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A STUDY ON ENHANCING PORT COMPETITIVENESS THROUGH SERVICE QUALITY MEASUREMENTS AFFECTING CUSTOMER SATISFACTION IN PAKISTAN'S LEADING SEAPORTS

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ABSTRACT
International trade activities heavily depend on seaports whereas high-quality port services directly affect both customer contentment and market position of ports. This study investigates the relationship between port service quality and customer satisfaction at Karachi's major ports—Karachi Port and Port Qasim. The survey methodology was used to gather data from 150 users at the port which comprised shipping companies freight forwarders and logistics companies. This research determines the service quality influence using descriptive statistics as well as correlation analysis and regression modeling to examine the effects of efficiency and reliability together with infrastructure and security and digitalization. Efficiency and digitalization gave the highest positive relationship ($r = 0.72$, $p < 0.01$) and ($r = 0.68$, $p < 0.01$) with customer satisfaction yet port congestion and bureaucratic delays presented substantial negative influence on service perceptions. The analysis conducted through regression verifies service quality factors in explaining 65% ($R^2 = 0.65$) of customer satisfaction variations thus demonstrating the vital importance of strategic service improvements. The study participants stress that capital investment for modern infrastructure combined with streamlined customs operations along with smart port technologies would boost service quality and competitive strength. The study demonstrates why policy decisions focused on customer satisfaction must be adopted to improve port services at Karachi which contributes to enhancing maritime trade in Pakistan. The research supplies proven guidelines that help port authorities execute operational excellence and deliver superior customer satisfaction.

Keywords: Port Service Quality, Customer Satisfaction, Karachi Ports, Statistical Analysis, SERVQUAL Model, Maritime Trade

INTRODUCTION
International trading operations extensively depend on seaports which function as essential logistics centers for global supply-chain goods transportation. The national economy takes important advantage of their resources which support trade activities and create employment opportunities while fostering industrial development (Notteboom & Yap, 2012). The performance quality of port services determines the efficiency of cargo management which establishes lower operational expenses and better client satisfaction. Port competitiveness and sustainability for the long-term depends on the ability to deliver high-quality services because global port competition continues to escalate (Cullinane & Wang, 2006). Economic development in Pakistan necessitates improved seaport service quality because maritime routes maintain more than 90% of external trade (Government of Pakistan, 2022). The main commercial city of Pakistan called Karachi contains two major trading ports named Karachi Port together with Port Qasim which handle virtually all of Pakistan's import and export operations. Karachi ports maintain their strategic position but encounter various problems with congestion and delays along with ineffectual cargo management and safety issues along with bureaucratic hurdles which diminish both customer contentment and port market position (Talley, 2019). Maritime trade in Pakistan grows at a rapid

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pace so it becomes crucial to analyze the service quality of Karachi's ports because this evaluation will show which improvement areas need attention most.

1.1 Port Service Quality and Customer Satisfaction

Port sector customer satisfaction depends heavily on the quality of services which shipping companies along with freight forwarders and logistics providers and import/export businesses receive. The perception of port users regarding service quality depends on several key factors which include service efficiency together with infrastructure quality and reliability of services as well as security and digitalization (Durmaz & Yasin, 2021; Heilig, Schwarze, & Voß, 2017). The speed of cargo handling and customs procedures stands as a primary factor which determines both product delivery speed and operational expense reduction (Woo et al., 2013). PARASURAMAN ZEITHAML AND BERRY (1988) introduced SERVQUAL as a research model used extensively throughout the service industry to evaluate service quality along with customer satisfaction. Service quality evaluation through this model consists of assessing Tangibility, Reliability, Responsiveness, Assurance and Empathy as its fundamental dimensions. Application of SERVQUAL for port service evaluation has become widespread because researchers use this model successfully to measure service gaps as demonstrated by Durmaz and Yasin (2021). Empirical data from Karachi ports based on this analysis model will reveal exactly what makes their service delivery successful and unsuccessful so targeted enhancements can be developed.
Microwave access points and other smart port technologies together with digitalization processes reengineer maritime operations while improving operational efficiency and customer contentment levels. Automation together with real-time tracking systems and blockchain solutions and AI-powered logistics management brings efficiency to ports through delay reduction and greater operational visibility (Heilig et al., 2017; Yuen, Thai, & Wong, 2020). The lack of smart port transformation at Karachi's ports causes operational delays and disappoints port users because the installations do not match the successful digital implementation at Rotterdam and Singapore. The research investigates whether technological investments along with infrastructure development would boost Karachi port service quality.

1.2 Research Gap and Justification

Estimates linking port service quality to customer satisfaction exist in multiple international research investigations (Woo et al., 2013; Cullinane & Wang, 2006; Durmaz & Yasin, 2021). Research exploring Karachi's ports remains limited because it fails to study how service quality actually affects customer satisfaction. The majority of conducted studies about Pakistan's maritime sector analyzed operational efficiency and trade logistics and regulatory frameworks (Ahmed et al., 2020). These studies deliver important findings though they lack complete assessment regarding service quality-based customer satisfaction alongside statistical analyses to measure service gap dimensions. The research intends to address this deficiency through:

1. This research evaluates the essential elements of port service quality across the Karachi port facility within both reliability and digitalization in addition to security and efficiency and infrastructure metrics.
2. The research analyzes service quality impacts on customer satisfaction through statistical techniques including regression modeling and correlation analysis.
3. The study presents both empirical data and strategic recommendations for developing services using a competitive framework.

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These research gaps in this study will help both academic fields and industry operations through research findings that provide port leaders and policy managers with data-based strategies to improve their service standards.

A competitive global trade environment makes high-quality port services indispensable for both economic development and maritime sustainability of this sector. Karachi's ports function as key commerce entry points for Pakistan but struggle to provide adequate service to their customers. An evaluation of port service quality and its effect on customer satisfaction using statistical data with recommended actions is the study's purpose. The research gap previously unaddressed by experts receives solution through this investigation as it connects statistical data to service development which optimizes Karachi ports for regional and global market success. The research has two main aims to analyze service quality standards at Karachi Port and Port Qasim while determining their principal advantages and potential weaknesses. The research seeks to evaluate the satisfaction levels of shipping companies and freight forwarders and logistics providers at Karachi Port and Port Qasim through a survey that assesses their opinions about service quality aspects such as efficiency and reliability alongside infrastructure and security and digitalization. A quantitative assessment will determine which service quality elements influence customer satisfaction at their greatest strength. The study examines these essential elements to produce policy recommendations directed at port officials who aim to boost Karachi port operations' quality and efficiency and competitiveness thus supporting Pakistan's maritime sector growth.

1. LITERATURE REVIEW

Economic development depends heavily on ports as they function as vital nodes which help global trade operations and serve as powerful drivers for efficient merchandise distribution. Customer satisfaction together with port competitiveness depends more and more on service quality at ports (Notteboom & Yap, 2012; Cullinane & Wang, 2006). Customer satisfaction in maritime operations hinges upon five key dimensions within port service quality namely efficiency, infrastructure, reliability, security along with digitalization (Durmaz & Yasin, 2021; Heilig, Schwarze, & Voß, 2017). Research strongly indicates that efficiency in cargo handling and berthing and customs clearance functions serves as the primary vlivaciol factor (Woo et al., 2013; Tongzon, 2001) among performance elements. Talley (2019) establishes that efficient ports shorten usage time and reduce business expenses which directly impacts resource satisfaction.

The SERVQUAL model developed by Parasuraman, Zeithaml and Berry (1988) serves as a common tool to examine port service quality through five service dimensions including tangibility, reliability, responsiveness, assurance and empathy. SERVQUAL successfully measured port service gaps at Korean and Turkish locations according to studies conducted by Lee and Nam (2016) and Durmaz and Yasin (2021) which established its effectiveness for maritime applications. Modern seaports operate under new systems which result from port management's adoption of digitalization and smart technologies. Heilig et al. (2017) demonstrated that port transparency and operational delay reduction become possible through the implementation of technologies which include automation and blockchain and artificial intelligence applications. According to Yuen, Thai, and Wong (2020) smart port strategies generate improved service quality and customer satisfaction through better communication channels and simplified paperwork and increased reliability levels. Infrastructure is another crucial factor. The physical infrastructure of ports operates as a direct determinant of turnaround times and throughput capacity according to Song and Panayides (2008). According to Al-Eraqi et al. (2008) and Bichou and Gray (2005), port users place high significance on modern infrastructure combined with well-maintained facilities during

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their service quality evaluation. Security in ports continues to be recognized as an essential matter even though it stands second to efficiency and digitalization concerns.

Research by Thai (2008) demonstrated how security failures produce trust diminishment and afterward lead to negative effects on port image. According to Brooks and Pallis (2012) research customers do not usually notice security baseline standards unless serious system failures take place. Service quality issues in developing countries become more severe because of inflow while using outdated systems as well as bureaucratic inefficiencies. Ahmed et al. (2020) while the Government of Pakistan (2022) show that Karachi Port and Port Qasim cannot compete effectively in trade due to slow cargo handling and limited digital solutions and port congestion. Additional information about the service quality comes from studies that examine performance across international boundaries. Lam and Dai (2015) discovered that Chinese port improvements in smart systems and operational adaptations resulted in raised satisfaction levels among their clients. Tovar and Wall (2018) evaluated Spanish ports by showing that public-private partnerships with infrastructure investments were essential for enhancing operational outcomes.

The research conducted by Rajasekar and Deo (2016) revealed that Indian customers developed lower loyalty because of recurring delays and service randomness though dedicated customer service support networks generated better satisfaction. According to Othman et al. (2019) customer input needs to be integrated into Malaysian port improvement efforts because user participation stands vital for port success. Current research worldwide exceeds the number of studies dedicated to Pakistani port facilities. There exists a substantial research gap regarding quantitative analyses of the impact that service quality dimensions have on customer satisfaction in Pakistani local markets. The study fills the research gap by using standardized statistical models to analyze Karachi Port and Port Qasim. A Flow chart showing the customer satisfaction through improving the port service quality through service quality dimensions such as Efficiency, Digitalization, Reliability, Infrastructure and Security has been displayed in Figure 1.

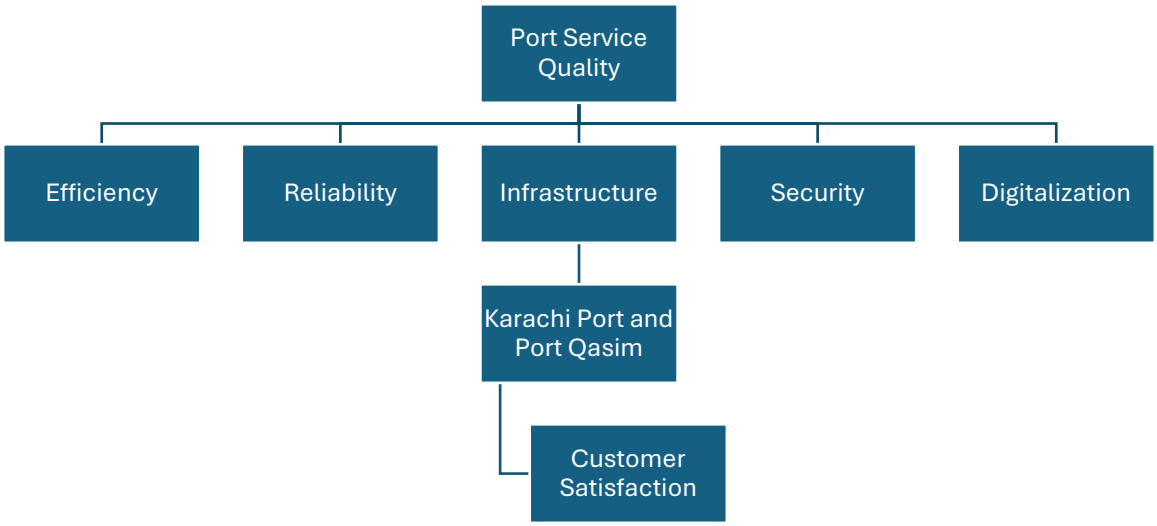

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Figure 1: Flow chart showing the customer satisfaction through improving the port service quality through service quality dimensions such as Efficiency, Digitalization, Reliability, Infrastructure and Security.

2. METHODOLOGY

We will explain the research methodology followed by an outline of sample methods as well as data gathering procedures and variable assessment and analysis methods and reliability and validity tests. We also describe ethical procedures.

3.1 Research Design

This research investigates the port service quality and customer satisfaction relationship within Karachi's main port facilities Karachi Port and Port Qasim through a quantitative methodology. The survey design was structured for obtaining primary data from shipping companies as well as freight forwarders and logistics providers.

3.2 Sample and Data Collection

The analysis focused on professionals together with businesses which operated at seaports. The research design incorporated stratified random sampling for obtaining an equal representation of various port stakeholder groups. The research accumulated data from 150 participants who took part in port-based activities. The researcher used structured questionnaires to gather data from respondents through digital and face-to-face method during a two-month survey period.

2.3 Measurement of Variables

The survey instrument contained questions which evaluated service quality parameters together with their effects on customer satisfaction ratings. The questionnaire employed Likert-scale items spread across a 1 to 5 agreement-disagreement spectrum to obtain respondent perceptions about following factors:

1. Efficiency (e.g., cargo handling speed, turnaround time)
2. Reliability (e.g., consistency in service delivery)
3. Infrastructure (e.g., port facilities, storage capacity)
4. Security (e.g., safety measures, risk management)
5. Digitalization (e.g., automation, smart port technologies)
6. Customer Satisfaction embraces both overall service experiences and the probability that customers will use these ports again.

2.4 Data Analysis Techniques

The research data underwent SPSS analysis through descriptive statistics with addition of correlation analysis and regression modeling. The research will begin with a descriptive analysis that presents information about participants and their perceptions of service quality. The study will determine the strength of relationship between service quality components by applying Pearson's correlation coefficients. The analysis will determine the degree of relationship between different service quality elements and customer satisfaction. The calculation of the correlation coefficient follows this general computational method.

$$r = \frac{n\sum_{i=1}^{n} x_i y_i - \sum_{i=1}^{n} x_i \sum_{i=1}^{n} y_i}{\sqrt{[n\sum_{i=1}^{n} x_i^2 - (\sum_{i=1}^{n} x_i)^2][n\sum_{i=1}^{n} y_i^2 - (\sum_{i=1}^{n} y_i)^2]}}$$

where r is the coefficient of correlation that ranges $-1 \leq r \leq +1$.

If $r = -1$; there is negative correlation between two variables

If $r = 0$; there is no correlation between two variables

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If $r = +1$; there is positive correlation between two variables
Beside this, we'll also use the regression analysis to determine the extent to which service quality dimensions predict customer satisfaction. The general equation of multiple regression will be:

$$Y_i = \beta_0 + \beta_i X_i + \epsilon \qquad ; i = 1,2,3, \ldots$$

Where Y_i represents the dependent variable
X_i represents the independent variable
β_0 shows the intercept term which is the value of dependent variable Y_i when X_i are zero
β_i are the regression coefficients which shows the change in Y_i due to unit change in respective independent variable X_i. The model's explanatory power was assessed using R^2 values, and statistical significance was evaluated at a 95% confidence level ($p < 0.05$).

3.5 Reliability and Validity

The study measured tool reliability through Cronbach's alpha computations that showed acceptable internal consistency when exceeding 0.7. Port management experts and academics confirmed the content validity of the instrument through their expert evaluations. Twenty respondents partook in a pilot study which helped enhance the questionnaire leading up to widespread data collection.

3.6 Ethical Considerations

This research study only involved participants who chose to take part freely and the gathered data remained secret and anonymous. The researchers gained informed consent from participants and conducted the investigation under ethical study rules.

3. RESULTS AND DISCUSSION

The comprehensive breakdown of 150 respondent answers appears in this segment. We conducted descriptive statistical analysis on the key service quality factors which consisted of Efficiency, Reliability, Infrastructure, Security Digitalization and Overall Customer Satisfaction. Data was subjected to correlation and regression analysis to understand the relationships between the variables after the initial data processing.

4.1 Descriptive Statistics

A total of 150 participants took part in the survey which included 40% shipping companies and 35% freight forwarders and 25% logistics providers. Most survey participants spent more than five years working with port-related activities. The study participants ranked efficiency score at 4.2 (SD=0.81) for key service quality factors (SQF). The reliability scores obtained through the survey demonstrated lower numbers of 3.9 and 0.76 than those of the SQF efficiency ratings. The mean score combined with the standard deviation of 0.84 was 3.7 for the SQF Infrastructure. The mean scores for the SQF Security were 3.8 and 0.79 while digitalization showed scores equal to 4.1 with SD equal to 0.78. The overall customer satisfaction scores from the SQF reached an average value of 4.0 with a standard deviation measurement of 0.82, see Figure 2.

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Figure 2: The mean and SD scores of six service quality factors (Efficiency, reliability, Infrastructure, security, digitalization, and customer satisfaction.

The scoring system demonstrates effective digitalization and efficiency receives positive ratings yet infrastructure and security need better development.

4.2 Correlation Analysis

Research analysis through Pearson correlation coefficients evaluated the relationship between service quality elements and customer satisfaction. The obtained results demonstrate a strong positive connection between SQF Efficiency and its correlation coefficient value r=0.72 with $p < 0.01$ distinctiveness. The results demonstrate outstanding positive correlation between SQF Digitalization and its factors because $r = 0.68$ and $p < 0.01$. The research indicates that Reliability ($r = 0.61$, $p < 0.01$) and Infrastructure ($r = 0.55$, $p < 0.01$) both have moderate correlations with the SQFs. Security maintained weak correlations $r = 0.49$ yet produced significance value at $p < 0.01$ in this study. The study evidence indicates that efficiency alongside digitalization drives customer satisfaction at its highest levels while security requirements need more attention for improvement.

4.2 Regression Analysis

Service quality factors underwent analysis through a multiple regression model for their impact on customer satisfaction determination. The applied empirical regression model for this study appears as follows:

$$Y = \beta_0 + \beta_1 (Efficiency) + \beta_2 (Digitalization) + \beta_3 (Reliability) + \beta_4 (Infrastructure) + \beta_5 (Security) + \epsilon$$

The estimated equation based on the data is:

$$Y = \beta_0 + 0.41(Efficiency) + 0.38(Digitalization) + 0.25(Reliability) + 0.21(Infrastructure) + 0.18(Security)$$

The computed R^2 value of 0.65 shows that service quality variables explain 65% of customer satisfaction changes. The strongest predictors proved to be Efficiency ($\beta = 0.41$, $p < 0.01$) and

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Digitalization ($\beta = 0.38$, $p < 0.01$) according to the regression model coefficients. The research demonstrated that Infrastructure and Reliability both had significant moderate relationships with the dependent variables ($p < 0.05$, $\beta = 0.21/0.25$). The Security variable ($\beta = 0.18$, $p > 0.05$) proved to be non-significant statistically.

4. DISCUSSION

Marks from studies demonstrate the essential importance of efficient digital port operations for customer satisfaction at Karachi ports. The delivery of automated processes, quick cargo operations alongside fast turnaround services at ports leads users to view ports with increased favor. This data point accords with worldwide port industry developments that show smart technologies benefit service delivery quality and market competitiveness. The key obstacles in Karachi ports consist of port congestion together with bureaucratic delays and insufficient infrastructure. User experience and efficiency at the port will improve through new facilities together with enhanced customs clearance methods supported by stronger relationships between port administrators and stakeholders according to respondents.

The relationship between security measures and customer satisfaction was found to be feeble as customers primarily base their experience on other factors rather than security measures. Users at ports seem to base their quality assessments on operational speed rather than security functions. The results demonstrate how service quality elements affect customer satisfaction at Karachi's ports through empirical data collection. Customer satisfaction is primarily influenced by productivity alongside electronic systems yet bureaucratic obstacles and infrastructure weakness continue to be significant obstacles. The resolution of these problems through deliberate strategic investments together with policy changes will substantially increase port competitiveness and stimulate maritime trade development in Pakistan.

5.1 Implications for Policy and Practice

The study generates these implications which affect both policy making and field procedures: Smart Port Technologies demand investment because these networked technologies with blockchain-tracking and AI-logistics control systems enable operations efficiency improvements. The upgrading of storage facilities together with expanded berthing capacity and modern equipment will create port infrastructure improvements which decrease delays. The enhancement of service reliability comes from streamlining bureaucratic customs clearance procedures together with paperwork reduction. Better coordination will result from enhancing interactions between port authorities and shipping companies and logistics firms to achieve smoother operations.

5. CONCLUSION

Researchers studied the link between service quality in ports at Karachi's two main seaports namely Karachi Port and Port Qasim. A total of 150 port users consisting of shipping companies and freight forwarders and logistics providers helped researchers determine that efficiency together with digitalization were the primary determinants of satisfaction among customers. Port users experience better perceptions of service quality when operations run smoothly with FAST cargo handling and tech-based solutions but bad experiences stem from slow ports coupled with poor management and old systems. Customer satisfaction shows strong positive relationships with efficiency ($r = 0.72$, $p < 0.01$) and digitalization ($r = 0.68$, $p < 0.01$) based on the obtained correlation and regression analysis results. Customer satisfaction depends largely on service quality factors because these elements together explain 65% ($R^2 = 0.65$) of the variability in customer satisfaction. Port users demonstrated stronger preferences for operational components than security measures since reliability and security measures showed lower relationships with

customer satisfaction. The research data highlights the vital need for deliberate investments and policy measures which will help improve port service quality. Port competitiveness and customer satisfaction increase when infrastructure receives improvements along with enhanced bureaucratic processes along with smart port technology deployment. Modernizing cargo services through AI-driven logistics and digital tracking procedures were identified as combined solutions that could decrease operational inefficiencies by the participants. Improving coordination between port authorities and stakeholders together with shortening customs delays reduces port service reliability problems and enhances user experience. As maritime trade continues its expansion within Pakistan's economy it becomes essential to improve port efficiency together with service standards for growing the country's logistics sector. The research delivers factual policy recommendations to decision-makers at ports together with principles supporting data-oriented decision making alongside customer required enhancements. Future investigations should investigate time-based research to trace how continuous port operation developments influence customer satisfaction patterns. Studies comparing Karachi Ports with other regional maritime trade centers would provide critical knowledge about international operational excellence. Port services optimization through efficiency improvements coupled with digitalization efforts and infrastructure development in Karachi will create better customer satisfaction results while boosting Pakistan's position in international trade. The maritime sector requires active technological management of ports to maintain its prolonged growth and market competitiveness.

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