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An Empirical Study of Customer and Service Quality at Jinnah International Airport Using Yeh's Satisfaction Model

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ABSTRACT

Service quality is a key determinant of passengers' experience and satisfaction at airports, directly influencing perceptions of efficiency, comfort, and overall travel quality. This study evaluates airport service quality and customer satisfaction at Jinnah International Airport, Karachi, using Yeh's Satisfaction Index Model. The research is based on primary data collected through structured questionnaires, focusing on multiple service dimensions, including staff behavior, operational efficiency, infrastructure, and passenger amenities. The quantitative data were analyzed using digital tools such as SPSS and Microsoft Excel. The findings reveal that passengers are generally satisfied with core operational services such as staff courtesy, baggage handling, and flight information systems, which recorded satisfaction levels above 50%. However, significant dissatisfaction is observed in areas related to infrastructure and passenger comfort, including restroom cleanliness, waiting area facilities, food quality, and internet services. Additionally, operational challenges such as congestion during peak hours and delays in boarding procedures negatively affect passenger experience. The study concludes that while the airport performs well in functional service delivery, there is a critical need to improve physical facilities and value-added services to enhance overall passenger satisfaction. The results provide important insights for airport authorities and policymakers to develop targeted strategies for service improvement and align airport performance with international standards.

Keywords: Airport Service Quality; Airport Performance; Customer Satisfaction Index Model; Yeh's Satisfaction Index Model

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1. Introduction

The global aviation industry has experienced transformative growth over recent decades, with airports evolving from mere transportation nodes into complex commercial ecosystems. In this competitive landscape, service quality has emerged as a critical differentiator and a significant performance indicator for airport operations and management^[1-3]. Unlike many service industries where customers exercise direct choice, air passengers often have limited alternatives regarding which airport to use, regardless of price and quality levels, making the measurement and management of service quality particularly crucial for stakeholder satisfaction and operational success^[4-6].

The concept of airport service quality (ASQ) encompasses a multi-dimensional framework that includes physical environment, interactional quality, and outcome quality attributes^[1,7,8]. These dimensions collectively influence passenger satisfaction, airport reuse intentions, and even destination revisits. As airports face increasing pressure to generate non-aeronautical revenue, attract passengers, and maintain competitive advantage, the need for robust, theoretically grounded measurement models has become paramount^[1,9]. However, despite the proliferation of service quality research, a notable gap persists: there is no generally accepted conceptual framework for adequately measuring service quality with users' overall satisfaction at airports^[1,6,10].

As traffic volume rises, airports struggle to optimize infrastructure while adopting a customer-oriented focus to achieve better performance. Passenger satisfaction with airport service quality is influenced by the level of service in the previous service quality^[9]. Passenger satisfaction is a key performance indicator for airport operations. International airports located in different regions or countries, by and large, do not compete with one another. Passengers often do not have a choice between airports, regardless of price and quality levels of airport services^[7]. The quality of facilities has a direct link to the passengers' perception of the level of excellence of the facilities provided. Service quality indicators focus on how passengers perceive the level of service provided by the airport and on objective measures of service delivery. Service quality is an important area of airport performance that reflects the efforts made by the airport to deliver a high standard of service in various areas^[11,12].

For instance, analysis of passenger expectations regarding the airport service and using a structural equation modeling approach to the complex relationships between passenger attitudes and Airport Service Quality (ASQ).

Non-aeronautical activities in general and terminal retail have been part of airport management for six decades. In other words, the percentage of total airport revenues represented by non-aeronautical or commercial revenues has not stopped growing and may reach 90%^[7,11]. Performance measurement is a broad topic, and it is defined as the process of measuring the efficiency and effectiveness of an action. Airports need to evaluate their performance and effectiveness periodically to determine whether objectives are being achieved and how their performance compares to similar best practices' businesses^[6,8,13]. Furthermore, measuring airport performance can be carried out for several purposes: to evaluate the efficiency of various aspects of an airport in financial and operational terms, to validate the safety and security procedures, and to assess the potential environmental impacts of airport activities^[14,15]. In this context, the airport industry has been progressively motivated to adopt a different approach regarding ASQ.

According to Armenti et al., many approaches can be found in defining the concept of service quality. Various propositions about the evolution of service quality in a service organization can be seen in the studies by researchers^[16,17]. Many researchers have proposed extensions to the original quality gaps concept in later studies. Airport Council International (ACI) and the International Civil Aviation Organization (ICAO) identified service quality as a major factor in measuring airport performance. When an airport provides an attractive facility or a good quality service to its users, it will help it to become a competitive international airport. SD represents the level of service provided that the customer would like to receive, while SM reflects the minimum level of service that the customer would tolerate. When the service is rendered, the customer evaluates the level of service received/perceived through his or her perceptions. When the service provided exceeds the desired service level, the customer will be delighted within the zone of tolerance because they have received a service in line with their expectations. Service quality is a very important factor at the airport that affects the feedback or perception of passengers towards the service. The importance and perfor-

mance measures give the management a better understanding of customer perceptions of a facility or service^[18,19].

The SERVQUAL technique identifies the customer satisfaction with service attributes by comparing customers' expectations and customers' perceptions. The concept of passenger satisfaction is still abstract. Because passengers are airports' main customers and their first impression of airports' service and facilities may influence their feelings towards and evaluation of airports, it is essential for airports to provide services with safety, comfort, and convenience in an economic manner^[4]. Achieving passenger satisfaction requires a simple or complex process. The professional researchers identified the importance of the actual passenger needs (passenger-centric). The importance of value to meet the passengers' needs even exceeds the passengers' needs in the aviation business, to support the airport service quality. The landside facilities at the Terminal respond to any changes in passengers' needs in the aviation business. The addition of new functions, services, and processes should be realized according to the passengers' needs. Passenger perception is a process where the user can select, organize, and describe something that is accepted as a complete perspective. By the same 10 indication, someone's perception of something may be different from the perceptions of others, because the needs, values, and expectations are not the same for each user^[9,16].

SERVQUAL is a method that was first developed by Parasuraman, Zeithaml, and Berry in 1985. During development, renewal methods occurred from 1985 to 1994. This method is used to allow the airport operator to identify passengers' perceptions and expectations quickly against the services provided. Servqual also has benefits for analyzing the gap. The dimensions of service quality are being used as a measuring tool to assess a service, namely: 1. Reliability, 2. Responsiveness, 3. Assurance, 4. Empathy, and 5. Tangibles^[9,11,17]. Quality customer service entails positive perceptions, thereby increasing non-aeronautical revenues and reducing the percentage of aviation charges. The ASQ analysis can examine each part of the service process and the gaps between service performance and passenger satisfaction, which helps construct strategies for improvement and troubleshooting^[7].

In the case of departing passengers, process activities comprise the passenger flow from check-in, security screen-

ing, to boarding. Discretionary activities comprise what the passengers can do with their slack time in the terminal (i.e., those moments when they are moving between processing points) when they can shop, eat, rest, change money, or engage in any other activity provided by the airport^[1,6,11]. Concerning processing activities, passenger perception of quality has traditionally been associated with the efficiency of the processes, short waiting times, and the positive attitude of the service staff. As to discretionary activities, a variety of factors should be considered, including passenger perception of leisure/convenience alternatives and airport servicescape, i.e., the physical setting in which a service is performed, delivered, and consumed^[20].

Overall, it appears that there is a growing recognition of ASQ's multidimensionality. Indeed, some of the previously mentioned studies have emphasized passenger perception from a multidimensional perspective, and some factorial structures for measuring ASQ have been discussed. However, more research on the validity and reliability of service quality measurement in airport settings is required. The importance of such concerns in avoiding misinterpretation of passenger perceptions and guiding the use of surveys in the performance measurement process cannot be overstated. The remainder of this paper is organized as follows. Section 2 presents a comprehensive literature review of airport service quality research, tracing the evolution from SERVQUAL to specialized airport models. Section 3 details the methodology, including the theoretical framework of Yeh's satisfaction model, data collection procedures, and analytical techniques. Section 4 presents the empirical findings, including service quality rankings and dimensional analyses. Section 5 discusses the theoretical and practical implications of the findings, acknowledges research limitations, and suggests directions for future inquiry.

2. Theoretical Background

The measurement of airport service quality has emerged as a critical concern for airport managers and researchers alike, driven by the aviation industry's evolution from operational functionality toward customer-centric service delivery. Traditional approaches to service quality measurement, most notably the SERVQUAL model developed by Parasuraman, Zeithaml, and Berry (1985), have dominated

the services marketing literature. The SERVQUAL framework evaluates service quality by measuring the gap between customers' perceptions of actual service delivery and their prior expectations^[21]. While influential, this model presents inherent challenges when applied to airport contexts, particularly regarding the conceptualization and measurement of perceived quality^[1,7]. Alternative frameworks, such as Grönroos's (1984) Nordic model distinguishing technical and functional quality dimensions, have offered valuable perspectives but require adaptation to the unique characteristics of airport environments^[22]. The ServPerf model, which focuses on performance-only measurement, has also been proposed as a more parsimonious alternative to the gap-based SERVQUAL approach^[23,24].

In response to these methodological challenges, Yeh and Kuo (2003) developed a fuzzy multi-attribute evaluation model specifically designed for assessing passenger service quality at international airports^[8,15,16,18,25]. This innovative approach departed from conventional gap-based measurements by introducing the concept of the "degree of optimality" to evaluate service performance. The Yeh satisfaction model incorporates fuzzy assessment techniques to handle the inherent subjectivity and vagueness in passenger evaluations of qualitative service attributes, providing a more nuanced and operationally useful framework for airport service benchmarking^[25,26].

The Yeh model addresses several critical limitations of traditional approaches. First, it acknowledges that passenger perceptions of service quality are inherently fuzzy rather than crisp; passengers may experience varying degrees of satisfaction across different service touchpoints. Second, the model incorporates decision-makers' confidence levels and preferences into the evaluation process, allowing for context-specific adaptations^[8,15]. Third, it generates an overall service performance index that enables meaningful comparisons between airports, facilitating both competitive benchmarking and strategic service improvement initiatives^[12,16,20]. These characteristics make the Yeh satisfaction model particularly suitable for the complex, multi-stakeholder environment of international airports.

The application of fuzzy multi-attribute decision-making (MCDM) methods to airport service quality evaluation has gained increasing attention in the literature. Several studies have focused on the deterministic nature of multi-

criteria decision processes, while others have taken into account uncertainty and imprecise numeric values of decision data^[3,23,27]. For instance, fuzzy extensions of the ServPerf model combined with ELECTRE III have been employed to comparatively evaluate service quality at international airports, demonstrating the effectiveness of fuzzy approaches in handling passenger uncertainties^[8,27]. Similarly, fuzzy Importance-Performance Analysis (IPA) has been utilized to assess airport service quality from passenger perspectives, identifying critical service factors requiring management attention^[27]. The fuzzy concept has also been applied to measure the level of service at airport passenger terminals, addressing the vagueness inherent in service ratings such as "satisfied" and "unsatisfied"^[25,28,29].

Despite these advances, research specifically applying Yeh's satisfaction model has received limited attention in the broader airport service quality literature^[24]. Most contemporary research continues to employ conventional SERVQUAL-based instruments or ad hoc attribute lists, potentially overlooking the methodological advantages of fuzzy multi-attribute approaches. Furthermore, as noted by Park and Park (2018), the servicescape attributes of airport physical environments remain underexplored, and there exists limited coverage of how different airport users, air travelers versus service providers, perceive service quality dimensions^[1,29]. These gaps suggest significant opportunities for extending Yeh's methodological framework to address contemporary airport service quality challenges^[28].

Recent studies have further confirmed the multidimensional nature of airport service quality and the need for more comprehensive evaluation approaches^[30]. Systematic reviews have shown that no single measurement framework has gained universal acceptance and have called for the development of context-specific models that integrate passenger perceptions with operational realities^[3,6]. The growing use of online passenger reviews, predictive analytics, and advanced multicriteria decision-making techniques has enriched the understanding of passenger satisfaction, highlighting the importance of cleanliness, staff behavior, information provision, wayfinding, retail and food services, and digital connectivity^[31]. At the same time, recent research demonstrates that passenger evaluations are influenced by situational factors such as flight delays and emotional context, suggesting that flexible and nuanced approaches are

needed to capture the complexity of airport service experiences. These developments reinforce the relevance of Yeh's satisfaction model, whose fuzzy multi-attribute structure is particularly well suited to accommodating the uncertainty and subjectivity inherent in passenger assessments of airport service quality^[6,27,28].

This research paper aims to bridge these gaps by systematically examining the application of Yeh's satisfaction model for measuring airport service quality. Specifically, this study pursues the following objectives: (1) to explicate the theoretical foundations and methodological procedures of Yeh's fuzzy multi-attribute evaluation model, (2) to demonstrate the model's applicability to contemporary airport service quality assessment, and (3) to compare insights generated through this approach with findings from conventional service quality frameworks. By advancing the understanding of how fuzzy multi-attribute models can enhance airport service quality measurement, this research contributes to both academic knowledge and practical airport management.

3. Research Methodology

3.1. Study Area

Jinnah International Airport (KHI) is Pakistan's premier aviation facility and the busiest airport in the country, playing a central role in both domestic connectivity and international air travel. It is strategically located 14 km east of central Karachi. Karachi city is Pakistan's largest metropolitan and economic hub, which makes KHI a critical node for trade, tourism, and migration flows. Completed in 1992, the Jinnah Terminal complex serves as the primary gateway for both domestic and international flights, including Emirates, Qatar

Airways, and Turkish Airlines. It offers modern amenities, including lounges, dining, and duty-free shopping.

The airport traces its origins to the pre-independence period, when Karachi served as a key aviation stopover during British India. After the creation of Pakistan in 1947, it became the primary international gateway for the newly formed state. It was later renamed in honor of Muhammad Ali Jinnah.

A major transformation occurred in the early 1990s with the construction of the modern Jinnah Terminal Complex, replacing older infrastructure. This development significantly enhanced passenger handling capacity and introduced modern aviation facilities aligned with international standards.

The airport is operated by the Pakistan Civil Aviation Authority, which oversees airport management, air traffic control, and regulatory compliance. The authority ensures adherence to standards set by the International Civil Aviation Organization. The airport handles millions of passengers annually and also supports Hajj and Umrah traffic, which significantly increases seasonal passenger flow. **Figure 1** shows the front view of Jinnah International Airport.

3.2. Sample and Data Collection

Jinnah International Airport received almost 6,802,121 passengers each year before the pandemic. During the COVID-19 pandemic (especially 2020–2021), total annual passenger traffic dropped to 3,366,509 passengers^[32]. The authorities claimed that around 50% reduction was recorded during the pandemic. So, we calculated the number of passengers traveling each day through JIAP for the years 2019–2020 (amidst the COVID-19 pandemic), for which the population was rounded off to approximately 300 passengers each day.



Figure 1. Front View of Jinnah International Airport, Karachi.

To calculate its sample size, researchers have used Cochran's Formula. This formula is a widely accepted method for determining sample size in quantitative research^[16,33]. The formula incorporates key statistical parameters such as the confidence level (z), margin of error (e), and population proportion (p), which collectively help minimize sampling error and enhance the reliability of research findings^[34].

$$n = \frac{n_0}{1 + \frac{n_0 - 1}{N}} \quad (1)$$

Equation (1) given above is the formula for Cochran's formula suitable for calculating the sample size in the case of finite small populations. N is the population size. Symbol n_0 is the sample size that has been calculated for an infinite population by using the formula:

$$n_0 = \frac{z^2 pq}{e^2} \quad (2)$$

Researchers first calculated n_0 by using Equation (2), taking z as the critical value of the desired confidence interval.

The confidence interval (CI) is 95%, where the desired level of precision ϵ is taken as 50%. p is the estimated proportion of an attribute, which is usually taken as 50%, producing maximum results, and q is equal to $1 - p$. The z -value in this condition was calculated by using the Chi-square table and found to be 1.96. p (50%) is taken as $50/100 = 0.5$, while q is also taken as 0.5. The value of e at 5% is taken as 0.05. Putting all these values in Equation (2), n_0 was found to be 384.16.

Now, the final calculation was made by using Equation (1). Taking $N = 300$ and $n_0 = 384$, the final sample size was calculated as 169. That means 169 questionnaires were filled out in the study area. This sampling method also validates the use of De Morgan's Table.

This study also falls in the category of simulation approach, which involves the construction of an artificial environment within which relevant information and data can be generated. All the graphical data were generated in an artificial environment using SPSS and Microsoft Excel.

3.3. Model and Data Analysis

Tourist satisfaction is crucial in the sense that it affects expectations and intentions for the next destination purchasing decision. Thus, tourist destinations consider customer satisfaction as one of the most important sources of their

competitive advantage. In this research work, researchers used Yeh's satisfaction index model to analyze the satisfaction level of respondents regarding the facilities and services provided at Jinnah Intl' terminal by using the satisfaction index method given by Yeh with the help of a questionnaire within the study area.

One of the primary justifications for using Yeh's model lies in its comprehensive approach to service quality measurement and customer satisfaction. Unlike traditional models that focus on limited dimensions, Yeh's framework incorporates multiple factors such as check-in services, security procedures, terminal facilities, staff behavior, and overall passenger experience, ensuring a holistic evaluation^[28,35,36].

Yeh's model is particularly suitable for airport environments, where passenger experience is influenced by a sequence of service encounters. Airports are complex systems involving multiple stakeholders, and the model effectively captures this complexity by evaluating different service points across the passenger journey^[28].

The model is also justified due to its quantitative applicability. It allows researchers to use structured questionnaires and statistical techniques (e.g., regression analysis, factor analysis) to measure satisfaction levels, making it suitable for empirical research and large datasets^[25].

$$YSI = \frac{(Satisfied - Dissatisfied) \times 10}{Total\ respondents}$$

YSI = Yeh's Satisfaction Index.

Through this formula, researchers come to know about the satisfaction level of passengers regarding the facilities provided at Jinnah International Airport. The details of satisfaction and dissatisfaction are given in **Table 1**.

Table 1. Scale of satisfaction or dissatisfaction.

S. No.	Ratio/Percentage	Level of Satisfaction
1.	0	No satisfaction/dissatisfaction
2.	0.25 or 25%	Minimum satisfaction
3.	0.50 or 50%	Moderate satisfaction
4.	0.75 or 75%	Strong satisfaction
5.	≥ 0.90 or $\geq 90\%$	Highly strong satisfaction
6.	0	No satisfaction/dissatisfaction
7.	-0.25 or -25%	Minimum dissatisfaction
8.	-0.50 or -50%	Moderate dissatisfaction
9.	-0.75 or -75%	Strong dissatisfaction
10.	≥ -0.90 or $\geq -90\%$	Highly strong dissatisfaction

The research flow chart of this paper is based on the complete hierarchy of research that the researchers have followed (**Figure 2**):

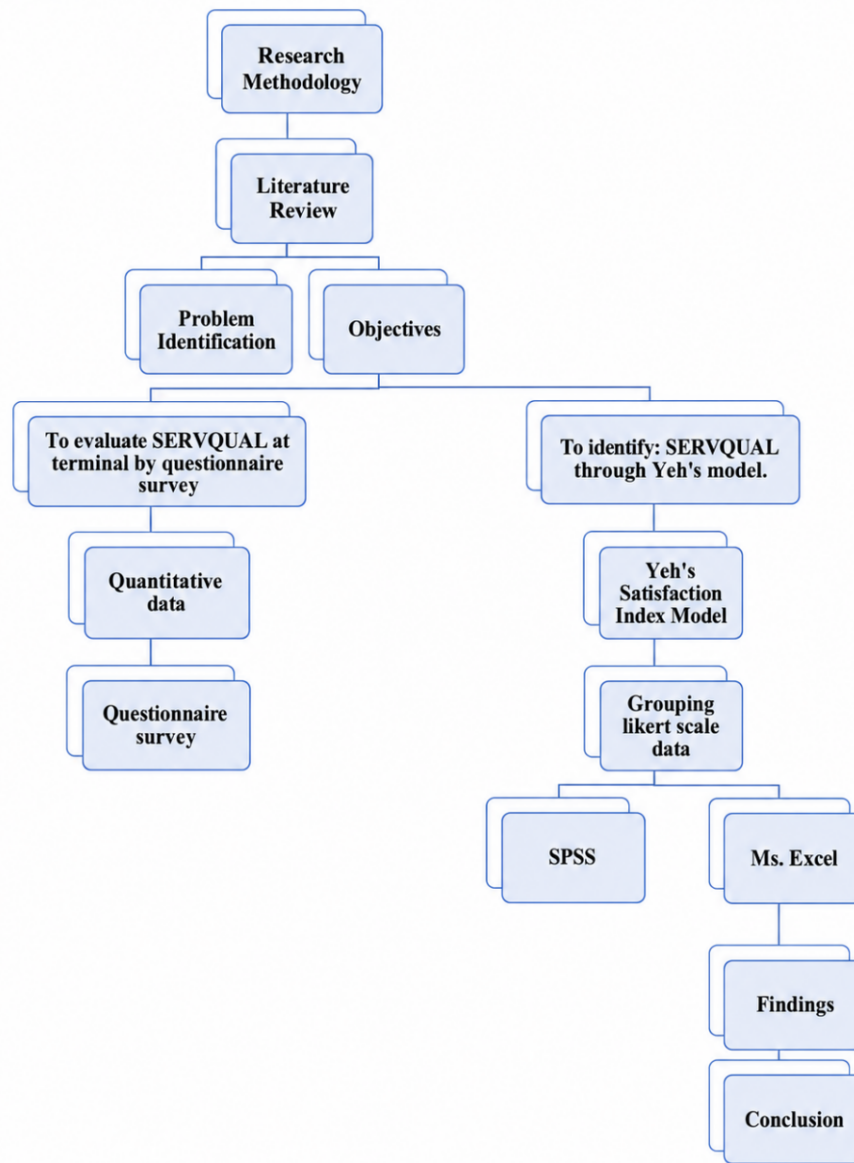


Figure 2. Flowchart of the Study.

4. Results and Discussion

A survey on “Measuring Airport Service Quality—A multi-dimensional approach at Jinnah International Airport” was done by site observation and by distributing questionnaires to passengers/consumers at Jinnah terminal, Karachi. On this site, the researchers investigated: what services and facilities are, and how these will be identified? How will the satisfaction level of passengers be analyzed? The evaluation of the availability of services and facilities at the Jinnah terminal was done through a questionnaire survey and SPSS and Microsoft Excel. The identification of the satisfaction level of passengers for the SERVQUAL at the terminal is

analyzed through Yeh’s satisfaction index method.

4.1. Results

Through Yeh’s satisfaction index model, it has been found that passengers are not enough satisfied or dissatisfied on the basis of positive and negative values and also on the variables statement either positive or negative of variables like: courtesy and helpfulness of the staff at check-in counters with a result of 20.71%, which shows no satisfaction; efficiency of the check-in staff with 16.56%, which shows no satisfaction; staff courtesy at security screening with the result of 40.82%, which shows no level of satisfaction; staff

courtesy at immigration and customs with 31.36%, which shows no level of satisfaction. However, the sections on airports' facilities, airports' ambiance, and airports' accessibility got negative responses like -1.77% (ATM availability), -18.34% (condition of restrooms), -12.42 (comfort), -2.36% (availability of info kiosks), -8.87% (condition of baggage trolleys), and -11.83% (Wi-Fi). Negative values indicate that people are dissatisfied with the above variables. Also, variables such as the availability of showers/hotels at the air-side area, cleanliness at the airport terminal, up-to-date ambiance of the airport terminal, variety of shops available

at the terminal for quick and reasonable shopping, availability of restaurants and eating facilities within the terminal, and the quality of food and beverages up to mark for the customers according to the price, have values of -15.97%, -7.10%, -7.69%, -0.59%, -14.20%, and -24.85%; these have negative values with positive impacts that could uplift the perception of passengers for Jinnah International Airport in a positive way and generate revenue. These negative values described that people are dissatisfied with the above variables but the dissatisfaction levels vary from 80% to 50%.

The details of all responses are shown in **Table 2**.

Table 2. Respondents' satisfaction and dissatisfaction.

No.	Variables	Satisfied		Dissatisfied	
		Response	%	Response	%
1.	Courtesy and helpfulness of the staff at check-in counters	85	50.3%	50	29.6%
2.	Efficiency of the check-in staff	83	49.1%	55	32%
3.	Staff courtesy at security screening	103	60.9%	34	20.2%
4.	Staff courtesy at immigration and customs	92	54.4%	39	23.1%
5.	Efficiency of boarding procedure	89	52.7%	44	26%
6.	Flights get delayed because of boarding queues due to the peak hours	40	23.7%	104	61.5%
7.	Baggage is safely secured	103	61%	38	22.5%
8.	Baggage is delivered safely	98	58%	39	23.1%
9.	Courtesy of staff at customs and quarantine	94	55.6%	33	19.5%
10.	Availability of ATMs and money changers	80	47.4%	83	48.2%
11.	Sanitary conditions of the restroom	64	37.9%	95	53.4%
12.	Comfort provided in the waiting area	63	37.3%	84	50.1%
13.	Availability of enough desks/kiosks information	65	38.4%	69	48%
14.	Availability and condition of baggage trolleys	76	45%	61	36.1%
15.	Availability and fast connection of internet or Wi-Fi	59	34.9%	79	46.7%
16.	Ease of connection among terminals	83	49.1%	44	26%
17.	Availability of shower/hotel in the air-side area	53	31.4%	80	47.3%
18.	Flight schedule boards updated according to the flight schedules	105	62.1%	22	13%
19.	Cleanliness at the airport terminal	64	37.9%	76	45%
20.	Ambiance of the airport terminal is up to date	62	36.7%	75	44.4%
21.	Variety of shops available at the terminal for quick and reasonable shopping	73	43.2%	74	43.7%
22.	Replacement of shops for multi-choices	108	63.9%	36	21.3%
23.	Availability of restaurants and eating facilities within the terminal	55	32.5%	79	46.7%
24.	Quality of food and beverages up to mark for the customers according to the price	48	28.4%	90	53.2%

A key finding of the study is that frontline staff performance and operational services are relatively strong. A majority of respondents expressed satisfaction with staff courtesy and helpfulness, particularly at security screening (60.9%), immigration and customs (54.4%), and check-in counters (around 50%). This indicates that human interaction and service delivery at critical touchpoints are positively perceived (see **Table 2** and **Figure 3**). According to Yeh's model, such service encounters play a central role in shaping overall passenger satisfaction, as they directly influence passengers' immediate experience^[18]. Similarly, efficiency in boarding procedures (52.7%) and check-in operations (49.1%) reflects acceptable operational perfor-

mance, although there remains room for improvement (see **Table 2** and **Figure 3**).

Another significant strength identified is related to baggage handling services, where a substantial proportion of respondents reported satisfaction with both baggage safety (61%) and delivery (58%). These results suggest that back-end operational systems are functioning efficiently, contributing positively to passengers' trust and perceived reliability of the airport services. In addition, flight information systems, particularly updated schedule boards (62.1%), received the highest satisfaction rating, indicating effective communication and information dissemination, which is a critical component of service quality.

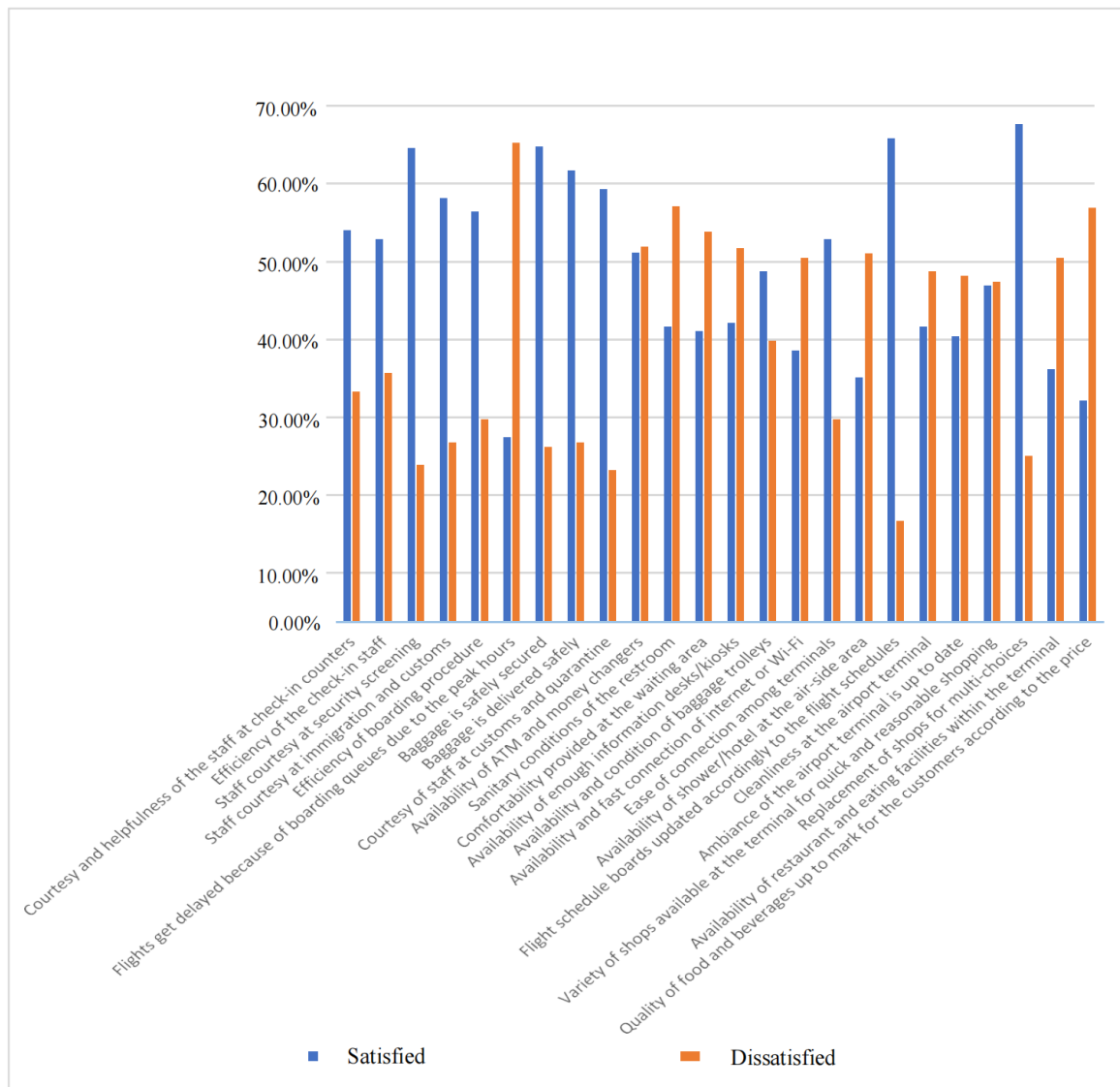


Figure 3. CSAT Chart for Jinnah International Airport, Karachi.

However, the findings also reveal serious deficiencies in infrastructure and passenger comfort facilities, which negatively impact overall satisfaction. A majority of respondents expressed dissatisfaction with sanitary conditions of restrooms (53.4%), comfort in waiting areas (50.1%), and cleanliness of the airport terminal (45%). These aspects fall under the “physical environment” dimension of service quality and are essential in shaping passengers’ overall impressions. The results suggest that while core operations are maintained, supporting facilities are not meeting passenger expectations.

A particularly critical issue highlighted in the findings is congestion and inefficiency during peak hours, with 61.5%

of respondents dissatisfied due to flight delays caused by boarding queues. This indicates shortcomings in passenger flow management and capacity handling, which are vital components of airport efficiency. Such operational bottlenecks can significantly reduce overall satisfaction despite good performance in other areas.

The study also identifies gaps in value-added services, particularly in commercial and hospitality facilities. High levels of dissatisfaction were observed in availability of restaurants (46.7%), quality of food and beverages (53.2%), and Wi-Fi connectivity (46.7%). These findings suggest that the airport is underperforming in providing modern passenger amenities that are increasingly expected in international

airports. Similarly, dissatisfaction regarding availability of ATMs and money changers (48.2%) and information desks (48%) indicates inconsistencies in essential support services.

Interestingly, the results show a mixed perception of commercial services, where a variety of shops received nearly equal levels of satisfaction (43.2%) and dissatisfaction (43.7%), suggesting that retail offerings are present but may not fully meet passenger expectations in terms of diversity or pricing. On the other hand, the replacement and availability of shops for multiple choices (63.9%) indicate some positive developments in commercial infrastructure.

Furthermore, connectivity-related services, such as ease of movement among terminals (49.1% satisfied), demonstrate moderate performance, suggesting that while basic connectivity exists, it may not be fully efficient or user-friendly for all passengers. Similarly, dissatisfaction with the availability of showers or hotel facilities at the airside (47.3%) reflects a lack of premium or transit-oriented services, which are important for international travelers.

4.2. Discussion

The findings of this study, conducted at Jinnah International Airport using Yeh's Satisfaction Model, reveal patterns that are largely consistent with existing literature on airport service quality and passenger satisfaction.

The results indicate that staff courtesy, efficiency, and baggage handling services are among the most satisfactory aspects of airport performance. High satisfaction levels in these dimensions suggest that interpersonal service quality and operational reliability significantly influence passenger perceptions. This finding aligns with the SERVQUAL framework proposed by Parasuraman et al. (1985)^[21], which emphasizes that responsiveness, assurance, and reliability are key determinants of customer satisfaction. Similarly, Yeh et al. (2011)^[28] argue that service encounters at critical touchpoints such as check-in, security, and boarding play a vital role in shaping the overall passenger experience.

In contrast, the study highlights considerable dissatisfaction with physical infrastructure and passenger amenities, including restroom cleanliness, waiting area comfort, and terminal environment. These findings are consistent with Chen (2008)^[36], who found that tangible elements of service quality, such as physical facilities and environmental conditions, significantly affect passenger satisfaction in air transport.

The results also support the argument that the servicescape, or physical environment, is a critical dimension of service quality in airport settings, according to Bitner (1992)^[5].

Another important finding is the dissatisfaction related to boarding delays and congestion during peak hours, which reflects inefficiencies in passenger flow management. This is in line with the observations of the International Civil Aviation Organization (2021)^[32], which highlights that operational delays and congestion are major factors negatively affecting passenger satisfaction globally. Efficient management of peak-hour traffic is therefore essential to maintaining service quality standards.

Furthermore, the study identifies gaps in value-added services, particularly in areas such as food quality, Wi-Fi connectivity, and availability of restaurants. These findings support previous research indicating that non-core services and amenities significantly contribute to the overall passenger experience and airport competitiveness presented by Chen^[36] and Yeh et al.^[28]. The dissatisfaction observed in these areas suggests that while core services are functioning adequately, the airport is not fully meeting modern passenger expectations.

The mixed responses regarding commercial services and retail variety further indicate that passenger satisfaction is influenced not only by availability but also by the quality, diversity, and pricing of services. According to Yeh and Kuo (2003)^[25], passenger satisfaction is a cumulative outcome of multiple service dimensions, and deficiencies in any one dimension can negatively impact overall perception.

Overall, the findings reinforce the multidimensional nature of airport service quality, as emphasized in Yeh's Satisfaction Model. The study confirms that both functional efficiency (e.g., staff performance, baggage handling) and experiential factors (e.g., comfort, cleanliness, amenities) must be addressed simultaneously to achieve higher levels of passenger satisfaction. This is consistent with broader service quality literature, which highlights the need for a balanced approach to service delivery^[9,11].

5. Conclusions

The study concludes that airport service quality at Jinnah International Airport presents a dual performance pattern, where operational efficiency and staff-related services are

relatively strong, while infrastructure and passenger comfort facilities remain inadequate. The application of Yeh's Satisfaction Model demonstrates that passenger satisfaction is influenced by both functional and experiential dimensions of service quality.

High satisfaction levels in staff courtesy, baggage handling, and flight information systems indicate that the airport is effective at managing core service operations. However, the presence of high dissatisfaction in areas such as cleanliness, waiting area comfort, food services, and internet connectivity highlights critical gaps in service delivery. Furthermore, issues related to congestion and boarding delays during peak hours reflect inefficiencies in capacity management and passenger flow.

The study emphasizes that improving only operational efficiency is not sufficient to achieve high levels of passenger satisfaction. Instead, a holistic approach focusing on infrastructure development, enhanced passenger amenities, and service innovation is required. Addressing these issues will not only improve passenger experience but also strengthen the airport's competitiveness at regional and international levels.

This research is limited to a single case study of Jinnah International Airport, which may restrict the generalizability of the findings to other airports with different operational contexts. Secondly, the study relies on self-reported data collected through questionnaires, which may be subject to respondent bias and personal perceptions.

Another limitation is the lack of longitudinal data, as the study captures passenger satisfaction at a specific point in time rather than over an extended period. This restricts the ability to analyze trends or changes in service quality. Additionally, some variables, such as domestic and international passenger differences or class-based experiences, were not separately analyzed, which could provide deeper insights.

Finally, the application of Yeh's Satisfaction Model, while comprehensive, may not capture all emerging aspects of modern airport services, such as digitalization, smart technologies, and post-pandemic health and safety measures.

Author Contributions

Conceptualization, M.Z. and S.K.; methodology, M.Z. and S.K.; software, M.Y.M.; validation, M.Y.M. and

U.A.; formal analysis, M.Z.; investigation, S.K.; resources, M.Y.M.; data curation, U.A.; writing—original draft preparation, M.Z.; writing—review and editing, S.K.; visualization, M.Z.; supervision, S.K.; project administration, M.Y.M. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki, and approved by the Department of City and Regional Planning Research & Ethics Committee of Mehran University of Engineering and Technology, Jamshoro, Pakistan (protocol code 04318 on 14/04/2021).

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

All data generated or analyzed during this study are included in this article.

Conflicts of Interest

The authors declare no conflict of interest.

AI Use Statement

During the preparation of this work, the authors used the Consensus app for literature search purposes. The authors subsequently reviewed and edited the content as necessary and take full responsibility for the final content of the published article.

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