

Airport infrastructure and passenger satisfaction at Ninoy Aquino International Airport: Basis for action plan

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Abstract

This study investigates the relationship between airport infrastructure quality and passenger satisfaction at the Ninoy Aquino International Airport (NAIA), the Philippines' central international arrival facility and a critical hub for Southeast Asian travel. Recognizing the increasing global demand for service excellence in air transportation, the study aims to describe passenger profiles in terms of sex, age group, marital status, educational attainment, and frequency of travel; assess airport infrastructure across terminal facilities, accessibility, safety and security, signage and wayfinding, and amenities; and evaluate satisfaction in queue management, comfort during delays, passenger support systems, sustainability initiatives, and staff service efficiency. Utilizing a descriptive-correlational research design, validated survey questionnaires were administered to 385 respondents proportionally distributed across Terminals 1, 2, and 3. Statistical tools such as One-Way ANOVA, independent t-tests, and Pearson r correlation were employed to analyze the data. Findings indicated that demographic variables significantly influence satisfaction levels, with younger travelers favoring speed and automation, while older and married passengers prioritize comfort and support services. A very strong positive correlation between airport infrastructure quality and overall passenger satisfaction was established. Based on these findings, a strategic action plan was proposed targeting improvements in digital connectivity, dining diversity, family amenities, wayfinding systems, multilingual support, and security transparency through biometric innovations. This study contributes to the growing body of knowledge on airport management and hospitality infrastructure by offering a replicable model for passenger-centered service delivery. Its implications extend to policy-making for more sustainable, inclusive, and traveler-centric airport operations, not only for NAIA but also for other emerging airports in Southeast Asia.

Keywords: airport infrastructure, passenger satisfaction, service quality, terminal facilities, stakeholder planning, NAIA

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1. Introduction

The global aviation industry has significantly advanced in recent years, driven by increasing air traffic, heightened service expectations, and the accelerated adoption of smart technologies. Major international airports such as Singapore Changi, Incheon, and Heathrow have embraced AI-powered automation, contactless services, and data-driven operational strategies to improve efficiency and passenger experience. In Southeast Asia, emerging economies like Thailand, Malaysia, and Vietnam have prioritized infrastructure modernization to enhance regional connectivity and competitiveness. Within the Philippine context, however, airports continue to face substantial challenges, particularly at Ninoy Aquino International Airport (NAIA)—the country’s principal international gateway. Despite its strategic location and volume of passenger traffic, NAIA is consistently plagued by outdated infrastructure, inefficient terminal operations, and limited technology adoption. These issues are especially pronounced in Terminals 1, 2, and 3, which, although serving distinct airline profiles, all exhibit performance gaps that directly affect the travel experience of passengers passing through Metro Manila.

Current local studies have paid limited attention to the comprehensive assessment of airport infrastructure and its impact on passenger satisfaction. While fragmented research has been conducted on topics such as security screening, airline service, and passenger flow, there remains a gap in literature specifically exploring the infrastructure-performance-satisfaction relationship within NAIA’s multi-terminal setup. Much of the existing empirical data focuses on isolated variables without considering the broader infrastructural ecosystem and its influence on passenger experience. This study is a preliminary inquiry into that overlooked intersection. It aims to systematically evaluate the state of NAIA Terminals 1, 2, and 3 by identifying infrastructure deficiencies and assessing their direct implications on passenger satisfaction. This gap in empirical understanding highlights the urgency of conducting a detailed investigation, which may serve as a springboard for policy reform and long-term development planning in Philippine airport infrastructure.

Three main constructs serve as the backbone of this study: airport infrastructure, passenger satisfaction, and strategic improvement. Airport infrastructure is defined in terms of physical elements such as terminal layout, accessibility, safety protocols, signage, and amenities. Passenger satisfaction refers to the overall assessment made by travelers based on their expectations and actual experience within the airport environment. Strategic improvement pertains to the formulation of data-informed interventions that can optimize airport performance. These three variables are interrelated: infrastructure quality influences the level of satisfaction passengers feel, and both variables shape the foundation for determining appropriate modernization efforts and service upgrades.

To underpin this study, three theoretical models are utilized. The Expectancy-Disconfirmation Theory explains how passenger satisfaction emerges when actual airport experiences either confirm or fall short of expectations formed prior to travel. This theory provides the basis for assessing perceived quality in areas such as queue efficiency, communication, and comfort during disruptions. The Infrastructure Quality Theory emphasizes the importance of facility design, spatial layout, and accessibility in determining service performance and overall user satisfaction. It supports the evaluation of NAIA’s physical infrastructure components—including terminal facilities, safety protocols, and signage systems. Finally, the Airport Innovation Theory highlights how technological integration, such as digital check-in systems and AI-powered wayfinding, enhances operational efficiency and improves the passenger journey. These theories collectively justify the study’s core variables and guide the design of the research instrument.

Recent empirical studies also affirm the importance of each sub-variable in this research. Bakır et al. (2022) found that terminal comfort, availability of seating, and restroom quality are critical in forming positive travel

impressions. Meanwhile, Tsai et. al.,(2011) examined amenities and services, concluding that retail, dining, and waiting areas have a strong effect on the perceived value of the airport experience. These findings validate the use of variables such as terminal facilities, accessibility, safety, signage, and services as reliable indicators for assessing both infrastructure performance and satisfaction outcomes.

The core intention of this study is to examine the existing infrastructure in NAIA Terminals 1, 2, and 3, identify key performance gaps, and determine how this influence overall passenger satisfaction. The research will utilize quantitative data to assess infrastructure across multiple dimensions and correlate it with travelers' reported satisfaction levels. In doing so, the study aims to offer a grounded analysis that can support NAIA's modernization initiatives and address critical service inefficiencies through practical, evidence-based recommendations.

This research is intended to benefit a diverse range of stakeholders. For airport administrators and the Manila International Airport Authority (MIAA), the findings may help refine operational priorities and infrastructure investments. Government bodies such as the Civil Aviation Authority of the Philippines (CAAP) can use the results to enhance national aviation policy. Airlines and service providers may gain insights into traveler needs, leading to improvements in ground services. Passengers—both local and international—will benefit from improvements in comfort, safety, and efficiency. Academic researchers will have access to localized data on the infrastructure-satisfaction nexus within a developing country's aviation context.

The primary output of this study is a strategic action plan designed to address identified gaps in airport infrastructure and service performance. Beyond offering immediate solutions, the study contributes to the larger body of tourism and hospitality knowledge by providing a model for evaluating infrastructure in other developing-country airports. It reinforces the importance of infrastructure investment as a pathway to improving customer satisfaction, airport competitiveness, and national connectivity in the global air transport system.

This study is delimited to Terminals 1, 2, and 3 of NAIA. Terminal 4 is excluded not only due to its distinct operational design and limited capacity—which differ significantly from the other three terminals—but also because it ceased operations during the last quarter of the previous year and is currently undergoing major renovations. The research likewise relies on self-reported perceptions from surveyed passengers, which may be influenced by subjective biases or situational travel experiences. Nonetheless, the data collection was designed to ensure demographic diversity and statistical reliability, allowing the findings to reflect a valid cross-section of current passenger perspectives. While the results are not intended to be generalizable to all Philippine airports, they offer critical insight into the state of the country's largest and busiest aviation hub. Although the study did not formally adopt a service quality framework as its primary theoretical base, its passenger satisfaction indicators were conceptually aligned with the SERVQUAL model. This model outlines five core service quality dimensions—tangibles, reliability, responsiveness, assurance, and empathy—which have been widely applied in both tourism and transportation research. These dimensions served as guiding principles in the design of the research instrument, ensuring that the measurement of satisfaction adhered to established global standards. This methodological positioning reinforces theoretical coherence while accommodating the operational complexities of airport service environments.

Objectives of the Study - The research investigates the relationship between airport infrastructure and passenger satisfaction at Ninoy Aquino International Airport (NAIA) and propose a strategic action plan for improvement. In particular, it (1) assesses airport infrastructure in terms of terminal facilities, accessibility, safety and security, signage and way-finding, and amenities and services; and (2) evaluates passenger satisfaction concerning queue management efficiency, passenger comfort during delays and cancellation, passenger support systems, sustainability initiatives, and staff communication and service efficiency. (3) examines the significant relationship between airport infrastructure and overall passenger satisfaction. Lastly, it (4) proposes an action plan based on the result of the study.

2. Methods

Research Design - This study employs a descriptive-correlational research design, which systematically examines relationships between variables while providing a detailed assessment of NAIA's airport infrastructure and passenger satisfaction. The descriptive component evaluates the current state of NAIA's facilities, accessibility, safety and security, signage, and amenities, while the correlational aspect determines the statistical relationship between infrastructure quality and passenger satisfaction. This design is widely used in aviation and service quality research, ensuring a quantitative, empirical approach to assessing passenger perceptions and experiences. This assesses five key airport infrastructure factors: terminal facilities, accessibility, safety and security, signage and wayfinding, and amenities and services. Terminal facilities are evaluated based on cleanliness, seating availability, restroom adequacy, and overall passenger comfort. Accessibility is assessed in terms of ramps, elevators, inclusive layouts, and ease of movement for passengers with disabilities. Safety and security are measured by analyzing the efficiency of screening processes, professionalism of security personnel, and overall emergency preparedness. Signage and wayfinding are reviewed for clarity, language inclusivity, and navigational effectiveness, while amenities and services are examined based on the quality and variety of food, retail, lounges, and transport connectivity. This investigates whether the quality of NAIA's infrastructure directly influences passenger satisfaction. The study examines whether infrastructure deficiencies contribute to lower satisfaction ratings and identifies key areas for strategic intervention. By utilizing a descriptive-correlational approach, this study ensures an evidence-based framework for improving airport infrastructure and service delivery.

Participants of the Study - The participants for this study are passengers who have traveled through Ninoy Aquino International Airport (NAIA) Terminals within the past 12 months. This time frame ensures that the data collected reflects recent passenger experiences under current operational and infrastructural conditions, offering timely and relevant insights for evidence-based decision-making. To qualify, participants must be at least 18 years old and voluntarily agree to participate in the study. These criteria prioritize individuals with firsthand and meaningful experiences of NAIA's facilities and services, enhancing the reliability and validity of the data. To contextualize the data, it is important to emphasize that data collection was conducted during the last quarter of 2024—prior to the official transition to new airport management. This ensures that passenger insights reflect conditions and systems under the former administration. This study includes both domestic and international passengers to represent a wide spectrum of user experiences. To ensure diverse feedback, participants who have interacted with critical services—such as baggage handling, customer service counters, and transportation facilities—are prioritized. This selection strategy allows the research to focus on the operational and experiential aspects of NAIA, identifying key areas for improvement that directly influence passenger satisfaction.

A sample size of 385 respondents was determined using Raosoft's sample size calculator, applying parameters of a 5% margin of error and a 95% confidence level. Stratified sampling is utilized to ensure proportional representation of passengers based on the traffic distribution across NAIA's three primary terminals: Terminal 1, Terminal 2, and Terminal 3. This approach captures the diversity of passenger interactions and experiences across different types of airport operations while maintaining statistical rigor.

NAIA Terminal 4 was excluded from the study to maintain a consistent comparison across terminals with similar operational capacities and infrastructure. Terminal 4 primarily serves low-cost carriers and regional flights with minimal amenities, fewer passenger services, and a unique operational framework that differs significantly from Terminals 1, 2, and 3. Including Terminal 4 could introduce variations that may confound the analysis of infrastructure quality and passenger satisfaction in terminals designed for both domestic and international traffic. By focusing on Terminals 1, 2, and 3, this study ensures that its findings are more applicable to NAIA's modernization efforts without dilution by fundamentally different service structures.

Stratified sampling ensures that data reflects the diversity of passenger experiences at NAIA. By proportionally allocating respondents based on terminal traffic, the study accounts for variations in passenger

needs, preferences, and challenges associated with different terminals. For example, Terminal 1's focus on international traffic may highlight distinct needs for immigration and customs facilities, while Terminal 2's focus on domestic traffic may emphasize efficiency and accessibility. Terminal 3's mixed traffic composition provides a balanced perspective on the integration of services for both types of passengers. This participant selection strategy is directly tied to actionable outcomes. Feedback will inform targeted recommendations for each terminal, allowing NAIA to address specific operational and infrastructure gaps with precision. For instance, insights from international passengers may lead to enhancements in lounges, immigration processing, and retail offerings, while domestic traveler feedback could prioritize streamlining check-in and improving wayfinding systems.

By ensuring statistical reliability and capturing diverse perspectives, this approach aligns with the study's objectives to evaluate passenger satisfaction comprehensively. It also supports the creation of strategic, terminal-specific interventions that address key performance indicators for NAIA's competitiveness. The carefully curated participant base contributes to a nuanced understanding of passenger needs, positioning this research to deliver meaningful improvements in infrastructure and service quality.

Data Gathering Instrument - The primary data collection tool for this study is a structured questionnaire, adapted from validated instruments used in previous research on airport infrastructure and passenger satisfaction. The questionnaire is aligned with the study's objectives and NAIA's operational environment, ensuring that responses capture passenger perceptions, infrastructure efficiency, and overall satisfaction levels. While no named service quality model was formally adopted, several satisfaction indicators were informed by globally recognized service delivery dimensions commonly emphasized in transportation and tourism literature. Passenger Comfort During Delays and Cancellations incorporated elements conceptually aligned with emotional care and empathetic service, reflecting best practices in service recovery. These were partly inspired by insights from widely cited models such as SERVQUAL, although SERVQUAL itself was not used as a formal theoretical foundation. The intent was not to adopt the framework in its entirety, but rather to capture critical service behaviors—such as empathy and responsiveness—that are consistent with global service quality literature and relevant to the NAIA passenger experience.

Part I collects demographic and travel-related information, including participants' sex, age, marital status, and frequency of travel. These variables provide essential contextual data for analyzing passenger behavior, preferences, and experiences. By segmenting respondents based on their demographic profiles—such as frequent business travelers, leisure tourists, or occasional flyers—the study can identify trends and variations in passenger satisfaction levels. Part II evaluates the physical infrastructure of NAIA, assessing five key areas: terminal facilities, accessibility, safety and security, signage and wayfinding, and amenities and services. The section includes tangible elements of the passenger environment such as cleanliness, seating comfort, lighting, and restroom availability, which are central to users' perception of facility quality. Accessibility features—such as elevators, ramps, and pathways for persons with reduced mobility—are evaluated to determine adherence to universal design standards. Safety and security measures are assessed in terms of visibility, effectiveness, and traveler confidence, reflecting expectations of assurance. Wayfinding is measured through signage clarity, directional guidance, and ease of navigation, while the amenities and services construct captures the availability, variety, and convenience of retail, food, and passenger support areas (Bakır et al., 2022). Part III measures overall passenger satisfaction, integrating insights from both infrastructure and service experience. Participants evaluate their perceptions of queue management efficiency, reliability of processing, comfort during delays and cancellations, responsiveness of support systems, sustainability initiatives, and staff communication. Several of these indicators reflect foundational elements of effective service delivery, including the consistency and timeliness of assistance, the ability of personnel to communicate clearly under pressure, and the availability of empathetic responses during service disruptions. In particular, the items under *Passenger Comfort during Delays and Cancellations* reflect traveler expectations for care, real-time updates, and physical comfort during unplanned interruptions. Respondents also indicate whether they would recommend NAIA to others and whether the airport aligns with international standards. Collectively, this section offers a comprehensive view of how both

infrastructure and service performance shape the passenger experience.

The development of the questionnaire followed a rigorous validation process to ensure accuracy, relevance, and comprehensiveness. Initial consultations with the research adviser refined its structure, clarity, and alignment with the study’s objectives. The first expert, with expertise in aviation safety and regulatory compliance, ensured the instrument aligned with service efficiency and passenger safety standards. The second expert, a professor and international airline crew member, contributed insights on passenger service quality and operational procedures to enhance the survey’s effectiveness in measuring satisfaction and efficiency. The third expert, a Domestic Head Cabin Attendant, provided valuable input on passenger comfort, in-flight service expectations, and customer engagement. Their combined expertise strengthened the questionnaire’s reliability, clarity, and applicability, making it a robust tool for assessing NAIA Terminals 1, 2, and 3 in terms of infrastructure efficiency and passenger satisfaction. To assess the reliability of the instrument, a pilot study was conducted in Cebu with 30 respondents who met the inclusion criteria of the study. Responses were analyzed using Cronbach’s Alpha, a statistical measure of internal consistency. The instrument achieved Cronbach’s Alpha values ranging from 0.954 to 0.975, indicating excellent reliability across all sections. These results confirm the questionnaire’s effectiveness in collecting consistent and meaningful data on passenger experiences and satisfaction (Bakır et al., 2022).

Table 1

Reliability Test Result

Indicators	Cronbach Alpha	Remarks
Terminal Facilities	0.968	Excellent
Accessibility	0.956	Excellent
Safety and Security	0.956	Excellent
Signage and Wayfinding	0.956	Excellent
Amenities and Services	0.955	Excellent
Queue Management Efficiency	0.954	Excellent
Passenger Comfort During Delays and Cancellations	0.975	Excellent
Passenger Support System	0.963	Excellent
Sustainability Initiatives	0.965	Excellent
Staff Communication and Service Efficiency	0.960	Excellent

George and Mallery (2003) provide the following rules of thumb: “_ > .9 – Excellent, _ > .8 – Good, _ > .7 – Acceptable, _ > .6 – Questionable, _ > .5 – Poor, and _ < .5 – Unacceptable”

The structured questionnaire serves as more than just a data collection tool; it is a key mechanism for developing actionable recommendations for NAIA. The data gathered helped pinpoint areas needing infrastructure improvement while offering strategic insights into passenger expectations and service gaps. For instance, if accessibility scores are low, this indicates the need for improved facilities for passengers with disabilities. If passengers express dissatisfaction with queue management, the findings will highlight the need for enhanced check-in processes and digital queueing solutions. By systematically addressing passenger priorities and operational gaps, this research ensures that its findings will contribute to evidence-based policies for improving NAIA’s competitiveness and aligning its services with international airport standards.

Data Gathering Procedures - The primary mode of data collection was an online survey. Respondents were approached in person outside various NAIA Terminals and provided with a QR code for easy access to the survey. Participants were required to be at least 18 years old and to have recent experience with air travel through NAIA Terminals. Before participating, respondents read and agreed to a consent form outlining the study's purpose, voluntary participation, and measures to protect their anonymity and confidentiality. The survey's online nature facilitated convenience and broad accessibility, allowing real-time monitoring of responses. Data were collected over a specified period from November 2024 to January 2025. To ensure a representative view of regular airport operations, data gathering was intentionally scheduled outside of peak holiday periods, such as Christmas and New Year travel surges. Future studies are encouraged to include seasonal comparisons to explore potential fluctuations in passenger satisfaction and service performance during peak travel periods. It is also important to note that the current study did not include direct stakeholder

consultation. While passenger perspectives provided valuable insights, the absence of viewpoints from airport management, frontline personnel, and regulatory agencies such as CAAP represents a methodological limitation. Future research may benefit from conducting focus group discussions with NAIA staff, CAAP officials, and frequent travelers to incorporate operational realities and qualitative perspectives into airport planning and service development.

Data Analysis - This study employed a comprehensive range of statistical techniques to assess the relationship between airport infrastructure and passenger satisfaction at Ninoy Aquino International Airport (NAIA). To evaluate the core components of airport infrastructure and passenger satisfaction, Weighted Means were computed. This approach provided an overarching view of prevailing attitudes within the sample, facilitating a deeper understanding of how infrastructure quality influences passenger experience. In examining differences among key variables, the study employed parametric tests based on the data distribution and sample size considerations. Given that the sample size ($n = 385$) meets the conditions of the Central Limit Theorem (CLT), parametric tests were deemed appropriate for group comparisons. By applying a structured statistical approach, this study ensured the validity and reliability of its findings. The combination of weighted means, and t-tests enabled a robust assessment of the relationship between airport infrastructure and passenger satisfaction. The findings from these analyses provide a data-driven foundation for strategic recommendations aimed at enhancing service quality, optimizing airport infrastructure, and improving overall passenger experience at NAIA.

Ethical Considerations - The study adhered to the Data Privacy Act of 2012 in the Philippines. This law regulates the collection, use, and disclosure of personal data, ensuring respondents' rights to privacy and data protection. A detailed consent form was provided to all respondents, ensuring they understand their rights and the study's purpose before participating. Personal identifiers will be excluded from the final report to maintain confidentiality. The study presents findings objectively and impartially, adhering to the highest ethical standards and ensuring the research's transparency and credibility.

3. Results and discussion

Table 2

Summary Table on Airport Infrastructure

Airport Infrastructure	WM	Interpretation	Rank
Terminal Facilities	2.83	Agree	4
Accessibility	2.88	Agree	3
Safety and Security	2.96	Agree	1.5
Signage and Wayfinding	2.96	Agree	1.5
Amenities and Services	2.69	Agree	5
Grand Weighted Mean	2.86	Agree	

Legend: 3.51 - 4.00: Strongly Agree, 2.51 - 3.50: Agree, 1.51 - 2.50 : Disagree, 1.00-1.50: Strongly Disagree

Table 2 presents a summary evaluation of airport infrastructure at NAIA across five core dimensions: terminal facilities, accessibility, safety and security, signage and wayfinding, and amenities and services. The grand weighted mean score of 2.86, interpreted as “Agree,” indicates that passengers perceive the airport’s infrastructure as generally functional and serviceable. However, the scores suggest that while foundational elements are in place, performance remains moderate, and the airport has yet to reach the operational and experiential quality expected of top-tier international aviation hubs.

The highest-rated dimensions were safety and security and signage and wayfinding, both receiving a weighted mean of 2.96. This reflects passengers’ recognition of visible protective measures and navigational support throughout the terminals. These findings affirm the critical role that environmental clarity and secure processes play in the airport experience—particularly as NAIA serves a growing mix of international, regional, and domestic travelers. Terminal 3, the most modern facility, appears to have set a higher operational benchmark that partially elevates the scores across the broader system. Passenger trust in safety and security is reinforced by

consistent screening protocols, the presence of trained personnel, and visible surveillance infrastructure. These measures are especially impactful in high-traffic zones of Terminals 1 and 3, where international passenger volume is heaviest.

Parallel to safety, the effectiveness of signage and way-finding emerged as a significant strength. Clear gate information, visible emergency exit signage, and strategically placed maps enable passengers to navigate efficiently, especially during transfers or tight boarding schedules. Terminal 3 features more digital signboards and interactive displays, while Terminals 1 and 2 rely on static signage that, when appropriately placed, still supports passenger movement. Ryu et al.,(2019) found that effective way-finding design reduces bottlenecks, missed connections, and dependency on staff. Walia et al. (2021) further emphasized that multilingual and digital signage systems contribute to traveler autonomy, particularly for non-local and first-time users.

In contrast, the lowest-rated infrastructure component was amenities and services, which received a weighted mean of 2.69. This suggests that while passengers acknowledge the presence of basic services, they view comfort-oriented features—such as dining diversity, Wi-Fi connectivity, and wellness lounges—as insufficient. These concerns are most evident in Terminals 1 and 2, where outdated layouts and physical constraints continue to limit service modernization. Terminal 3 performs better but does not fully compensate for these network-wide deficiencies. The finding aligns with the broader shift in passenger expectations, where modern travelers no longer distinguish sharply between functional infrastructure and experiential services. Colak et al. (2023) noted that the presence of personalized, tech-enhanced, and wellness-oriented amenities significantly shapes passenger loyalty. Without adequate spaces to dine, work, or relax, passengers perceive the terminal environment as utilitarian rather than accommodating—a perception that constrains the airport’s service reputation.

Terminal facilities, ranked fourth with a mean score of 2.83, further reinforce this perception. While passengers responded positively to restroom cleanliness and lighting quality, they expressed consistent dissatisfaction with seating comfort, leisure zones, and the spatial flexibility of older terminals. Terminal 3, by contrast, benefits from a more intuitive layout and brighter ambiance, illustrating how infrastructure age and design legacy influence passenger evaluations. As highlighted by Ryu et al.,(2019), layout coherence and environmental comfort are foundational to reducing terminal fatigue and enhancing time spent at the airport.

Together, the results from Table 2 suggest a structural imbalance: while NAIA performs well in security and navigability—both critical for operational functionality—it falls short in delivering comfort, digital accessibility, and personalized service. These findings are consistent with those from earlier tables and point to a system that prioritizes basic throughput but under-delivers in areas that create value-added experiences. To elevate service performance, airport authorities must view safety and signage not as standalone achievements but as foundations to build upon. Meaningful improvements in amenities, connectivity, and terminal comfort will require targeted investment in both infrastructure and service innovation. This includes expanding food and retail options, modernizing digital networks, and adapting spaces for multi-use comfort, such as co-working lounges or quiet zones. Ultimately, the pathway toward global competitiveness lies in re-balancing the infrastructure equation—maintaining strengths in safety and way-finding, while aggressively closing the satisfaction gap in passenger-centered services. NAIA’s ability to deliver a seamless, inclusive, and enriching experience will determine not just its rankings, but its long-term relevance in an increasingly experience-driven global aviation landscape.

Table 3 presents a summary evaluation of passenger satisfaction across five service dimensions, yielding a grand weighted mean score of 2.75, interpreted as “Agree.” This rating suggests that while passengers find the airport’s service delivery acceptable, it falls short of excellence. The moderate performance level reflects systemic inconsistencies in both tangible and intangible service elements, highlighting key areas in need of modernization, particularly in terms of passenger comfort and stress-reduction during service disruptions.

Among the evaluated dimensions, the highest-rated component was staff communication and service

efficiency, which earned a weighted mean score of 2.92. This result underscores the strong role of interpersonal service in enhancing the airport experience. Passengers consistently praised the clarity of verbal updates, cultural professionalism, and staff responsiveness—particularly in Terminal 3, where staffing levels and announcement systems are more robust. However, variations in performance across Terminals 1 and 2 suggest that this strength is not yet fully standardized across the airport complex.

Table 3

Summary Table on Passenger Satisfaction

Passenger Satisfaction	WM	Interpretation	Rank
Queue Management Efficiency	2.64	Agree	4
Passenger Comfort During Delays and Cancellations	2.54	Agree	5
Passenger Support System	2.89	Agree	2
Sustainability Initiatives	2.76	Agree	3
Staff Communication and Service Efficiency	2.92	Agree	1
Grand Weighted Mean	2.75	Agree	

Legend: 3.51 - 4.00: Strongly Agree, 2.51 – 3.50: Agree, 1.51 – 2.50 : Disagree, 1.00–1.50: Strongly Disagree

Academic research supports the significance of this service dimension. El Samra (2020) highlighted that multilingual announcements, AI-driven alerts, and professional communication from frontline personnel are critical to passenger satisfaction during both regular and disrupted travel. Bogicevic et al. (2013) further noted that clear interpersonal communication builds positive emotional experiences, particularly in high-traffic international terminals.

In contrast, the lowest-rated indicator was passenger comfort during delays and cancellations, which received a weighted mean of 2.54. This reveals a significant gap in the airport’s service resilience, particularly during high-stress events such as flight delays or long layovers. Passengers expressed dissatisfaction with the scarcity of designated rest areas, limited access to food services or lounges, and poor visibility of rebooking assistance desks. This issue was especially pronounced in Terminals 1 and 2, although even Terminal 3—despite its modern facilities—struggles to accommodate extended waiting times.

This finding mirrors concerns documented in previous research. Bogicevic et al. (2013) reported that passenger satisfaction drops significantly during delays when airports fail to offer comfort-related amenities, such as lounges, quiet zones, or wellness areas. Usman et al. (2023) emphasized that providing digital updates, timely rebooking support, and hospitality gestures—like food vouchers or access to premium lounges—can help recover service quality. El Samra (2020) advocated for the inclusion of ergonomic rest infrastructure and emotional comfort features as essential components of delay management strategy.

The disparity between high ratings for staff communication and low ratings for physical comfort illustrates a service model that is responsive but not fully resilient. While passengers feel seen and heard by airport personnel, their physical and emotional needs during delays are not being adequately met. This disconnection is particularly damaging to the airport’s reputation among long-haul travelers, families, and business passengers, who may face higher stakes when disruptions occur.

To address this challenge, NAIA must adopt a three-pronged strategy to elevate satisfaction and service continuity. First, investment is required in infrastructure that promotes rest and comfort, such as sleep pods, wellness lounges, and interactive entertainment areas. Second, the airport must deploy AI-driven queue management and flexible staffing to better manage peak-time congestion. Third, enhancing the visibility and interactivity of sustainability efforts can appeal to increasingly eco-conscious travelers, improving perception and reinforcing long-term engagement.

The results of Table 3 suggest that NAIA has built a solid foundation in customer-facing communication but lacks the physical and technological infrastructure needed to manage discomfort during disruptions. Achieving a higher level of satisfaction will require transforming isolated service strengths into a seamless,

end-to-end passenger experience that blends emotional support, physical comfort, and operational innovation.

Ultimately, bridging the satisfaction gap across service dimensions will be essential to positioning NAIA as a leading airport in Southeast Asia. With focused investment in comfort, digitalization, and inclusivity, the airport can move from providing acceptable service to delivering truly exceptional passenger experiences—those that build loyalty, resilience, and international acclaim.

Table 3

Relationship between the Indicators of Airport Infrastructure and Passenger Satisfaction

Terminal Facilities	r-value	p-value	Remarks
Queue Management Efficiency	0.689	0.000	Significant
Passenger Comfort During Delays and Cancellations	0.782	0.000	Significant
Passenger Support System	0.657	0.000	Significant
Sustainability Initiatives	0.731	0.000	Significant
Staff Communication and Service Efficiency	0.646	0.000	Significant
Accessibility			
Queue Management Efficiency	0.717	0.000	Significant
Passenger Comfort During Delays and Cancellations	0.764	0.000	Significant
Passenger Support System	0.611	0.000	Significant
Sustainability Initiatives	0.693	0.000	Significant
Staff Communication and Service Efficiency	0.677	0.000	Significant
Safety and Security			
Queue Management Efficiency	0.747	0.000	Significant
Passenger Comfort During Delays and Cancellations	0.689	0.000	Significant
Passenger Support System	0.605	0.000	Significant
Sustainability Initiatives	0.660	0.000	Significant
Staff Communication and Service Efficiency	0.646	0.000	Significant
Signage and Wayfinding			
Queue Management Efficiency	0.749	0.000	Significant
Passenger Comfort During Delays and Cancellations	0.713	0.000	Significant
Passenger Support System	0.660	0.000	Significant
Sustainability Initiatives	0.751	0.000	Significant
Staff Communication and Service Efficiency	0.709	0.000	Significant
Amenities and Services			
Queue Management Efficiency	0.779	0.000	Significant
Passenger Comfort During Delays and Cancellations	0.771	0.000	Significant
Passenger Support System	0.644	0.000	Significant
Sustainability Initiatives	0.723	0.000	Significant
Staff Communication and Service Efficiency	0.602	0.000	Significant

If p – value > 0.05 Threshold Level: Accept Ho: Not Significant

Table 3 presents the correlation analysis examining the strength of relationships between the dimensions of airport infrastructure and various aspects of passenger satisfaction. The results reveal that all tested variables exhibit statistically significant relationships, with all probability values recorded well below the conventional 0.05 threshold, confirming the presence of meaningful associations. The correlation coefficients fall within the moderate to high range, indicating strong positive links between the quality of infrastructure and satisfaction levels across dimensions such as queue management, comfort during delays, customer support, sustainability, and staff communication.

The strongest relationship observed was between the quality of terminal facilities and passenger comfort during delays and cancellations, yielding a correlation coefficient of 0.782. This suggests a very high level of association, indicating that when terminal environments are well-designed—featuring sufficient seating, rest zones, power charging points, and accessible information desks—passengers are better able to cope with disruptions and prolonged waiting times. Terminals that are physically comfortable and operationally intuitive can offset the negative emotional effects of flight irregularities.

Terminal facilities were also strongly related to perceptions of sustainability, with a correlation value of 0.731. This indicates that well-maintained infrastructure is not only associated with operational quality but also with the airport's environmental identity. Passengers are more likely to trust and engage with green

initiatives—such as recycling programs or water-saving fixtures—when these are visibly integrated into the physical environment. The connection between terminal facilities and the passenger support system was also robust, with a correlation coefficient of 0.657. This reflects the importance of spatial and visual infrastructure in enabling effective service interactions. When help desks are easily located, and when infrastructure supports smooth movement, passengers experience faster resolution of issues and perceive support systems as more responsive.

The accessibility dimension also demonstrated high levels of association across all passenger satisfaction indicators. The strongest of these was with comfort during delays and cancellations, where the relationship registered a correlation of 0.764. This signifies that inclusive design—ranging from accessible toilets and ramps to wide pathways and elevators—enhances a passenger’s ability to comfortably endure unplanned waiting periods. This interpretation aligns with Symonds (2017), who emphasized that mobility-enhancing features serve not just those with physical impairments but also travelers carrying heavy luggage, elderly individuals, and families with small children. Kim et al. (2021) further explained that accessible layouts contribute to a calmer passenger experience, reducing the cognitive load associated with navigating unfamiliar terminals. Accessibility was also positively linked to queue management efficiency, with a correlation coefficient of 0.717. This suggests that efficient movement through the terminal, enabled by thoughtful infrastructure design, contributes to better crowd control and shorter wait times—especially in congested areas like immigration, security, and check-in counters.

Safety and security infrastructure also played a critical role in shaping passenger satisfaction. The most notable relationship was with queue management efficiency, reflected in a high correlation of 0.747. This supports the view that efficient security processes—those that are visible, streamlined, and conducted respectfully—are key drivers of perceived queue performance. When security checkpoints function without excessive delays or ambiguity, passengers feel reassured rather than obstructed. Comfort during delays was also significantly associated with safety and security, with a correlation coefficient of 0.689. This reinforces the idea that a sense of personal safety enhances the emotional resilience of travelers, particularly during prolonged waiting periods or in high-traffic zones. Secure, well-monitored environments reduce anxiety and foster a sense of trust in airport operations. Way finding and signage produced some of the most consistently high correlations across all satisfaction indicators. The strongest of these was with sustainability initiatives, where the relationship recorded a coefficient of 0.751. This suggests that when sustainable practices are well-communicated—through signage that explains environmental efforts or directs passengers to eco-friendly amenities—passengers become more aware of, and engaged with, the airport’s green agenda.

A similarly strong correlation was observed between way-finding and queue management efficiency, where the coefficient reached 0.749. This implies that clear signage contributes directly to passenger flow and queuing effectiveness by minimizing confusion, dispersing crowds, and ensuring that travelers reach their destinations quickly and independently. These findings are in line with Colovic et al. (2022), who found that inadequate signage significantly impairs movement and generates bottlenecks, especially for international and first-time travelers. The amenities and services dimension demonstrated strong relationships with all satisfaction outcomes. Its most powerful link was with queue management efficiency, where the correlation value was 0.779. This suggests that the strategic placement of amenities such as self-check kiosks, drinking stations, and fast-track lanes not only enhances convenience but also supports operational efficiency.

Passenger comfort during delays was also highly related to the quality of amenities, as reflected by a correlation of 0.771. Whether through lounges, seating arrangements, entertainment options, or dining facilities, these elements enable passengers to make productive or restful use of their time when flights are delayed or rescheduled. A correlation of 0.723 was observed between amenities and sustainability satisfaction, reflecting the influence of eco-conscious commercial services—such as green-certified food vendors, biodegradable packaging, and low-energy lighting in retail spaces—on environmental perception. These relationships suggest that passengers evaluate an airport’s service values not only by what is offered but by how it is delivered.

In sum, the data affirm that each airport infrastructure component exerts a significant and positive influence on multiple dimensions of passenger satisfaction. Terminal facilities and accessibility most strongly support comfort and movement, while safety and signage reinforce trust and orientation. Amenities, meanwhile, serve as multifunctional supports that enhance rest, engagement, and sustainability awareness.

These results underscore the need for NAIA and other international airports to adopt a holistic approach to infrastructure development—one that aligns architectural, operational, and environmental strategies to traveler-centered outcomes. Prioritizing digital integration, universal accessibility, green infrastructure, and spatial intelligence will not only enhance satisfaction but also establish NAIA as a forward-thinking, globally competitive hub.

Table 4

Relationship between the Totality of Airport Infrastructure and Overall Passenger Satisfaction

CORRELATION		r-value	p-value	Remarks
Airport Infrastructure	Passenger Satisfaction	0.855	0.000	<i>Significant</i>

If p – value > 0.05 Threshold Level: Accept Ho: Not Significant

Table 4 presents the correlation result between the composite index of airport infrastructure and the overall measure of passenger satisfaction. The analysis revealed a statistically significant relationship, as indicated by a correlation strength of 0.855. This very high positive association demonstrates that passenger satisfaction increases as the quality of airport infrastructure improves. The accompanying probability value, well below the accepted significance threshold of 0.05, confirms that this correlation is not due to chance but reflects a robust and reliable connection. This result strongly validates the foundational premise of this study—that airport infrastructure serves as a critical determinant of service quality perception. The magnitude of the relationship suggests that airport users form holistic judgments of their travel experience based largely on the physical and operational systems in place. These systems encompass terminal layout, signage, cleanliness, accessibility, digital touchpoints, queue management, safety procedures, amenities, and sustainability initiatives. When these elements perform effectively in concert, they significantly enhance traveler comfort, reduce stress, and improve perceptions of service reliability.

The strength of the relationship (with a coefficient above 0.85) places it within the category of a very strong positive correlation. This means that improvements in infrastructure are highly predictive of increases in overall satisfaction, with very little variation unaccounted for. In real terms, a well-lit terminal with adequate seating, organized security lanes, clean facilities, and multilingual wayfinding will create a far more favorable impression than a terminal lacking these features, even if other service elements (such as airline punctuality) remain constant. The current result supports the conclusion that infrastructure is not just a background enabler of service—it is a visible, functional, and emotionally salient factor in the travel process. Each infrastructure touchpoint, from signage to rest areas to eco-friendly initiatives, contributes incrementally to a passenger’s overall evaluation. A single innovation (e.g., biometric gates) can enhance satisfaction, but its effectiveness is maximized only when supported by equally responsive systems (e.g., staff communication or accessible seating). Thus, a systems-based approach to infrastructure development is imperative.

This study’s findings also highlight that infrastructure improvements should not be implemented in isolation. Instead, development should be integrated across terminals, ensuring that no aspect of the passenger journey is under-supported. For example, efficient baggage handling systems must be complemented by spacious baggage claim zones, just as digital signage must be paired with strong Wi-Fi infrastructure to ensure usability. In other words, infrastructure synergy amplifies the return on investment. From a sustainability and inclusivity perspective, infrastructure improvements can also generate long-term loyalty. The presence of solar energy panels, recycling zones, low-flow water systems, and visible green campaigns contribute positively to brand image and satisfaction. Likewise, infrastructure that supports passengers with disabilities—such as tactile floor

paths, accessible counters, and priority seating—reinforces a commitment to equity and user-centric design.

The observed relationship also confirms that comfort is inseparable from satisfaction. As highlighted by Symonds (2017), airports that offer high levels of environmental comfort—through lighting, air circulation, noise control, and ergonomic seating—are more likely to retain passenger loyalty and generate favorable word-of-mouth. These subtle environmental cues, which fall under the broader umbrella of infrastructure, shape emotional perception as much as functional service. Moreover, the relevance of infrastructure extends into digital transformation. The correlation suggests that passenger satisfaction is increasingly tied to technological integration, such as automated check-ins, digital wayfinding, and real-time service notifications. As more travelers rely on mobile tools, infrastructure must support both physical and virtual navigation. Failure to do so can erode satisfaction, even in otherwise modernized terminals. Economically, a high satisfaction rating tied to infrastructure quality also implies financial benefits. These commercial gains can, in turn, support further infrastructure reinvestment, establishing a virtuous cycle of satisfaction and profitability.

In light of this finding, NAIA and similar airport authorities must treat infrastructure not as a fixed capital cost but as a dynamic component of passenger service strategy. Regular infrastructure audits, user-centered design updates, and integration of smart technologies must be institutionalized practices. Furthermore, any infrastructure enhancement should be evaluated not only in terms of compliance and capacity but also in terms of its impact on emotional comfort and service fluidity. In conclusion, the very strong and statistically confirmed relationship between airport infrastructure and overall passenger satisfaction affirms infrastructure as the core driver of the airport experience. Each investment in physical space, environmental control, digital tools, and sustainable operations contributes directly to the traveler’s impression of the airport. Therefore, infrastructure must be viewed as a strategic asset—not just a requirement for operation, but the foundation of service excellence, competitive differentiation, and passenger loyalty.

Table 5

Proposed Action Plan on Airport Infrastructure and Passenger Satisfaction

Key Result Area	Objectives	Key Performance Indicators	Strategies	Timeline	Expected Outcome
1. Enhance Passenger Comfort	To increase passenger comfort during delays and service disruptions	Number of rest zones established; passenger satisfaction rating during delays	Development of designated rest zones with ergonomic seating, nap pods, family zones, and on-call assistance desks across all terminals.	Q2 2025	Reduced passenger complaints and improved comfort ratings during irregular operations.
2. Improve Airport-Wide Digital Connectivity	To enhance digital engagement and access to real-time services	Wi-Fi speed and coverage metrics; user connectivity feedback	Upgrading of existing Wi-Fi to high-speed, terminal-wide access and deployment of ICT help desks at key areas.	Q3 2025	Improved digital access and real-time service availability for all passengers.
3. Strengthen Multilingual Communication and Cultural Support	To improve inclusivity and information access for international passengers	Availability of multilingual help desks; user satisfaction by language group	Installation of AI-powered translation kiosks and multilingual help counters at check-in, immigration, and information desks.	Q3 2025	Enhanced service inclusivity and increased satisfaction among foreign travelers.
4. Improve Queue Management and Passenger Flow	To reduce congestion and processing time during peak periods	Average queue time; system response speed	Deployment of AI-based queue monitoring systems and real-time wait-time signage across all terminals.	Q4 2025	Reduced waiting times and enhanced perceptions of efficiency and order.
5. Promote Sustainability Awareness	To encourage eco-conscious behaviors among passengers and staff	Participation rate in eco-programs; volume of recycled waste	Implementation of interactive eco-signage and QR-based incentive recycling campaigns	Q4 2025	Increased engagement in green practices and compliance with sustainability standards.
6. Standardize Passenger Support During Disruptions	To unify service protocols for better support during irregular operations	Availability of disruption response kits; traveler support feedback	Implementation of standardized disruption protocols (e.g., food vouchers, lounge access, rebooking assistance)	Q3 2025	Improved recovery consistency and stronger airport-airline coordination.

7. Support National Aviation Policy Development	To integrate passenger-centric recommendations into policy	Inclusion of study findings in national policy drafts	Collaboration with CAAP and DOT for incorporation of findings into planning frameworks	Q1 2026	Policy development grounded in evidence-based passenger experience data.
8. Expand Academic Collaboration and Research	To sustain evidence-based service innovation through research	Number of research partnerships; applied study outcomes	Establishment of formal research partnerships with HEIs focused on passenger satisfaction	Q3 2025	Continuous service evaluation and innovation grounded in scholarly research.
9. Strengthen Cybersecurity and AI Safety Systems	To modernize digital surveillance and threat response	Number of AI tools deployed; security incident response rate	Implementation of facial recognition, encrypted systems, and AI-powered threat monitoring	Q4 2025	Improved airport security aligned with global aviation safety protocols.
10. Increase Stakeholder Participation in Service Planning	To align airport improvements with stakeholder feedback	Frequency of stakeholder consultations; stakeholder satisfaction index	Conduct of quarterly consultation forums with frontline staff, airlines, CAAP, and frequent travelers	Q2 2025	More inclusive, need-based infrastructure planning and implementation.

4. Conclusions and recommendations:

Safety and security infrastructure, alongside signage and wayfinding systems, emerged as the most positively perceived aspects of airport infrastructure. However, terminal facilities, accessibility features, and the diversity and responsiveness of amenities and services showed areas of moderate to low satisfaction. Accessibility infrastructure, particularly for persons with disabilities, remains underdeveloped, while amenities such as rest areas, retail variety, and sensory-inclusive features are inconsistently available across terminals. These findings underscore the importance of a holistic and inclusive approach to infrastructure development to meet global standards and traveler expectations. Passenger satisfaction is influenced by several interrelated service dimensions. While staff communication and service efficiency continue to play a pivotal role in shaping emotional satisfaction and perceived service reliability, notable concerns persist in queue management efficiency, particularly during peak travel hours. Passenger comfort during delays and cancellations remains inconsistent, with limited access to rest areas and poor information dissemination. Support systems, such as help desks and digital assistance, are sporadically functional, and awareness of NAIA’s sustainability initiatives is generally low. These multidimensional gaps highlight the need for coordinated service improvement strategies that are both technologically adaptive and human-centered. A significant positive relationship between airport infrastructure quality and overall passenger satisfaction was established, reinforcing the imperative of investing in tangible service environments. Key infrastructure features—such as terminal comfort during delays and the strategic placement of wayfinding systems—act as mediators of emotional stability, service perception, and environmental engagement, confirming infrastructure’s central role in enhancing passenger satisfaction. Based on the findings, a strategic action plan was developed to address the identified service gaps and infrastructure deficits. The plan prioritizes four core pillars: (1) enhancement of digital infrastructure and real-time passenger communication tools; (2) expansion and diversification of amenities to cater to varied demographic segments; (3) implementation of inclusive design principles to improve accessibility for all travelers; and (4) visibility and integration of sustainability initiatives across touchpoints. These recommendations aim to elevate NAIA’s operational efficiency, passenger satisfaction, and alignment with global airport benchmarks, thereby positioning it as a traveler-centric and future-ready hub in the Asia-Pacific region.

The Manila International Airport Authority (MIAA) and airport facilities management teams may enhance traditional wayfinding systems by integrating dynamic digital signage, QR-based directional maps, and multilingual interactive kiosks to improve navigational ease, reduce passenger stress—particularly for first-time and foreign travelers—and align NAIA’s signage infrastructure with international accessibility and universal design standards, thereby elevating user experience and compliance with global benchmarks. The Airport Commercial Operations Division and terminal food and beverage concessionaires may redesign dining facilities across all terminals to better reflect passenger preferences regarding variety, spatial layout, and inclusivity by incorporating diverse culinary options, improved food court zoning, and menus that accommodate specific

dietary needs (e.g., vegetarian, halal, gluten-free), ultimately enhancing passenger satisfaction while increasing commercial revenues through broader and more inclusive culinary offerings. The Airport Planning and Development Office and the family services committee may establish dedicated family zones throughout the terminals, including stroller-accessible pathways, child-friendly play areas, and fully equipped nursing rooms to contribute to a safer, more convenient, and family-friendly airport environment in line with global best practices, thereby fostering inclusivity and improving the travel experience for passengers traveling with young children. The Airport Security Operations Center and Aviation Security Group may refine airport safety protocols by prioritizing transparency, responsiveness, and passenger-centric procedures through the integration of non-intrusive screening technologies and the implementation of real-time communication tools during security checks to enhance both passenger trust and comfort without compromising safety standards, leading to a more secure yet passenger-friendly security experience. The Airport Communications Office and Customer Service Division may strengthen multilingual and digitally assisted communication systems to enhance service inclusivity for international travelers by expanding language support across public announcements, mobile applications, and AI-based chat assistance platforms, thereby reducing communication barriers and improving the overall passenger experience in a diverse, global airport setting. The Bureau of Immigration, Bureau of Customs, and Airport Operations Management may streamline immigration and customs processing through the implementation of biometric e-gates, expanded queuing zones, and digital pre-clearance systems to mitigate congestion during peak periods and improve the efficiency and throughput of inbound and outbound passenger flows, thus aligning NAIA's border control operations with international benchmarks for seamless and efficient travel. The Manila International Airport Authority (MIAA) and future airport management stakeholders may replicate this study under the new airport administration to evaluate potential improvements in infrastructure quality and passenger satisfaction, providing comparative insights and validating the effectiveness of implemented strategies over time, thereby fostering a culture of evidence-based decision-making and continuous improvement. Future academic researchers and industry innovation committees may explore complementary dimensions of airport operations, such as digital feedback integration and responsive service recovery mechanisms, to develop smarter, more adaptive airport systems capable of sustaining high levels of traveler satisfaction even amid operational disruptions, thereby contributing to more resilient and traveler-centric aviation ecosystems.

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