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Evaluating the Performance Efficiency of the Banyuwangi Tourism App Using ISO 25010 and PLS-SEM Approach

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ABSTRACT

The Banyuwangi Tourism App serves as a key digital platform for providing tourism-related information and services in Banyuwangi, East Java, Indonesia, including destinations, attractions, accommodations, culinary offerings, events, and supporting facilities. However, users have reported that the application's performance has not been optimal and tends to decline over time. Therefore, a comprehensive evaluation of application performance is essential to ensure optimal user experience and improve the effectiveness of tourism services. This study aims to analyze the performance quality of the Banyuwangi Tourism App using the ISO 25010 quality model, focusing on performance efficiency attributes. A quantitative research approach was employed. Hypothesis testing was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM) based on data collected from 166 users of the Banyuwangi Tourism App. The results indicate that out of eight proposed hypotheses, seven variables have a positive and significant effect on the application's performance efficiency, while one variable does not show a significant influence. These findings provide empirical insights into the key determinants of application performance from the user perspective. This study contributes by offering a structured and theory-driven evaluation of tourism application performance using ISO 25010 integrated with PLS-SEM analysis. The results can assist developers and stakeholders in prioritizing improvements on critical quality attributes, thereby enhancing application efficiency and delivering a better user experience.

1. Introduction

In the increasingly digital era, technological change has impacted almost every aspect of human life compared to the way of life before its existence (Savolainen & Collan, 2020; Ancillai et al., 2023; Athanasopoulou et al., 2019; Rapanta et al., 2021; Achmad et al., 2025; Bernacki et al., 2020), one of which is mobile applications in the tourism sector (Elkhwesky et al., 2022). Tourism plays a key role in supporting the economic growth of a region (Achmad et al., 2023). The increasing number of tourist visits can also encourage investment in infrastructure and improvements in public services, which in turn improve the quality of life for local residents (Achmad et al., 2023). The Banyuwangi Tourism App has revolutionized the way tourists explore Banyuwangi and its tourism industry (Suharso et al., 2022; Hanum & Saifudin, 2019; Fitroh et al., 2023). The Banyuwangi Tourism App has opened up new opportunities to expand knowledge about tourist attractions, enhance travel experiences, and keep up with tourism industry trends (Fitroh et al., 2023). The Banyuwangi Tourism App is a mobile application used by tourists visiting Banyuwangi to access information related to attractions, events, and supporting facilities (Majestic Banyuwangi Festival, 2023). The Banyuwangi Tourism App provides quick and easy access to essential information for travelers. This includes destination maps, information about tourist attractions, traveler reviews, and important travel notifications (Majestic Banyuwangi Festival, 2023). The Banyuwangi Tourism App can be used to plan trips and access the latest information on

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tourist events (Fitroh et al., 2023; Majestic Banyuwangi Festival, 2023). With its various benefits, the Banyuwangi Tourism App is not only an essential tool for supporting the tourist experience but also a means of making travel in Banyuwangi more enjoyable and well-connected with all available tourism resources. A high-quality mobile app is key to successfully meeting user needs and expectations (Bernacki et al., 2020). In recent times, the use of the Banyuwangi Tourism App as a tourist support tool has become increasingly important in enhancing the tourist experience in the area (Fitroh et al., 2023; Majestic Banyuwangi Festival, 2023). Although this app has great potential in providing information and services to users, tourists are increasingly experiencing a decline in the quality of its performance. This can be seen from the interviews and application reviews shown in Figure 1. This decline may have a negative impact on user experience and ultimately reduce the application's effectiveness in supporting the tourism sector.

The performance quality of mobile applications plays a critical role in shaping user experience (Palau-Saumell et al., 2019; Ko & Lim, 2021). Users satisfied with application performance tend to continue usage, whereas poor performance can negatively affect institutional image (Ko & Lim, 2021). In the context of e-tourism, applications with fast loading, responsive interfaces, and minimal technical issues significantly enhance user experience and attract tourist visits (Masri et al., 2020). Optimized applications also provide smoother and more enjoyable travel experiences (Masri et al., 2020; Singh & Bashar, 2021).

Furthermore, effective tourism applications and management systems improve operational efficiency, including managing tourist information, enabling interaction, and delivering real-time updates (Koliouska & Andreopoulou, 2023; Rumanti et al., 2023). Reliable applications contribute to better destination management and user experience (Wang et al., 2023; Mohammed et al., 2023), while high performance quality ensures accurate and real-time information delivery, enhancing tourist experience and monitoring processes (Wang et al., 2023). Despite its importance, the Banyuwangi Tourism App has not yet been evaluated using international standards.

The ISO 25010 framework is a widely recognized standard for evaluating software quality (Peters & Aggrey, 2020; Keibach & Shayesteh, 2022; Dewi et al., 2020). It provides comprehensive criteria for assessing key performance attributes such as speed, reliability, and efficiency, which are essential for user satisfaction (Keibach & Shayesteh, 2022; Dewi et al., 2020; Li et al., 2023). By applying ISO 25010, this study systematically evaluates the Banyuwangi Tourism App to identify strengths, weaknesses, and areas for improvement, enabling developers and stakeholders to enhance application quality and deliver greater value to users (Septiningrum et al., 2022).

This research brings significant innovation by combining two important approaches to measuring tourism app performance: the use of ISO 25010, an international standard for software quality evaluation, and critical performance analysis. In the context of the Banyuwangi Tourism App, this research not only introduces a globally recognized performance measurement method but also integrates it with a thorough analysis of the app's critical elements. By combining ISO 25010, which covers aspects such as functional suitability, reliability, performance efficiency, usability, security, compatibility, maintainability, and portability (Peters & Aggrey, 2020; Suryadi et al., 2022), with a more specific performance analysis of aspects relevant to tourism apps, this research provides more comprehensive insights into the app's performance quality. This not only allows for more accurate problem identification but also provides a clearer view of how improvements can be directed to increase the Banyuwangi Tourism App's effectiveness in supporting the tourism sector.

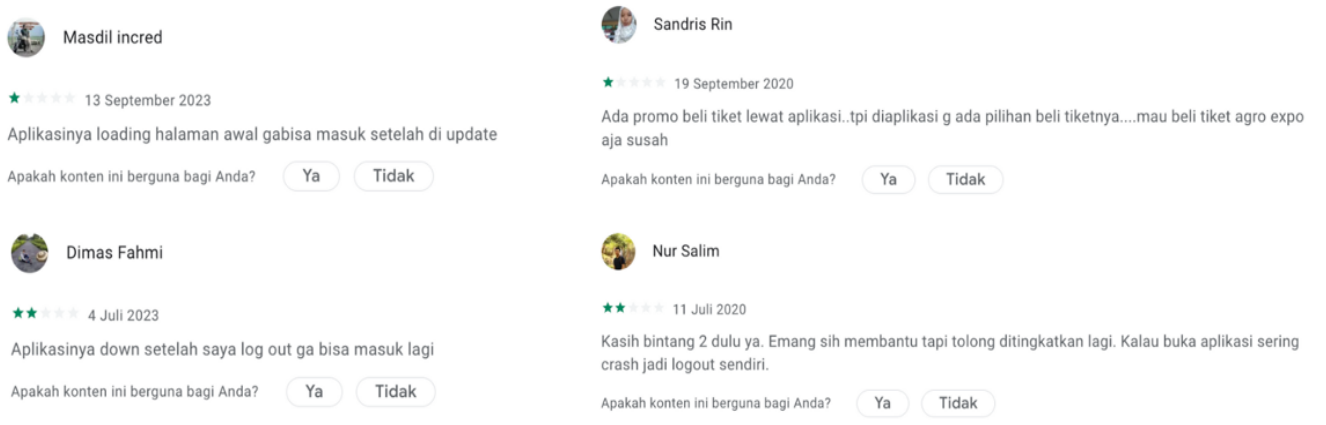

Figure 1. Review of the banyuwangi tourism app on google play store.

Thus, this paper creates a new perspective in measuring application performance with a specific focus on tourism applications, which can have a positive impact on the tourist experience and the economic contribution of the Banyuwangi region. The results of this study will serve as a foundation for the improvement and development of better applications, which will ultimately benefit all stakeholders in the tourism sector of Banyuwangi Regency, East Java, Indonesia. By understanding the impact of these applications on service quality, necessary corrective actions can be identified and implemented to significantly improve the tourist experience and operational efficiency.

This study offers a novel contribution by integrating the ISO 25010 quality model with PLS-SEM analysis specifically in the context of tourism mobile applications. Unlike prior studies that primarily focus on general system quality evaluation, this research emphasizes user-perceived performance efficiency and empirically examines its determinants using a structural modeling approach. Furthermore, this study extends the application of ISO 25010 into the e-tourism domain, providing context-specific insights that are rarely addressed in existing literature.

2. Literature Review and Hypothesis Development

Software quality is a critical factor in determining the success of a system, particularly in mobile applications where user interaction directly influences perceived value and satisfaction. System quality reflects the extent to which a software product fulfills both explicit and implicit user needs, thereby delivering functional value and enhancing user experience (Keibach & Shayesteh, 2022). To systematically evaluate software quality, standardized models are required. Based on Figure 2, one of the most widely recognized frameworks is ISO 25010, which provides a comprehensive structure for assessing software product quality across eight key characteristics: functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability (Peters & Aggrey, 2020). In the context of tourism mobile applications, these quality attributes are essential, as users rely on accurate, fast, secure, and user-friendly systems to support their travel activities. Therefore, understanding the influence of each ISO 25010 dimension on overall software product quality becomes crucial for improving application performance and user satisfaction.

Functional suitability refers to the degree to which a system provides functions that meet stated and implied needs under specified conditions (Peters & Aggrey, 2020). In tourism applications, accurate and relevant features such as destination information, navigation, and event updates are essential to ensure users can achieve their goals effectively. A system that delivers appropriate and complete functionality enhances perceived usefulness and overall quality.

Performance efficiency relates to the system's ability to provide appropriate performance relative to the amount of resources used under stated conditions. This includes response time, processing speed, and resource utilization (Keibach & Shayesteh, 2022). In mobile tourism applications, fast loading times and smooth interactions are critical for maintaining user engagement. Poor performance can lead to dissatisfaction and abandonment.

Compatibility refers to the ability of a system to operate effectively across different devices, platforms, and environments. For mobile applications, compatibility ensures seamless operation on various operating systems, screen sizes, and network conditions (Mendoza et al., 2019). High compatibility improves accessibility and user reach, thereby enhancing perceived software quality.

Usability is defined as the extent to which a system can be used by specified users to achieve specific goals with effectiveness, efficiency, and satisfaction (Peters & Aggrey, 2020). In tourism apps, intuitive interfaces, ease of navigation, and clear information presentation are key determinants of user satisfaction. High usability reduces user effort and increases engagement.

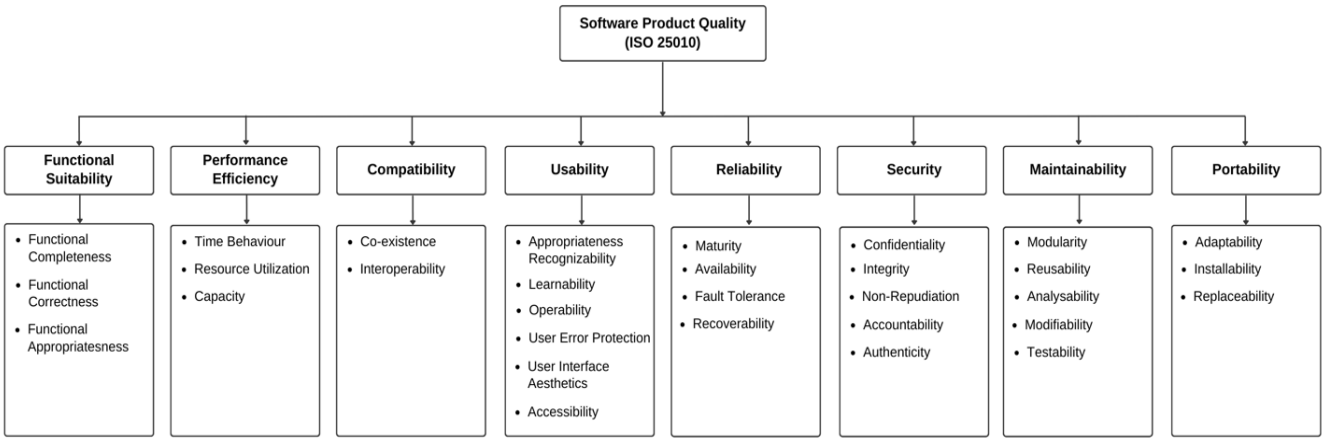

Figure 2. Software product quality ISO 25010

Reliability refers to the system's ability to perform specified functions under specified conditions consistently over time. This includes system stability, availability, and fault tolerance (Keibach & Shayesteh, 2022). In tourism applications, reliable performance ensures uninterrupted access to critical travel information, which is essential for user trust and satisfaction.

Security refers to the protection of information and data, ensuring confidentiality, integrity, and availability (Peters & Aggrey, 2020). In mobile applications, especially those involving user data and transactions, security plays a vital role in building trust. A secure system enhances user confidence and contributes positively to perceived quality.

Maintainability refers to the ease with which a system can be modified to correct faults, improve performance, or adapt to a changing environment (Mendoza et al., 2019). A maintainable system allows developers to implement updates efficiently, ensuring continuous improvement and long-term quality sustainability.

Portability is the ability of a system to be transferred from one environment to another with minimal effort. In mobile applications, portability ensures that the application can function across different platforms and devices without significant modifications (Peters & Aggrey, 2020). This enhances accessibility and overall system usability. Based on the above hypotheses, the proposed research model illustrates the relationships between ISO 25010 quality characteristics and software product quality, as presented in Figure 3.

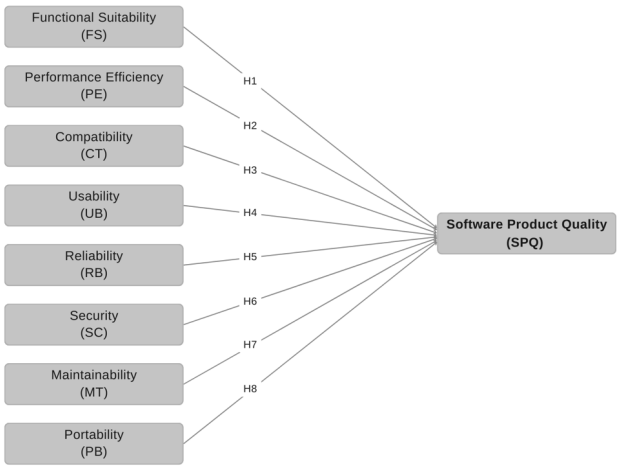

Figure 3. Research model software product quality

- **H1**: Functional Suitability (FS) has a positive and significant influence on Software Product Quality (SPQ).
- **H2**: Performance Efficiency (PE) has a positive and significant influence on software product quality.
- **H3**: Compatibility (CT) has a positive and significant influence on Software Product Quality (SPQ).
- **H4**: Usability (UB) has a positive and significant influence on Software Product Quality (SPQ).
- **H5**: Reliability (RB) has a positive and significant influence on Software Product Quality (SPQ)
- **H6**: Security (SC) has a positive and significant influence on Software Product Quality (SPQ).
- **H7**: Maintainability (MT) has a positive and significant influence on Software Product Quality (SPQ).
- **H8:** Portability (PB) has a positive and significant influence on Software Product Quality (SPQ).

3. Research Methods

This study aims to measure and analyze the quality of the Banyuwangi Tourism App's performance attributes to identify aspects requiring improvement in accordance with the quality standards set by ISO 25010. Each stage of the study is explained in this section. There are five sections explaining sample and data collection, variable measurement, construct operationalization, and data analysis. These stages are investigated in detail to provide an in-depth understanding of the research methodology adopted in this study.

3.1 Sample and Data Collection

This study employed a quantitative approach using a survey method to collect primary data from users of the Banyuwangi Tourism App. The data collection process was conducted over a ten-month period, from January 2024 to October 2024, to ensure sufficient representation of user experiences across different tourism seasons and usage intensities. The target population consisted of domestic and international tourists who had used the Banyuwangi Tourism App during their visit to Banyuwangi, East Java, Indonesia. A purposive sampling technique was applied, where respondents were selected based on specific criteria, namely: (1) having downloaded and used the Banyuwangi Tourism App, (2) having experience accessing key features such as destination information, events, or travel services, and (3) being willing to participate in the study voluntarily.

Data were collected using a structured questionnaire distributed both online and offline. The online survey was administered through digital platforms such as Google Forms and shared via social media, tourism forums, and travel communities. Meanwhile, offline data collection was conducted directly at several major tourist destinations in Banyuwangi, including beaches, cultural attractions, and event locations, to capture real-time user experiences.

The questionnaire items were developed based on the ISO 25010 quality model, focusing on performance-related attributes. All measurement items were assessed using a six-point Likert scale, ranging from 1 (strongly disagree) to 6 (strongly agree). Prior to the main data collection, a pilot test was conducted to ensure the validity and reliability of the instrument. A total of 166 valid responses were obtained and used for further analysis. The collected data were then processed and analyzed using Partial Least Squares

Structural Equation Modeling (PLS-SEM) to evaluate the relationships between variables and to test the proposed hypotheses.

The minimum sample size was determined based on the rule of thumb for PLS-SEM, which suggests at least 10 times the maximum number of structural paths directed at a latent construct. Given that eight constructs were tested, the sample size of 166 respondents is considered adequate for robust statistical analysis.

Ethical considerations were strictly followed in this study. All participants were informed about the purpose of the research and provided their consent prior to participation. Participation was voluntary, and respondents were assured of anonymity and confidentiality. No personally identifiable information was collected, and the data were used solely for academic purposes.

3.2 Measurement of Variable

This study measures software product quality based on the ISO 25010 model, comprising eight dimensions: functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability. All constructs are modeled as reflective latent variables using indicators adapted from prior studies and contextualized to the Banyuwangi Tourism App. The measurement captures users' perceptions of application performance based on actual usage experience. Each dimension reflects key aspects such as feature relevance, system speed, cross-platform compatibility, ease of use, system stability, data security, system adaptability, and platform flexibility. The instrument was validated through expert judgment and pilot testing to ensure reliability and content validity. The final measurement model was analyzed using PLS-SEM to assess construct validity and the relationships between variables, as shown in Figure 4.

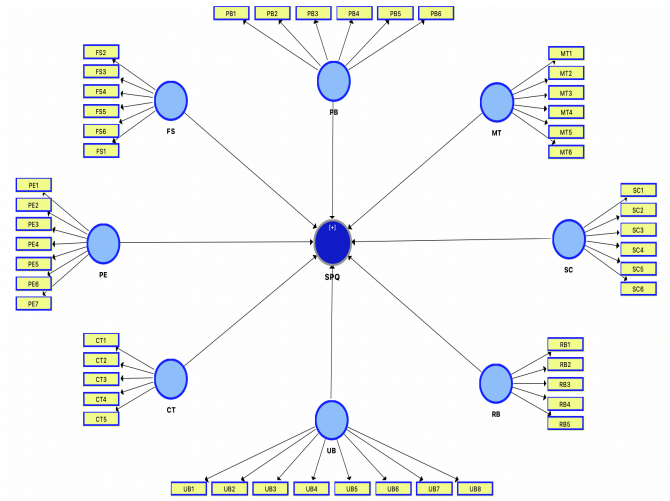

Figure 4. Relationships research model in PLS-SEM.

4. Research Methods

This study employs PLS-SEM to evaluate both the measurement and structural models. PLS-SEM is widely used to analyze complex relationships between latent variables and is particularly suitable for exploratory and predictive research (Hair et al., 2019). The evaluation consists of two main stages: the measurement model (outer model) and the structural model (inner model).

Based on Table 1, the demographic profile shows that the majority of respondents are female (53.0%) and aged between 21–30 years (55.4%), indicating that the application is predominantly used by young adult users. Most respondents are domestic tourists (79.5%), while international users account for 20.5% of the sample. In terms of usage frequency, the majority of respondents are occasional users (44.0%), followed by frequent users (31.9%) and rare users (24.1%). These characteristics suggest that user perceptions of application quality are largely influenced by digitally literate and moderately experienced users, which may affect how performance efficiency and usability are evaluated.

Table 1. Respondent Demographics

Category	Description	Frequency	Percentage
Gender	Male	78	47.00%
	Female	88	53.00%
Age	< 20 years	18	10.80%
	21–30 years	92	55.40%
	31–40 years	36	21.70%
	> 40 years	20	12.10%
Origin	Domestic Tourists	132	79.50%
	International Tourists	34	20.50%
Usage Frequency	Rare (1–2 times)	40	24.10%
	Occasional (3–5 times)	73	44.00%
	Frequent (>5 times)	53	31.90%

4.1 Measurement Model

The measurement model evaluates the relationship between indicators and latent constructs using four criteria: internal consistency, indicator reliability, convergent validity, and discriminant validity (Hair et al., 2019). The results show that all constructs meet the required thresholds, with Cronbach's Alpha and Composite Reliability values exceeding 0.70, indicating satisfactory internal consistency. All indicators demonstrate outer loadings above 0.70, confirming adequate indicator reliability without the need for item removal (Hair et al., 2019). Furthermore, all constructs achieve AVE values above 0.50, indicating good convergent validity (see Table 2). Discriminant validity is also established, as the square root of AVE for each construct exceeds its correlations with other constructs, and each indicator loads highest on its respective construct. Overall, the measurement model demonstrates strong reliability and validity, supporting further structural model analysis.

Table 2. Composite Reliability Value and AVE

Measuring Instrument	Cronbach's Alpha	CR	AVE
Functional Suitability (FS)	0.901	0.925	0.673
Performance Efficiency (PE)	0.914	0.935	0.682
Compatibility (CT)	0.887	0.918	0.691
Usability (UB)	0.926	0.944	0.679
Reliability (RB)	0.893	0.921	0.701
Security (SC)	0.905	0.931	0.712
Maintainability (MT)	0.889	0.919	0.694
Portability (PB)	0.882	0.913	0.676

4.2 Structural Model

The structural model evaluates the relationships between latent variables and tests the proposed hypotheses. To address this issue, the Variance Inflation Factor (VIF) was employed to evaluate whether excessive correlations exist among interrelated variables in the model. A VIF value below the recommended threshold of 3.0 indicates that each dimension contributes uniquely to its corresponding construct and does not suffer from measurement redundancy (Hair et al., 2019). In this study, VIF testing was conducted comprehensively which is shown in Table 3. The assessment includes examining path coefficients, significance levels (t-values and p-values), and the coefficient of determination (R^2). The results indicate that seven out of eight hypotheses are supported, showing positive and significant relationships with software product quality. Specifically, functional suitability, performance efficiency, compatibility, usability, reliability, security, and portability significantly influence software product quality.

Table 3. VIF Value

Collinearity Between	Value	Decision
Functional Suitability → SPQ	1.000	No collinearity
Performance Efficiency → SPQ	1.000	No collinearity
Compatibility → SPQ	1.000	No collinearity
Usability → SPQ	1.000	No collinearity
Reliability → SPQ	1.000	No collinearity
Security → SPQ	1.000	No collinearity
Maintainability → SPQ	1.000	No collinearity
Portability → SPQ	1.000	No collinearity

Table 4. Path Coefficient and Hypothesis Testing

	Relationship	β	T-Statistic	P-Value	Decision
H1	FS → SPQ	0.214	3.215	0.001	Supported
H2	PE → SPQ	0.268	4.102	0.000	Supported
H3	CT → SPQ	0.187	2.874	0.004	Supported
H4	UB → SPQ	0.295	4.563	0.000	Supported
H5	RB → SPQ	0.176	2.659	0.008	Supported
H6	SC → SPQ	0.193	3.021	0.003	Supported
H7	MT → SPQ	0.082	1.214	0.225	Not Supported
H8	PB → SPQ	0.201	3.145	0.002	Supported

Meanwhile, maintainability does not show a significant effect, suggesting that users may not directly perceive maintainability aspects as part of their application experience. The coefficient of determination (R^2) indicates that the model explains a substantial proportion of variance in software product quality, demonstrating strong explanatory power. This suggests that the ISO 25010 dimensions collectively provide a robust framework for evaluating application performance.

4.3 Discussion

The findings highlight that performance efficiency and usability are among the most influential factors affecting software product quality. This aligns with prior studies indicating that fast response time, smooth interaction, and ease of use are critical determinants of user satisfaction in mobile applications, particularly in the tourism sector. Functional suitability also plays a significant role, emphasizing the importance of providing relevant, complete, and accurate features to meet user needs (Azadi et al., 2025; Li et al., 2025). In the context of the Banyuwangi Tourism App, this includes features such as destination information, event updates, and navigation support. Compatibility and portability are found to significantly influence software quality, indicating that users value applications that function seamlessly across devices and platforms (Tian et al., 2022). This is particularly important in tourism applications where users rely on different devices during their travel. Reliability and security also show significant effects, highlighting the importance of system stability and data protection in building user trust. Users expect the application to operate consistently without errors and to safeguard their personal information. Interestingly, maintainability does not significantly influence software product quality from the user perspective. This can be explained by the fact that maintainability is inherently a backend-oriented attribute, which is not directly visible to end users. Users tend to evaluate applications based on observable characteristics such as usability, speed, and reliability, rather than internal system properties. This finding aligns with prior studies in user-centered research, which indicate that technical attributes related to system maintenance are often outside the cognitive awareness of users and therefore have limited impact on perceived quality (Palos-Sanchez et al., 2021; Masri et al., 2020). Additionally, it is possible that respondents did not fully understand the indicators used to measure maintainability, leading to weaker perception alignment.

This study confirms that the ISO 25010 model provides a comprehensive framework for evaluating software quality in tourism applications. The results offer practical implications for developers and stakeholders to prioritize improvements in performance efficiency, usability, and functional features to enhance user experience and application effectiveness. From a theoretical perspective, this study strengthens the applicability of the ISO 25010 model in the context of tourism mobile applications by empirically validating the

role of its dimensions in shaping software product quality. Practically, the results provide a clear prioritization strategy, where performance efficiency, usability, and functional suitability should be the primary focus for improving application effectiveness. These insights can guide developers and policymakers in allocating resources more efficiently and designing user-centered tourism applications that enhance overall user experience and support the digital transformation of the tourism sector.

Based on the analysis of indicator loadings, several practical recommendations can be proposed. For instance, indicators related to "time behavior" within the performance efficiency construct show relatively lower contributions. This suggests that users may experience delays or inefficiencies during application usage. Therefore, developers are recommended to optimize image asset sizes, implement efficient caching mechanisms, and reduce unnecessary background processes to improve response time. Additionally, optimizing server-side performance and adopting content delivery networks (CDNs) can further enhance application speed and responsiveness. These improvements are essential to ensure a seamless and efficient user experience.

5. Conclusion

This study aims to evaluate the software product quality of the Banyuwangi Tourism App using the ISO 25010 framework and PLS-SEM approach. The results reveal that seven out of eight dimensions, functional suitability, performance efficiency, compatibility, usability, reliability, security, and portability have a positive and significant effect on software product quality. Among these, usability and performance efficiency emerge as the most influential factors, highlighting the importance of user-friendly design and system responsiveness in enhancing user experience. In contrast, maintainability does not show a significant effect, indicating that users may not directly perceive backend or system maintenance aspects in their evaluation of application quality.

From a practical perspective, the findings provide clear guidance for developers and policymakers to prioritize improvements in usability, performance efficiency, and functional features to enhance user satisfaction and application effectiveness. Ensuring system reliability, security, and cross-platform compatibility is also essential to maintain user trust and accessibility. From a theoretical standpoint, this study contributes to the literature by empirically validating the applicability of the ISO 25010 model in the context of tourism mobile applications. It also strengthens the understanding of how different software quality dimensions influence overall product quality, particularly from a user-centered perspective.

Despite its contributions, this study has several limitations. First, the sample size is limited to users of the Banyuwangi Tourism App, which may affect the generalizability of the findings. Second, the study relies on self-reported data, which may introduce subjective bias. Third, the cross-sectional design limits the ability to capture changes in user perceptions over time. Future research is recommended to expand the sample across different regions or tourism applications, incorporate longitudinal data, and integrate additional analytical approaches such as machine learning or user behavior analytics. Further studies may also explore the integration of other evaluation frameworks or include moderating and mediating variables to provide deeper insights into software quality and user experience.

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