceptual Model

After developing the research conceptual model, hypotheses were formulated. The formulation of hypotheses aims to test the validity of assumptions made based on the literature study conducted. A total of 23 hypotheses have been formulated:

- H1-9: Software quality variables have a significant positive effect on customer satisfaction.
- H10: Customer trust has a significant positive effect on customer satisfaction.
- H11: Customer experience has a significant positive effect on customer satisfaction.
- H12: Customer trust has a significant positive effect on customer loyalty.
- H13: Customer experience has a significant positive effect on customer loyalty.
- H14: Customer satisfaction has a significant positive effect on customer loyalty.
- H15-23: Software quality variables have a significant positive effect on customer loyalty through customer satisfaction.

Next, the questionnaire was prepared by developing the questionnaire statement instrument. The statements are made for end-users, not for developers, and are framed in the context of consumer satisfaction rather than evaluating the features or functions of the Access by KAI application. Therefore, the indicators of analysability and testability in the maintainability variable are not included in the statements. The variables and indicators in the questionnaire are shown in Table 1.

Table 1. Questionnaire Variables and Indicators

Variable	Code	Indicator
Functional Suitability	FUS1	Functional completeness
	FUS2	Functional correctness
	FUS3	Functional appropriateness
Performance Efficiency	PEE1	Time behaviour
	PEE2	Resource Utilisation & Capacity
Compatibility	COM1	Co-existence
	COM2	Interoperability
Interaction Capability	INC1	Appropriateness recognizability
	INC2	Learnability
	INC3	Operability
	INC4	User error protection
	INC5	Appropriateness recognizability
	INC6	Learnability
	INC7	Operability
	INC8	Self-descriptiveness
Reliability	REL1	Faultlessness
	REL2	Availability
	REL3	Fault tolerance
	REL4	Recoverability
Security	SEC1	Confidentiality
	SEC2	Integrity
	SEC3	Non-repudiation
	SEC4	Accountability
	SEC5	Authenticity
	SEC6	Resistance
Maintainability	MAI1	Modularity
	MAI2	Reusability
	MAI3	Modifiability
Flexibility	FLE1	Adaptability
	FLE2	Scalability
	FLE3	Installability
	FLE4	Replaceability
Safety	SAF1	Operational constraint
	SAF2	Risk identification
	SAF3	Fail safe
	SAF4	Hazard warning
	SAF5	Safe integration
Customer Satisfaction	CUS1	Adequacy
	CUS2	Effectiveness
	CUS3	Efficiency
	CUS4	Overall satisfaction
Customer Trust	CUT1	Integrity
	CUT2	Benevolence
	CUT3	Ability
	CUT4	Willingness to depend
Customer Experience	CUE1	Accessibility
	CUE2	Helpfullness
	CUE3	Personalisation
	CUE4	Problem Solving
	CUE5	Value for Time
	CUE6	Emotional Experience
	CUE7	Cognitive Experience
Customer Loyalty	CUL1	Purchase frequency
	CUL2	Cross-buying
	CUL3	Word-of-mouth
	CUL4	Loyalty

These variables are obtained from various sources of literature and previous research. Previous research. The statement references the definition of each variable, with some also adopted from previous research. This questionnaire uses closed questions, namely asking respondents to choose one of several alternative answers provided. Data collection techniques in this study involve an online questionnaire created using Google Forms.

In this study, respondents' perceptions were measured using a Likert Scale. The Likert scale is a measurement tool used to assess attitudes, opinions, and perceptions of a person or group of people towards social phenomena (Sugiyono, 2018). The use of a Likert scale with five options can help respondents to express a neutral or impartial opinion, while if there is no midpoint in the Likert scale, it can cause bias because respondents there is no midpoint in the Likert scale, it can cause bias

because respondents are forced to choose between agreeing or disagreeing (Chyung, et al., 2017). The five points of the Likert Scale: 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree.

The research used a purposive sampling method, in which the sample was selected based on certain considerations. Therefore, the criteria for respondents in this study are customers aged 17 years and above who use the Access by KAI application and have booked long-distance train tickets. The minimum age of respondents is set at 17, as individuals at this age are considered to have reached both personal and legal maturity.

The study employs the PLS-SEM method, where the sample size is generally determined using the ten-times rule. However, according to Peng and Lai (2012), this rule has a limitation as it can only be applied when high effect size values and measurement item reliability are met. To enhance the effectiveness of sample size, power analysis can be used with the GPower application. Power analysis is a new method for determining sample size, ensuring the accuracy and consistency of research results, because GPower identifies the effect size and adjusts the level of statistical error (Kang, 2021). Gpower can increase confidence in detecting significant effects and ensure adequate statistical power.

This study uses the A priori analysis type because researchers generally need to know the minimum sample size from the beginning to avoid post-data collection errors (Memon et al., 2020). The minimum threshold for determining sample size is α (significance level) = 0.05, effect size = 0.15 (medium effect), and power = 0.80 (Memon et al., 2020). In this study, the number of predictors used is 11, corresponding to the maximum number of variables that lead to one dependent variable (customer satisfaction) in the model. The minimum sample size results, as shown in Figure 2, are 123 respondents.

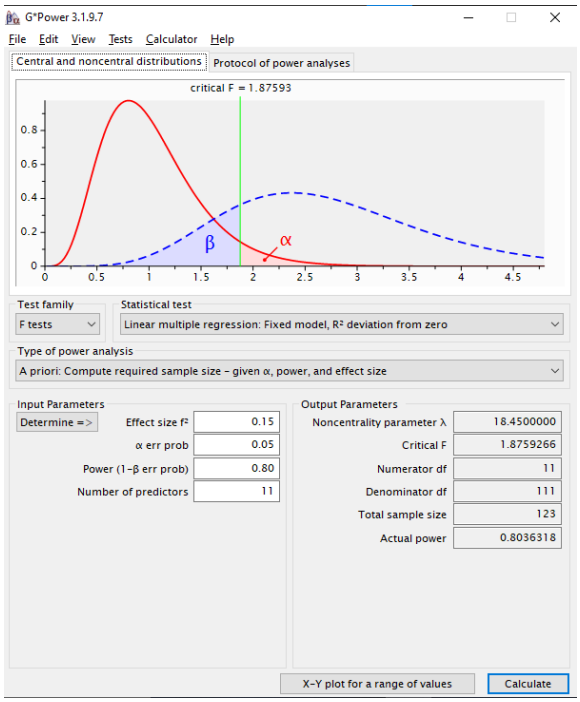

Figure 2. Minimum Sample Size

After preparing the questionnaire and determining the method and sample size, the questionnaire was distributed. The list of questions and statements was created online using Google Forms.

3. Results and Discussion

The distribution of the questionnaire resulted in 209 respondents. The details of the respondents are visualised using pie charts, which include age, province of residence, and frequency of long-distance train ticket purchases. Information regarding the age range is shown in Figure 3.

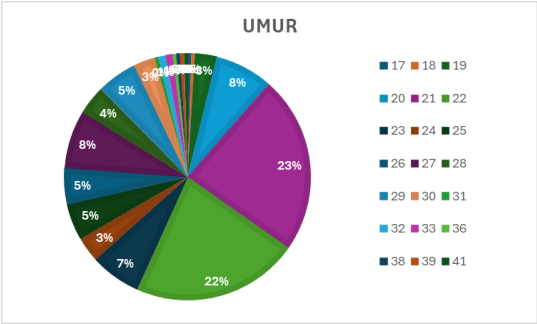

Figure 3. Age Pie Chart

The majority of respondents are 21 years old, with 49 respondents or 23.44% of the total. Then, in second place, there are 46 respondents aged 22 years, followed by 16 respondents aged 20 years in third place. Information regarding the province of residence is shown in Figure 4.

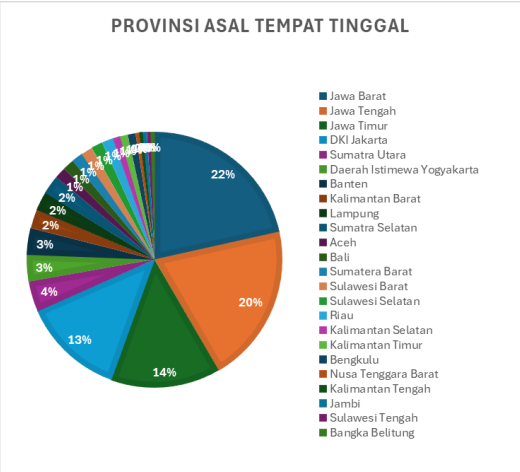

Figure 4. Province of Residence Pie Chart

Most of the respondents come from West Java Province, namely 45 respondents or 21.53% of the total respondents. Total respondents. Central Java Province occupies the second position with 42 respondents, while DKI Jakarta Province occupies the third position with 27 respondents. Information regarding the frequency of long-distance train ticket purchases is shown in Figure 5.

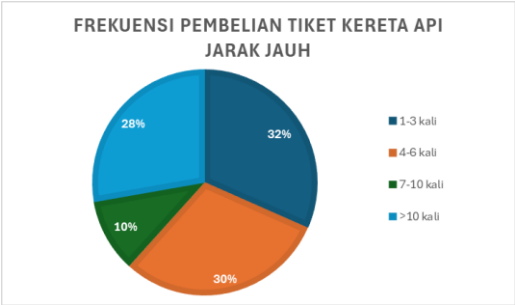

Figure 5. Frequency of Long-Distance Train Ticket Purchases Pie Chart

Majority of respondents using the Access by KAI application to buy long-distance train tickets most with a frequency of 1-3 times with 66 respondents or 31.58% of the total respondents, second followed by 63 respondents who used the application with a frequency of 4-6 times, third by 58 respondents who used the application with a frequency of >10 times, and fourth 22 respondents used the application with a frequency of >10 times. The application is used by 22 respondents more than 10 times, with some using it 7-10 times.

The next stage is data processing using the PLS-SEM method with SmartPLS. There are two stages of data processing with the PLS-SEM method: the evaluation of the measurement model (outer model) and the evaluation of the structural model (inner model). The initial structural model is shown in Figure 6.

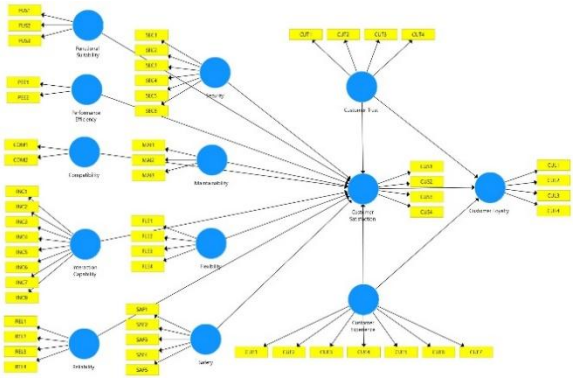

Figure 6. Initial Structural Model

3.1. Evaluation of the Measurement Model (Outer Model)

Evaluation of the measurement model (outer model) is carried out to reveal the relationship between indicators and latent variables. Measurement model evaluation is assessed through validity and reliability assessments. Validity consists of convergent validity and discriminant validity.

a. Convergent Validity

Convergent validity operates on the principle that measures of a latent variable should be highly correlated. It is assessed by examining the outer loading values and the average variance extracted (AVE) values. These values are obtained through the PLS algorithm process.

The outer loading value indicates the correlation between an indicator and its latent variable. The practical rule for outer loading values is that they should be above 0.7. Indicators with outer loading values between 0.4 and 0.7 should be considered for removal if doing so improves composite reliability, average variance extracted (AVE), and content validity. Indicators with outer loading values below 0.4 should always be removed (Hair, et al., 2017). The results of the final iteration outer loading values are shown in Table 2.

Table 2. Final Outer Loading Values

	COM	CUE	CUL	CUS
COM1	0,831			
COM2	0,760			
CUE1		0,757		
CUE2		0,658		
CUE3		0,800		
CUE4		0,748		
CUE5		0,737		
CUE7		0,660		
CUL1			0,718	
CUL3			0,780	
CUL4			0,853	
CUS1				0,766
CUS2				0,839
CUS3				0,766
CUS4				0,801

	CUT	FLE	FUS	INC
CUT1	0,773			
CUT2	0,775			
CUT3	0,761			
CUT4	0,748			
FLE1		0,798		

	CUT	FLE	FUS	INC
FLE3		0,719		
FLE4		0,751		
FUS1			0,779	
FUS2			0,723	
FUS3			0,856	
INC2				0,745
INC3				0,726
INC5				0,685
INC6				0,729
INC8				0,693

	MAI	PEE	REL	SAF	SEC
MAI1	0,771				
MAI2	0,684				
MAI3	0,677				
PEE1		0,925			
PEE2		0,746			
REL1			0,781		
REL2			0,700		
REL3			0,672		
REL4			0,715		
SAF1				0,787	
SAF2				0,733	
SAF3				0,699	
SAF4				0,826	
SAF5				0,791	
SEC1					0,780
SEC2					0,772
SEC3					0,704
SEC4					0,705
SEC6					0,654

The outer loading values resulted in the removal of 7 indicators (INC1, INC4, INC7, SEC5, FLE2, CUE6, CUL2) because their removal would enhance content validity and reliability. Therefore, these factors were eliminated.

The AVE (Average Variance Extracted) value represents the average squared loadings of the indicators related to the latent variable. Based on the AVE values, it was found that all variables have values greater than 0.5, indicating that all variables in the model are valid and suitable for use in the model. Then the AVE values are shown in Table 3.

Table 3. Average Variance Extracted (AVE) Values

Variable	Average Variance Extracted (AVE)	Variable	Average Variance Extracted (AVE)
COM	0,634	INC	0,513
CUE	0,531	MAI	0,507
CUL	0,617	PEE	0,707
CUS	0,629	REL	0,516
CUT	0,584	SAF	0,591
FLE	0,573	SEC	0,525
FUS	0,621		

b. Discriminant Validity

Discriminant validity operates on the principle that measures of different latent variables should not be highly correlated. A practical rule for testing discriminant validity with reflective indicators involves examining the cross-loading values and the Fornell-Larcker criterion.

The Fornell-Larcker criterion states that the square root of the AVE of each latent variable should be greater than the correlation values between that latent variable and other latent variables. The results of testing the Fornell-Larcker criterion are shown in Table 4.

Table 4. Fornell-Larcker Criterion

	COM	CUE	CUL	CUS	CUT	FLE	FUS	INC	MAI	PEE	REL	SAF	SEC
COM	0,796												
CUE	0,458	0,729											
CUL	0,330	0,651	0,786										
CUS	0,524	0,774	0,685	0,793									
CUT	0,450	0,765	0,628	0,757	0,764								
FLE	0,434	0,645	0,504	0,602	0,592	0,757							
FUS	0,373	0,542	0,469	0,578	0,551	0,469	0,788						
INC	0,479	0,686	0,470	0,639	0,601	0,539	0,522	0,716					
MAI	0,464	0,614	0,503	0,548	0,519	0,601	0,387	0,533	0,712				
PEE	0,377	0,476	0,272	0,468	0,359	0,329	0,164	0,423	0,411	0,841			
REL	0,499	0,684	0,529	0,654	0,593	0,493	0,432	0,626	0,586	0,591			
SAF	0,331	0,532	0,363	0,497	0,360	0,375	0,118	0,455	0,467	0,576			
SEC	0,471	0,634	0,437	0,570	0,574	0,511	0,446	0,626	0,578	0,368			
REL	0,499	0,684	0,529	0,654	0,593	0,493	0,432	0,626	0,586	0,591	0,718		
SAF	0,331	0,532	0,363	0,497	0,360	0,375	0,118	0,455	0,467	0,576	0,595	0,769	
SEC	0,471	0,634	0,437	0,570	0,574	0,511	0,446	0,626	0,578	0,368	0,601	0,556	0,724

Cross-loading testing compares an outer loading within a latent variable to its correlations with other latent variables. The cross-loading results are acceptable if no outer loading value for an indicator within a variable is smaller than its correlation with other variables. Cross loading test results are shown in Table 5.

Table 5. Cross Loading Values

	COM	CUE	CUL	CUS	CUT	FLE	FUS	INC	MAI	PEE	REL	SAF	SEC
COM1	0,831	0,384	0,218	0,448	0,361	0,364	0,314	0,455	0,378	0,388	0,450	0,335	0,372
COM2	0,760	0,344	0,317	0,383	0,357	0,326	0,280	0,297	0,361	0,200	0,339	0,181	0,380
CUE1	0,395	0,757	0,545	0,608	0,663	0,540	0,458	0,484	0,450	0,269	0,537	0,314	0,468
CUE2	0,323	0,658	0,391	0,518	0,454	0,402	0,277	0,542	0,466	0,470	0,522	0,558	0,506
CUE3	0,328	0,800	0,442	0,601	0,591	0,429	0,441	0,540	0,402	0,341	0,491	0,336	0,406

	COM	CUE	CUL	CUS	CUT	FLE	FUS	INC	MAI	PEE	REL	SAF	SEC
CUE4	0,292	0,748	0,475	0,528	0,519	0,452	0,417	0,533	0,486	0,344	0,512	0,385	0,477
CUE5	0,360	0,737	0,532	0,592	0,519	0,510	0,408	0,480	0,511	0,437	0,539	0,422	0,513
CUE7	0,292	0,660	0,442	0,523	0,581	0,471	0,345	0,428	0,367	0,230	0,379	0,335	0,404
CUL1	0,298	0,482	0,718	0,429	0,442	0,436	0,389	0,395	0,361	0,165	0,434	0,262	0,330
CUL3	0,192	0,503	0,780	0,556	0,533	0,365	0,358	0,322	0,432	0,208	0,340	0,287	0,351
CUL4	0,295	0,549	0,853	0,614	0,502	0,397	0,366	0,398	0,392	0,260	0,476	0,306	0,349
CUS1	0,406	0,662	0,620	0,766	0,613	0,552	0,512	0,497	0,467	0,217	0,495	0,303	0,468
CUS2	0,404	0,623	0,579	0,839	0,648	0,438	0,519	0,538	0,451	0,415	0,554	0,419	0,470
CUS3	0,407	0,510	0,453	0,766	0,502	0,403	0,332	0,454	0,341	0,463	0,503	0,404	0,364
CUS4	0,446	0,644	0,506	0,801	0,624	0,508	0,448	0,530	0,466	0,410	0,522	0,456	0,492
CUT1	0,344	0,555	0,424	0,558	0,773	0,434	0,431	0,433	0,394	0,254	0,445	0,213	0,409
CUT2	0,336	0,565	0,520	0,598	0,775	0,478	0,413	0,444	0,451	0,249	0,460	0,335	0,500
CUT3	0,403	0,618	0,488	0,586	0,761	0,445	0,448	0,493	0,401	0,289	0,485	0,276	0,408
CUT4	0,292	0,599	0,482	0,570	0,748	0,451	0,392	0,465	0,336	0,305	0,423	0,269	0,432
FLE1	0,330	0,559	0,431	0,489	0,464	0,798	0,314	0,473	0,561	0,331	0,426	0,447	0,433
FLE3	0,333	0,442	0,343	0,459	0,504	0,719	0,445	0,367	0,394	0,081	0,289	0,066	0,380
FLE4	0,322	0,457	0,366	0,415	0,370	0,751	0,304	0,376	0,397	0,338	0,404	0,331	0,341
FUS1	0,313	0,422	0,452	0,459	0,476	0,430	0,779	0,432	0,301	0,120	0,358	0,092	0,332
FUS2	0,218	0,362	0,267	0,407	0,366	0,359	0,723	0,309	0,241	0,063	0,253	0,132	0,307
FUS3	0,341	0,489	0,381	0,496	0,454	0,325	0,856	0,480	0,362	0,192	0,399	0,064	0,407

	COM	CUE	CUL	CUS	CUT	FLE	FUS	INC	MAI	PEE	REL	SAF	SEC
INC2	0,371	0,514	0,361	0,503	0,502	0,410	0,503	0,745	0,401	0,220	0,360	0,228	0,436
INC3	0,339	0,498	0,399	0,479	0,458	0,414	0,444	0,726	0,370	0,300	0,488	0,285	0,396
INC5	0,295	0,497	0,297	0,392	0,403	0,387	0,314	0,685	0,396	0,297	0,448	0,375	0,499
INC6	0,299	0,466	0,353	0,421	0,380	0,327	0,264	0,729	0,360	0,255	0,380	0,359	0,501
INC8	0,397	0,481	0,268	0,476	0,396	0,386	0,315	0,693	0,383	0,441	0,563	0,402	0,429
MAI1	0,254	0,364	0,339	0,380	0,339	0,303	0,228	0,264	0,771	0,362	0,379	0,366	0,385
MAI2	0,408	0,434	0,365	0,419	0,420	0,511	0,386	0,413	0,684	0,162	0,396	0,135	0,415
MAI3	0,317	0,514	0,368	0,365	0,340	0,459	0,195	0,459	0,677	0,370	0,479	0,521	0,432
PEE1	0,384	0,488	0,300	0,477	0,371	0,368	0,206	0,436	0,415	0,925	0,557	0,490	0,385
PEE2	0,221	0,272	0,118	0,272	0,200	0,135	0,026	0,238	0,247	0,746	0,423	0,505	0,196
REL1	0,407	0,537	0,466	0,550	0,535	0,341	0,458	0,545	0,387	0,416	0,781	0,360	0,496
REL2	0,356	0,512	0,405	0,488	0,451	0,435	0,402	0,397	0,409	0,348	0,700	0,345	0,381
REL3	0,261	0,398	0,272	0,386	0,348	0,243	0,150	0,413	0,451	0,479	0,672	0,504	0,374
REL4	0,395	0,501	0,347	0,431	0,337	0,385	0,167	0,429	0,462	0,482	0,715	0,546	0,468
	COM	**CUE**	**CUL**	**CUS**	**CUT**	**FLE**	**FUS**	**INC**	**MAI**	**PEE**	**REL**	**SAF**	**SEC**
SAF1	0,226	0,421	0,233	0,375	0,318	0,274	0,073	0,359	0,344	0,466	0,442	0,787	0,463
SAF2	0,244	0,367	0,297	0,336	0,225	0,271	0,005	0,308	0,337	0,445	0,407	0,733	0,347
SAF3	0,241	0,372	0,266	0,344	0,238	0,322	0,103	0,273	0,403	0,346	0,441	0,699	0,352
SAF4	0,226	0,400	0,258	0,380	0,219	0,278	0,053	0,336	0,324	0,457	0,481	0,826	0,413
SAF5	0,322	0,469	0,334	0,454	0,361	0,296	0,193	0,446	0,386	0,486	0,503	0,791	0,529
SEC1	0,366	0,512	0,343	0,419	0,428	0,424	0,349	0,477	0,435	0,386	0,511	0,420	0,780
SEC2	0,376	0,501	0,340	0,457	0,447	0,414	0,319	0,493	0,443	0,270	0,471	0,430	0,772
SEC3	0,345	0,470	0,328	0,407	0,378	0,362	0,394	0,456	0,332	0,253	0,398	0,328	0,704
SEC4	0,334	0,414	0,245	0,389	0,415	0,317	0,356	0,441	0,419	0,157	0,337	0,389	0,705
SEC6	0,278	0,391	0,322	0,385	0,407	0,326	0,192	0,395	0,466	0,259	0,454	0,446	0,654

c. Reliability

To test reliability, there are two methods: Cronbach's Alpha and Composite Reliability. Both values should be greater than 0.7 to indicate good reliability. However, Cronbach's Alpha is often considered an underestimate, so it is recommended to refer to Composite Reliability for more accurate results (Ghozali et al., 2015). Reliability testing, as indicated by the composite reliability value, is presented in Table 6.

Table 6. Composite Reliability Values

Variable	Composite Reliability	Variable	Composite Reliability
COM	0,776	INC	0,840
CUE	0,871	MAI	0,754
CUL	0,828	PEE	0,827
CUS	0,871	REL	0,809
CUT	0,849	SAF	0,878
FLE	0,801	SEC	0,846
FUS	0,830		

3.2. Evaluation of the Structural Model (*Inner Model*)

a. Bootstrapping

The bootstrapping method is used to evaluate the significance of path coefficients. If the T-statistic value for an independent variable is greater than 1.96 (significance level = 5%), then the variable significantly affects the dependent variable. Additionally, the P-values should be considered. A variable is deemed significant if the P-values are less than 0.05. The results of the direct relationship are shown in Table 7.

Table 7. Bootstrapping Results Direct Relationship

	Original Sample (O)	T Statistics (|O/STDEV|)	P Values
COM→CUS	0,108	1,706	**0,089**
CUE→CUL	0,231	2,198	**0,028**
CUE→CUS	0,236	3,017	**0,003**
CUS→CUL	0,387	3,189	**0,002**
CUT→CUL	0,158	1,489	**0,137**
CUT→CUS	0,318	3,966	**0,000**
FLE→CUS	0,059	1,143	**0,253**
FUS→CUS	0,173	2,843	**0,005**
INC→CUS	0,043	0,732	**0,464**

Based on the bootstrapping results for direct relationships, the accepted hypotheses are hypotheses 1, 9, 10, 11, 13, and 14, with T Statistics > 1.96 and P Values < 0.05. It is concluded that functional suitability, safety, customer trust, and customer experience have a significant positive impact on customer satisfaction directly. Additionally, customer trust and experience have a significant positive impact on customer loyalty directly. The results of the indirect relationship are shown in Table 8.

Table 8. Bootstrapping Results: Indirect Relationship

	Original Sample (O)	T Statistics (|O/STDEV|)	P Values
COM→CUS→CUL	0,042	1,754	**0,080**
FLE→CUS→CUL	0,023	1,035	**0,301**
FUS→ CUS→CUL	0,067	2,128	**0,034**
INC→CUS→CUL	0,016	0,728	**0,467**
MAI→ CUS→CUL	-0,007	0,268	**0,789**
PEE→ CUS→CUL	0,021	0,825	**0,410**
REL→ CUS→CUL	0,022	0,686	**0,493**
SAF→ CUS→CUL	0,055	2,021	**0,044**
SEC→ CUS→CUL	-0,027	1,216	**0,224**

Based on the bootstrapping results for indirect relationships, the accepted hypotheses are hypotheses 15 and 23, with T Statistics > 1.96 and P Values < 0.05. It is concluded that functional suitability and safety have a significant positive impact on customer loyalty through customer satisfaction.

b. Coefficient of Determination (R^2)

R Square is used to measure how much the dependent variables explain the independent variables. The basis for decision-making for the structural model based on the R Square value is: an R Square value of 0.75 indicates a good model, a value of 0.50 indicates a moderate or fairly good model, and a value of 0.25 indicates a weak model (Hair, et al., 2011). The adjusted R-squared is a refined version of R-squared that takes into account predictors that do not significantly contribute to a regression model. In other words, it indicates whether adding more predictors enhances the regression model. Information on the coefficient of determination of the model is shown in Table 9.

Table 9. Coefficient of Determination Values

Variable	R Square	R Square Adjusted
Customer Loyalty	0,515	0,508
Customer Satisfaction	0,725	0,710

The coefficient of determination shows an R Square value of 0.515 (fairly good) for customer loyalty and 0.725 (good) for customer satisfaction. The Adjusted R Square values for customer loyalty and customer satisfaction are 0.508 and 0.710, respectively, indicating that customer loyalty explains 50.8% of the exogenous variables, while customer satisfaction explains 71%.

c. *Predictive Relevance* (Q^2)

Q Square is a value used to evaluate and predict the model when there is no sample (Hair, et al., 2017). If the value is greater than zero, it means the model is capable of predicting values well. The result of the predictive relevance value through the blindfolding process can be seen in Table 10.

Table 10. Predictive Relevance Values

Variable	SSO	SSE	Q^2 (=1-SSE/SSO)
Customer Loyalty	627,000	441,015	0,297
Customer Satisfaction	836,000	477,638	0,429

3.3. Analysis of Google Play Store Reviews

Based on the results of PLS-SEM, two software quality variables have a significant positive effect on customer satisfaction and customer loyalty, namely functional suitability and safety variables. Therefore, the collected reviews are focused on the two software quality variables that refer to the concept of the research of Al-Salami, El-Zelawi, and Sultan (2023), which discusses the relationship between software quality and customer satisfaction variables.

The initial step involved collecting reviews to analyse application performance issues and provide improvement suggestions. Reviews were collected using web scraping from the Google Play Store web page. Reviews are categorised based on the results of PLS-SEM, namely software quality variables that have a significant positive effect on customer satisfaction and customer loyalty. Reviews were collected by searching for keywords related to each variable according to the ISO 25010:2023 definition. Variable keywords are shown in Table 11.

Table 11. Review Collection Keywords

No	Variable	Keywords
1	Functional Suitability	-Function -Features -Information
2	Safety	-Disruptions -Transaction errors -Warning notifications

a. Functional Suitability

The Access by KAI application is appreciated for providing comprehensive information about schedules, ticket prices, types of trains, and other details, ensuring smooth ticket purchases and enhancing user convenience. However, some users encounter issues with specific features, including ticket addition and train food ordering, which malfunction, and application instability that prevents schedule display and hinders ticket booking.

b. Safety

The Access by KAI application receives positive reviews for fast notification features and a satisfying ticket booking experience. However, negative reviews highlight incidents that erode comfort and trust, such as unannounced booking

code changes, underscoring the need for enhanced security measures to prevent transaction errors that harm users.

3.4. Prioritisation Analysis of Proposals

To determine improvement suggestions, a quantitative analysis was conducted by counting the number of reviews containing the keywords of the specified variables in Table 11. Then, positive and irrelevant reviews were filtered out. The reduced list of reviews was analysed with a word cloud using Orange software to identify the most frequently occurring issues. The word cloud for the functional suitability variable is shown in Figure 7, and the word cloud for the safety variable is shown in Figure 8.

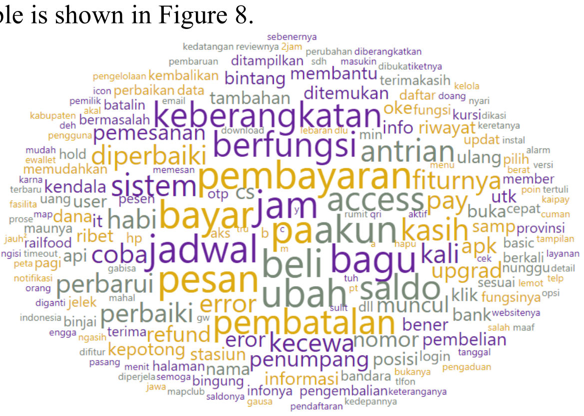

Figure 7. Word Cloud Functional Suitability

Figure 8. Word Cloud Safety

The issues from these two variables will be summarised and used as a reference for prioritising improvement suggestions.

1. The application offers a wide range of services, similar to a super app. The numerous disruptions in available services and features indicate instability. Therefore, it is recommended to reduce irrelevant features such as mobile credit, PLN (electricity), hotel, taxi, and bus services to focus on improving the main services.
2. Information related to payment, cancellation, and rescheduling is only accessible in the application before making a payment. Thus, it is suggested to add an information menu that includes the rules for the payment, cancellation, and rescheduling processes.
3. Adding a pop-up notification feature on the application icon to indicate the number of unread notifications for customers.
4. Adding a notification feature to the notification page for the train ticket booking process. For example, notifications about the remaining time to make a payment.

4. Conclusion

The development of the model for the software quality variables is based on ISO/IEC 25010:2023 regarding product quality. The relationships examined include 11 exogenous variables: 9 software quality variables and two supporting variables (customer trust and customer experience), which were tested for their relationship with customer satisfaction. Additionally, the relationship between customer trust and customer experience with customer loyalty was identified. Based on the PLS-SEM results, the functional suitability and safety variables have a significant positive indirect effect on customer loyalty through customer satisfaction. The functional suitability, safety, customer trust, and customer experience variables have a significant positive direct effect on customer satisfaction, while customer trust and customer satisfaction have a significant positive direct effect on customer loyalty.

Future research can explore the direct relationships between the ISO 25010:2023 software quality variables and customer loyalty, trust, and experience, as well as examine the customer satisfaction and loyalty variables using other indicators. The proposed improvements can be used for the development and enhancement of the Access by KAI application and to assess their effectiveness.

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