

Elevating the Journey: Measuring the Impact of Service Quality and Future Innovations at KLIA

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DOI: <https://doi.org/10.47772/IJRISS.2026.100500549>

Received: 10 May 2026; Accepted: 15 May 2026; Published: 06 June 2026

ABSTRACT

This study evaluates passenger satisfaction at Kuala Lumpur International Airport (KLIA) and identifies the key variables influencing it, addressing a geographical gap in airport service research. A quantitative, cross-sectional design was employed, utilizing a structured questionnaire administered to 396 KLIA passengers. Data were analyzed via descriptive statistics, independent T-tests, and multiple linear regression. The findings reveal high overall passenger satisfaction. Specifically, cleanliness, staff service, queuing efficiency, and future development initiatives significantly and positively impact user satisfaction. Conversely, digital innovation, sustainability practices, and signage showed no significant effect. Male and female passengers reported similar satisfaction levels, though males showed slightly higher reuse intentions and dining satisfaction. Practically, these results urge KLIA management to prioritize front-line staff training, maintain rigorous facility cleanliness, and develop gender-inclusive amenities. This study uniquely integrates traditional service dimensions with modern digital and sustainable demands within the Malaysian context.

Keywords: Kuala Lumpur International Airport (KLIA), passenger satisfaction, airport service quality, SERVQUAL model, digital transformation, sustainability, regression analysis.

INTRODUCTION

Airports today serve far more than their traditional role of facilitating passenger boarding and landing. They have evolved into complex service environments that influence the entire travel experience. Kuala Lumpur International Airport (KLIA), Malaysia's primary international gateway, plays a critical role in connecting the nation globally while supporting commerce, tourism, and economic development. As passenger volumes and expectations continue to rise, delivering high-quality airport services has become essential, particularly in the competitive global aviation industry where reputation and passenger satisfaction are key determinants of success.

Passenger satisfaction and service quality have been widely studied in leading international airports. For example, Changi Airport in Singapore and Incheon International Airport in South Korea have set global benchmarks through advanced technology, efficient operations, and exceptional customer service (Rajapaksha & Jayasuriya, 2020). Similarly, Bakır et al. (2022) found that factors such as queue management, cleanliness, and staff interaction significantly influence passenger satisfaction in European airports. Despite KLIA's continuous improvements, limited research exists on how passengers perceive its service quality and overall experience.

Beyond traditional service elements, emerging trends such as **digital innovation** and **sustainability practices** are reshaping airport operations worldwide. Technologies like biometric systems, mobile boarding applications, and contactless check-in enhance convenience and security, while sustainability initiatives—such as energy efficiency and waste reduction—address environmental concerns (Mohd Isa et al., 2020). KLIA has begun integrating these practices, yet little is known about their impact on passenger satisfaction within the Malaysian context.

Additionally, airports often plan **future development initiatives**, including new terminals, smart technologies, and infrastructure upgrades. However, passenger perceptions of these future enhancements remain underexplored, leaving a gap in understanding how such plans influence satisfaction and loyalty. Ignoring this dimension may result in missed opportunities for strategic improvements and customer engagement.

This study addresses these gaps by examining the relationship between **service quality factors** (cleanliness, signage, staff service, and queuing efficiency), **digital transformation**, **sustainability practices**, and **future development plans** on user satisfaction at KLIA. By doing so, it aims to provide actionable insights that enhance passenger experience, strengthen KLIA's competitive position, and contribute to the broader literature on airport service quality in Southeast Asia.

LITERATURE REVIEW

User satisfaction in the context of an airport encompasses the passenger's overall positive experience, driven by a multitude of factors ranging from operational efficiency to the physical comfort of the environment. Recent literature reveals a dynamic interplay between traditional service elements and modern demands like digital transformation and sustainability, highlighting a need to critically evaluate how these variables collectively influence the passenger journey. This review is organized thematically to synthesize current research on the tangible environment, human and operational efficiency, technological advancement, and long-term sustainability.

The Tangible Environment—Cleanliness and Spatial Navigation A fundamental baseline for passenger satisfaction is the tangible environment, particularly cleanliness and spatial navigation. While general definitions classify cleanliness merely as the basic maintenance of hygiene and orderliness to prevent dirt and germs, recent empirical literature reveals a critical shift in its relative importance. A key study by Valpuesta & Albala (2023) demonstrates that following the COVID-19 pandemic, cleanliness and hygiene measures have been elevated above almost all other comfort factors, as passengers heavily prioritize health and safety. This intense focus on physical maintenance is complemented by the need for effective spatial design and signage. Clear signage and architectural configuration not only prevent confusion but directly facilitate more accessible spaces for visitors. Furthermore, a significant study by Oel & Berkhof (2013) emphasizes that the physical and architectural design of passenger areas profoundly affects consumers' emotional states and shopping behaviors, indicating that the tangible environment is not just functional, but deeply psychological.

Human Interaction and Operational Efficiency Beyond the physical environment, the human element and operational efficiency remain critical determinants of service quality. Foundational sources describe staff services as the supportive and administrative functions necessary for an organization's objectives. However, a key study by Pholsook et al. (2025) critically advances this definition by demonstrating that courteous staff interactions, efficient conflict resolution, and reduced waiting times directly drive customer loyalty and satisfaction. This human element closely intersects with operational efficiency, particularly queuing. Traditional queue management often leads to crowding and irritation, prompting a shift toward virtual and self-service queues that allow staff to focus on delivering superior customer service. Ayodeji & Rjoub (2020) emphasize that waiting time itself is a pivotal variable that airport management must aggressively manage to guarantee customer loyalty. Thus, the literature suggests a vital synergy: technological queue management improves efficiency, but it primarily succeeds because it enables highly responsive staff interactions.

The Digital Shift vs. Traditional Service Expectations The adoption of modern digital technologies, or digital innovation, is widely recognized as a strategic tool to enhance consumer performance, optimize workflows, and build competitive advantages. Sharma (2024) provides a significant empirical evaluation, underscoring that integrating smart airport technologies is essential for meeting evolving passenger needs and directly enhancing overall enjoyment. However, a subtle contradiction emerges in the literature when comparing the aggressive push for digital self-service with the continued demand for physical and human service. While Gillis (2023) and Sharma (2024) champion automated workflows and digital tools as the primary future of the industry, Pholsook et al. (2025) and Valpuesta & Albala (2023) maintain that core physical aspects—like human interactions and basic hygiene—remain the most heavily scrutinized drivers of satisfaction. This contradiction implies that while

passengers demand modern digital conveniences, these innovations cannot replace foundational service quality and human touchpoints.

Long-Term Viability—Sustainability and Future Development The final major theme in the literature concerns airports' long-term planning through sustainability and infrastructure development. Sustainable airports focus on resource management, lowering carbon emissions, and minimizing environmental impacts while supporting community well-being. A key study by Wang et al. (2023) critically evaluates this, finding that corporate social responsibility (CSR) initiatives—such as sustainable practices—significantly and positively affect passenger satisfaction and loyalty. Looking toward the future, Ma (2023) notes that developing smart, efficient, and sustainable airports is an indispensable component of building advanced future smart cities. Therefore, the literature seamlessly connects current environmental and sustainability initiatives (Wang et al., 2023) directly with the conceptualization of long-term, future-ready infrastructure (Ma, 2023).

METHODOLOGY

This study adopts a quantitative research approach utilizing structured surveys to systematically gather numerical data and identify measurable patterns in user satisfaction at Kuala Lumpur International Airport (KLIA). An explanatory research design was applied to move beyond mere observation and actively determine why specific variables—such as queuing efficiency and digital innovation—impact overall passenger experiences. This aligns with Peterson's (2009) conceptualization of explanatory style, which seeks to understand the underlying causes and dimensions of user perceptions. Furthermore, a cross-sectional temporal frame was selected as the most practical methodology. In the fast-paced context of airport services where conditions fluctuate rapidly, a cross-sectional design effectively captures a reliable snapshot of passenger satisfaction at a single point in time.

The target population comprises all individuals who have utilized KLIA's services. Based on the Department of Statistics Malaysia (2024), KLIA handled approximately 11.2 million passengers in 2023. Given this vast population, Krejcie and Morgan's (1970) sample size determination table was used to establish a minimum required sample of 384 respondents. To safeguard against incomplete or invalid responses, the researchers successfully distributed and collected 396 questionnaires (Saunders, Lewis, & Thornhill, 2019).

A convenience sampling method was utilized to quickly and effectively engage accessible passengers (Ackam, 2020; Etikan, Musa, & Alkassim, 2016). Strict inclusion criteria were applied: participants had to be at least 18 years old and possess direct, prior experience with KLIA's services. To maximize reach, sampling was conducted both on-site and through online distribution platforms, (Edgar & Manz, 2017; Sekaran & Bougie, 2016). To ensure the study can be accurately replicated, data collection was systematically carried out over a specific time-frame from May to July 2024. On-site collection targeted high-traffic zones within KLIA, specifically departure halls, check-in desks, and common seating areas. To enhance efficiency and minimize physical contact, a digital-first approach was employed. Researchers approached eligible passengers and provided a QR code or a direct Google Form link. This allowed participants to complete the structured, 10-to-15-minute survey independently on their own smartphones, ensuring real-time data capture and supporting environmental sustainability.

The primary instrument was a bilingual (English and Malay) structured questionnaire heavily adapted from the established SERVQUAL framework (Parasuraman et al., 1988). The survey utilized a 5-point Likert scale (Likert, 1932) and was divided into four core sections: Demographic Information (Section A), Service Quality (Section B), User Expectations (Section C), and Future Improvements (Section D).

A pilot test was conducted with 10 users prior to the main data collection (Moore et al., 2011). Feedback obtained from these participants was used to refine the phrasing of several items and to ensure that the response scales were balanced and appropriately structured. Following these revisions, the internal consistency of the finalised instrument was assessed using Cronbach's alpha, in line with recommended reliability evaluation procedures (Forero, 2023).

Upon completion of the data collection phase, the 396 valid responses were exported from Google Forms, verified in Microsoft Excel, and imported into the Statistical Package for the Social Sciences (SPSS) for rigorous evaluation. The data analysis was executed in three distinct phases:

- Descriptive Statistics:** Frequencies, percentages, means, and standard deviations were calculated to profile the participants' demographic backgrounds and summarize general trends in baseline satisfaction levels.
- Reliability Testing:** Cronbach's alpha was calculated for all survey sections. All scales yielded scores well above the 0.70 threshold recommended by Sekaran and Bougie (2016), confirming excellent internal reliability.
- Inferential Statistics:** To test the research hypotheses, two primary inferential techniques were applied. First, an Independent Samples t-test was utilized to compare mean satisfaction differences between male and female demographic groups. Second, a Multiple Linear Regression analysis was conducted to precisely quantify the relationship and explanatory power of the seven independent service quality predictors on the dependent variable of overall user satisfaction.

No. of Items	Cronbach's Alpha	Cronbach's Alpha based on Standardised Items
29	0.886	0.888
Variables	Number of Items	Cronbach's Alpha
Demographics	5	0.987
Service quality	14	0.976
User expectations	5	1.000
Future Improvements	5	0.968

FINDINGS

Demographic Analysis

The study successfully gathered and analyzed 396 valid responses with no missing information [1]. The gender distribution was balanced, with 51.3% female and 48.7% male respondents [2]. The largest age group was 36–45 years old (31.8%), followed by 26–35 years old (30.1%) [3]. The majority of respondents were Malaysian (57.6%), while non-Malaysians made up 42.4% [3]. In terms of travel purpose, most respondents traveled for leisure or tourism (39.9%), followed by transit (28.0%) and business (16.9%) [4]. Regarding airport usage frequency, 48.2% reported using KLIA occasionally (1-2 times a year), 26.0% were first-time users, and 25.8% used it frequently (more than 3 times a year) [4, 5].

Independent T-test

An independent samples T-test was conducted to compare ratings between male and female passengers [5]. The findings revealed that both genders rated the majority of KLIA's services very similarly, with minimal variations in areas such as cleanliness, signage, staff politeness, and queuing efficiency [6, 7]. However, **two variables showed statistically significant differences:**

- Male passengers reported slightly higher satisfaction with food and beverage options (Mean = 4.70) compared to females (Mean = 4.65), which was statistically significant ($p = 0.039$) [8].
- Males indicated a stronger intention to use KLIA again (Mean = 4.66) compared to females (Mean = 4.48), reflecting a highly significant difference ($p = 0.002$) [8, 9].

Descriptive Analysis

Overall, passengers gave KLIA's service quality, digital transformation, and future development projects very high ratings, with most mean scores exceeding 4.4 out of 5 [10, 11].

- **Overall Satisfaction:** Passengers reported high overall happiness with their KLIA experience ($M = 4.68$, $SD = 0.48$) [12].
- **Service Quality:** Cleanliness achieved a high mean score of 4.59 ($SD = 0.59$), staff helpfulness/courtesy scored 4.55 ($SD = 0.57$), and signage scored 4.51 ($SD = 0.53$) [11]. The efficiency of queues at security or immigration was slightly lower but still positive at 4.47 ($SD = 0.61$) [11, 13].
- **Digital and Innovation:** Users had a positive view of KLIA's smart technologies ($M = 4.51$, $SD = 0.53$) and real-time flight updates ($M = 4.48$, $SD = 0.61$) [13, 14].
- **Sustainability and Future Development:** Environmentally sustainable practices scored 4.48 ($SD = 0.57$) [15]. Users highly rated the airport's readiness for future aviation technologies ($M = 4.59$, $SD = 0.59$) and its continuous infrastructure upgrades ($M = 4.55$, $SD = 0.57$) [12, 15].

Reliability Analysis

*(Note: Reliability was conducted in the methodology phase using Cronbach's Alpha to ensure internal consistency).*The instrument demonstrated excellent reliability across all sections: Demographic Information ($\alpha = 0.987$), Service Quality ($\alpha = 0.976$), Future Improvements ($\alpha = 0.968$), and User Expectations ($\alpha = 1.000$) [16].

Multiple Linear Regression Analysis

A multiple linear regression was conducted to determine how the seven independent variables affected overall user satisfaction [17].

- **Model Summary (R Square):** The model yielded an **R-squared value of 0.957**, meaning the seven predictors account for 95.7% of the variance in user satisfaction at KLIA [18, 19]. The adjusted R-squared was 0.956 with a standard error of 0.100 [19, 20].
- **ANOVA (Model Fit):** The regression model is highly statistically significant, as demonstrated by an **F-value of 965.489** and a **p-value < 0.001** [20]. This indicates the model fits the data well [21].
- **Coefficients and Hypothesis Testing:** Out of the seven variables evaluated, **four were statistically significant (at $\alpha = 0.05$) predictors** of user satisfaction [22]:
 - **Cleanliness:** Positively and significantly impacted satisfaction ($B = 0.113$, $p = 0.026$) [22].
 - **Staff Service:** Showed a highly significant positive influence ($Beta = 0.228$, $p = 0.005$), notably driven by staff proactively interacting with passengers ($B = 0.141$, $p = 0.005$) [23].
 - **Queuing and Efficiency:** Significantly impacted satisfaction ($Beta = 0.147$, $p = 0.023$), largely driven by users valuing fast and efficient check-in processes ($B = 0.116$, $p = 0.023$) [23, 24].
 - **Future Development:** Had a significant positive effect ($Beta = 0.222$, $p = 0.002$), particularly through ongoing infrastructure upgrades ($B = 0.158$, $p = 0.002$) [23, 25].
 - Non-significant predictors: **Signage** ($B = -0.031$, $p = 0.528$), **Digital and Innovation** ($B = -0.001$, $p = 0.992$), and **Sustainability** ($B = 0.088$, $p = 0.092$) were not statistically significant at the 5% level, though sustainability showed a slight positive trend approaching significance [23, 26-29].

DISCUSSION AND CONCLUSION

Interpretation of Key Findings

The current study evaluated the multifaceted elements influencing user satisfaction at Kuala Lumpur International Airport (KLIA). The multiple linear regression analysis demonstrated that service quality dimensions—particularly staff service, cleanliness, and queuing efficiency—are significant predictors of overall passenger satisfaction. The strong impact of staff service and cleanliness aligns with the findings of Ali & Raza (2015), who highlighted that the "human touch" and polite interactions are essential for elevating service quality and user happiness. Cleanliness also serves as a critical baseline for physical comfort, strongly shaping the overall perception of the airport environment.

Interestingly, while global trends emphasize the necessity of digital innovations, the regression model indicated that variables such as digital innovation and signage were not statistically significant predictors of satisfaction at the 5% level. This outcome likely stems from the fact that many smart technologies at KLIA, such as facial recognition and self-check-in kiosks, are currently limited to specific routes or airlines, meaning a vast majority of passengers have not yet experienced them enough to impact their overall satisfaction. Nevertheless, descriptive findings and broader discussions support previous literature by Remencová & Sedláčková (2021), which suggests that digital adaptation generally improves user experiences by fostering faster and more secure operations. Similarly, while sustainability practices showed only a moderate effect approaching significance, the literature indicates that prioritizing eco-friendly operations can yield long-term benefits for brand trust, reinforcing findings by Sreenath et al. (2021). Finally, ongoing future development initiatives profoundly and significantly enhanced passenger satisfaction, confirming Shahparan et al. (2024), who posited that a visible commitment to infrastructure upgrades reassures passengers of long-term service quality and adaptability.

Theoretical Implications

Theoretically, this study successfully integrates the traditional SERVQUAL framework—which emphasizes tangibles, reliability, responsiveness, assurance, and empathy—with modern aviation demands like digital transformation, sustainability, and future infrastructure planning. This comprehensive approach advances existing behavioral and tourism theories by providing a localized paradigm specifically for the Malaysian context. Furthermore, the findings fill a significant geographical gap in the literature; while prominent hubs like Singapore's Changi and Incheon International have been heavily studied, KLIA has historically received less academic attention regarding comprehensive service quality and future development (Rajapaksha & Jayasuriya, 2020).

Practical/Managerial Implications

For airport management, tourism operators, and policy makers, the results yield several actionable insights:

- **Invest heavily in front-line staff and core facilities:** Because staff interaction and cleanliness are the primary drivers of satisfaction, KLIA must maintain rigorous cleaning schedules and continue training staff to proactively and courteously engage with passengers.
- **Implement gender-inclusive amenities and services:** The study revealed that female passengers reported slightly lower intentions to reuse KLIA and lower satisfaction with food and beverage options. Operators should expand menus to include health-conscious or diet-specific options (e.g., vegan, low-calorie) and enhance the terminal environment with clean, female-friendly amenities like well-lit waiting areas, breastfeeding rooms, and visible security personnel.
- **Communicate future developments effectively:** Since infrastructural upgrades significantly boost passenger satisfaction, marketers should actively promote ongoing projects—like the rollout of the biometric "single-token" system—through interactive displays and social media to project a progressive, customer-focused image.

- **Amplify awareness of sustainability and digital efforts:** To convert neutral perceptions into high satisfaction, KLIA should increase the visibility of its existing eco-friendly practices (e.g., recycling programs, energy-efficient lighting) and clearly guide passengers on how to utilize new smart-technologies.

LIMITATIONS

Despite offering valuable insights, this study possesses several limitations. First, it utilized a **cross-sectional design**, capturing data at a single moment in time, which prevents the establishment of definitive cause-and-effect relationships. Second, there is a **generalizability issue**; the data was collected exclusively at KLIA during a specific timeframe, meaning the findings may not perfectly translate to other airports, varying demographics, or different travel seasons. Third, the reliance on **self-reported survey data** introduces the potential for response biases, such as recall errors or the tendency toward social desirability. Finally, the study was confined to seven predefined variables, potentially missing other critical elements like perceived security or cultural factors.

Future Research Suggestions

To address these limitations and expand upon the current findings, future research should adopt **longitudinal or experimental designs** to track changes in passenger satisfaction over time and establish causality. Additionally, researchers should broaden the geographic scope by comparing KLIA's performance with other international airports to enhance external validity. Future studies would also benefit from integrating objective, **empirical data**—such as actual queuing times or app usage statistics—to complement self-reported surveys. Lastly, **adding new variables** (e.g., accessibility, perceived security, and cultural differences) and employing qualitative methods like focus groups and in-depth interviews will help uncover deeper, more nuanced passenger perspectives.

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