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Quantifying service quality in a logistics enterprise using servqual approach

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A b s t r a c t

Customer satisfaction is considered the key principle of service quality. This study aims to measure customer satisfaction at a logistics firm using the Servqual method. A mixed-methods approach was employed in the research. The research was based on a descriptive qualitative approach. The study began by designing a questionnaire based on five dimensions: tangibles (five attributes), reliability (four attributes), responsiveness (four attributes), assurance (four attributes), and empathy (four attributes). Then, it was distributed to participants. The final ninety-seven filled questionnaires were collected. The qualitative stages involved validity testing using Pearson's Correlation, reliability testing using Cronbach's Alpha, and measuring importance, perception, and expectations. The research findings showed that the most important factor for customers was employees' skills and competencies. This research finding also highlights that 21 attributes have negative scores, reflecting the gap between perception and expectation. The importance analysis score indicates that the most important attribute for customers is the outstanding staff category. The two attributes with the most critical weaknesses in service quality and the most extensive gaps are responsiveness and tangibles. A Pareto result yielding three critical attributes needs improvement scenarios. The recommendations include strengthening complaint-handling procedures, improving staff responsiveness through training and performance monitoring, and expanding parking capacity.

Introduction

The growth of online shopping in Indonesia has accelerated in line with rising demand for logistics services. Recent developments in goods delivery require fast, secure services to ensure parcels arrive at their destinations on time. As a prominent courier service provider, Firm D plays a significant role in Indonesia's e-commerce development. Meanwhile, several logistics enterprises, including Firm D, have experienced significant growth, resulting in competition for market share. Empirical evidence shows that the core principle of sustainable business is customer service, which can be measured through customer satisfaction (Novadi & Mahbubah, 2021; Siagian & Wijoyo, 2021). Customers who have experienced high levels of service satisfaction have reported positive outcomes, such as repurchases, loyalty, and positive word-of-mouth (Ashiq & Hussain, 2024). Therefore, each business needs a robust strategy to deliver effective service and ensure customer satisfaction. Business economic sustainability depends on the enterprise's ability to build strong relationships with its customers.

Enterprises seeking a competitive edge must deliver services that meet customer expectations. Empirical evidence shows a positive correlation among service quality, customer satisfaction, and company profitability (Dimyati & Afandi, 2018; Sasongko et al., 2026). In contrast, Customer dissatisfaction creates a negative image, resulting in lost opportunities to acquire both regular and prospective customers.

Firm D has established a standardized operating procedure for inbound and outbound logistics business activities. In addition, Firm D also has a policy and standard operating procedure for managing customer dissatisfaction. The management has a policy for categorizing customer dissatisfaction cases into three groups: minor, moderate, and advanced. Based on regular assessments, findings from minor cases include the absence of queue numbers, an invisible banner, difficulties for first-time customers, and difficulty contacting officers by telephone. The moderate cases classification, such as many customers arriving at that break time, leads to a long waiting queue. Further moderate cases included goods not received due to courier issues, such as incomplete addresses, unreachable customer phone numbers, and

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delayed pickups. The advanced complaint cases include serious issues such as errors in the name and destination address, damaged or broken items, failed delivery of guaranteed next-day packages, items delivered not as expected, items lost or damaged during delivery, and items exchanged.

Theoretical evidence on service quality has been developed through case studies in both manufacturing and service enterprises at various scales, from small and medium enterprises to multinational corporations (Rani & Kaur, 2025). One of the most practical and widely used customer satisfaction theories is the Servqual theory, developed five decades ago and still relevant as a service quality dimension tool to date. (Parasuraman, Berry L, et al., 1988; Siyum, 2024). The SERVQUAL approach is not just a theoretical concept but a practical tool for identifying attributes and measuring the relationship between consumer expectations and perceptions of the service they receive as customers (Parasuraman, Zaithaml, et al., 1988; Siyum, 2024).

Empirical studies show that retaining and satisfying current customers is more effective than continuously prospecting for new ones, as it leverages the cumulative value of ongoing relationships (Rachmawati, 2020). Efforts to retain regular customers over the long term can foster loyalty and steady growth. Customer loyalty, as expressed through customer-led leads, drives positive word of mouth and serves as free advertising to reach extended family members and friends, who are more influential than traditional advertising (Al-Balas et al., 2025). This approach underscores the economic benefits of customer retention and the importance of maintaining high customer satisfaction levels.

In addition, customer satisfaction is determined not only by internal factors but also by external ones. Maintaining customer satisfaction is emphasized not only by private companies but also by government institutions across various countries, particularly in public service satisfaction (Al-Balas et al., 2025; Kheddache & Djadli, 2025b; Siyum, 2024). Government offices in transportation and public health are also implementing innovations and improvements to elevate service excellence, thereby improving the image of public services and enhancing their effectiveness across various countries (Siyum, 2024).

In line with the aforementioned findings, empirical research also distinguished that there are multi-dimensional models and variables to measure service quality and customer satisfaction, which are not only used in the national context but are also spreading worldwide, such as in Jordan, Pakistan, Ethiopia, and Iran (Al-Balas et al., 2025; Ashiq & Hussain, 2024; Rahimi et al., 2025; Siyum, 2024). While it is empirically proven that variables such as human resources, capital, machinery, methods, and the external environment are positively associated with service quality, a gap remains: service quality can be determined by assessing customer satisfaction through perceptions and expectations.

Furthermore, case studies using service quality theory have been conducted in several industries, varying from healthcare, telecommunications, logistics, hospitality, and e-commerce, as well as government sectors, due to the adaptability of the Servqual tool to measure service quality in various industries (Al-Balas et al., 2025; Cai et al., 2025; Kheddache & Djadli, 2025b). The Servqual method measures service quality based on the attributes of each dimension, yielding a gap score that represents the difference between consumers' perceptions of the service received and their expectations of the service (Parasuraman et al., 1988). The essence of the Servqual method is the gap score, which allows for the determination of the extent of the gap between customer perceptions and a service company's expectations (Rani & Kaur, 2025). The SERVQUAL concept is a concise scale with high reliability and validity that company management can use to understand better consumer perceptions and expectations of the services provided (Palamidovska-Sterjadovska et al., 2025).

Although empirical evidence shows that service quality theories have been developed across various case studies worldwide, the implementation of service quality methods remains theoretically applicable. Previous research on service quality was characterized by relatively small sample sizes, with most studies conducted in the public service, hospitality, and healthcare sectors.

This study addresses gaps in sample size and in the selection of case study objects, namely the courier service sector, a growing industrial sector in Indonesia. In addition, the use of a large sample size and the selection of the research location, namely Gresik City, which is a buffer zone for Surabaya and where many industries are located in the regency, ensure that supporting businesses, such as logistics services, are necessary for the smooth logistics of the industrial area. The results of this study address the gap in the implementation of SERVQUAL in a courier service company operating in an industrial area.

This research aims to evaluate consumer satisfaction and quantify service quality at Firm D. The first objective is to determine the level of customer satisfaction by counting consumer complaints. The second objective is to calculate service quality, followed by an analysis of importance and satisfaction levels. The final objective is to propose improvements to enhance the relevance of service quality.

Literature Review and Hypothesis Development

The Servqual framework comprises five dimensions: tangibles, reliability, responsiveness, assurance, and empathy (Palamidovska-Sterjadovska et al., 2025; Rani & Kaur, 2025). Tangibles refer to physical facilities, equipment, personnel, and communication materials. Reliability denotes the ability to perform the promised service dependably and accurately. Responsiveness reflects the willingness to help customers and provide prompt service. Assurance refers to employees' knowledge and courtesy, and their ability to convey trust and confidence. Empathy represents the caring and individualized attention provided to customers.

In logistics and courier services, service quality is closely linked to customer satisfaction and retention. (Rashid & Rasheed, 2024) found that logistics service quality and product satisfaction significantly influence e-commerce customer satisfaction. (Rebualos et al., 2024) demonstrated that the Servqual framework can identify service quality gaps in engineering design departments. (Al-Balas et al., 2025) showed that responsiveness is often the most problematic dimension in healthcare service quality. (Kheddache & Djadli, 2025a) found that tangible dimensions related to physical infrastructure generated among the largest negative gaps in hotel services. These studies suggest that responsiveness and tangible attributes are critical areas of service quality management across service sectors.

Based on the literature, the following propositions are developed for a descriptive quantitative study. First, perceived service quality attributes are expected to show gaps between perception and expectation. Second, the tangibles, reliability, responsiveness, assurance, and empathy attributes are expected to be measured as gap dimensions. Because this study is descriptive-quantitative, these propositions are examined through gap ranking and Pareto analysis rather than inferential hypothesis testing.

Research Methods

A descriptive-quantitative research approach was used. The cycle consisted of seven stages: topic selection and focusing on the research question based on customer satisfaction. Designing the study based on the questionnaire and determining the population and sample were the next stages. Once the research design was completed, the fourth and fifth stages included data collection and analysis. The final stage was to synthesize the data interpretation based on the analysis results from previous stages (Damayanthi et al., 2020). This research was conducted in Gresik City, East Java Province, Indonesia. The geographical area was chosen based on the research phenomenon and its proximity.

The sampling technique used was simple random sampling from an infinite population. The sampling procedure and technique were random, ensuring that all customers were included in the research sample. However, the inclusion criterion was that the selected respondents were customers who had used the courier service at least 5 times in the previous year. The respondents' criteria for the validation process were that they had used this courier service. The Bernoulli method was used to determine the sample size for an infinite population, such as customers of firm D, using the following formula (Novadi & Mahbubah, 2021):

$$n \geq (Z\alpha/2).\ p.q)/e^2 \quad (1)$$

$$= ((1.96)^2 .0.97.\ (0.03))/\ ((0.05)^2) = 44.72 = 45 \text{ samples}$$

Annotation:

n = Minimum sample size
Z = Normal distribution value
α = Significance level (0.95)
e = Error level (0.05)
p = Proportion of questionnaires considered correct
q = Proportion of questionnaires considered incorrect

The Bernoulli formula yields a minimum sample size of 45. Furthermore, this study distributed questionnaires to 100 respondents. The questionnaire returned 3 incomplete responses, resulting in a sample size of 97 for the study. This sample size exceeded the minimum required for an unlimited population. The sample size used in this study aligns with empirical evidence suggesting that larger samples generate more accurate results.

Data collection and research instrument

The research instrument was a questionnaire based on five dimensions of service quality: tangibles, reliability, responsiveness, assurance, and empathy. The questionnaire used a Likert scale to assess

customer importance and satisfaction. Respondents were asked to rate service attributes on a scale from 1 (very unimportant) to 5 (very important). T. Whilst the attribute design questionnaire regarding customer perception and expectations can be seen in Table 2. The five-point Likert scale ranges from 5 (Extremely Good) to 1 (Extremely Not Good), with scores of 4 (Very Good), 3 (Fair), and 2 (Not Good).

Data analysis

Four stages have been carried out in the research procedure. The first stage involved determining the qualitative dimensions, which consist of five: tangibles (X1), reliability (X2), responsiveness (X3), assurance (X4), and empathy (X5). The second cycle involved designing the research instrument and then distributing questionnaires. At the same time, the selected respondents had specific requirements regarding the characteristics and sampling methods. The third cycle involved distributing and collecting the questionnaire, and then testing the questionnaire's validity and reliability. This validity testing was conducted using an internal validity approach, with the criteria derived from the test instrument. Each item of each attribute was then correlated with the total value, yielding a correlation coefficient. If the correlation coefficient based on the statistical result was lower than the correlation coefficient based on the theoretical R table, the item in question was disqualified from the test. The correlation was calculated using the Pearson correlation coefficient formula with a significance level of 5%. The Product-Moment correlation was selected because it aligns with the ordinal characteristics of the data scale (Damayanthy et al., 2020). The results of the validity test are shown in table 1.

Table 1. Validity Test

Attributes	R statistics	Expectation level	Importance level	R table	Summary
X1	0.321	0.260	0.228	0.202	Valid
X2	0.439	0.219	0.261	0.202	Valid
X3	0.285	0.342	0.359	0.202	Valid
X4	0.281	0.398	0.265	0.202	Valid
X5	0.216	0.414	0.227	0.202	Valid
X6	0.501	0.319	0.537	0.202	Valid
X7	0.381	0.228	0.377	0.202	Valid
X8	0.516	0.374	0.474	0.202	Valid
X9	0.640	0.338	0.543	0.202	Valid
X10	0.457	0.360	0.342	0.202	Valid
X11	0.382	0.377	0.358	0.202	Valid
X12	0.478	0.355	0.311	0.202	Valid
X13	0.246	0.440	0.286	0.202	Valid
X14	0.452	0.354	0.338	0.202	Valid
X15	0.296	0.490	0.324	0.202	Valid
X16	0.465	0.387	0.399	0.202	Valid
X17	0.473	0.501	0.457	0.202	Valid
X18	0.599	0.514	0.472	0.202	Valid
X19	0.544	0.460	0.529	0.202	Valid
X20	0.505	0.455	0.526	0.202	Valid
X21	0.253	0.421	0.316	0.202	Valid

As shown in Table 1, the questionnaire validity test yielded 21 valid attributes. The next stage concerned the reliability test, an index indicating the extent to which a measuring instrument is reliable. This test was conducted using Cronbach's Alpha Technique (Damayanthy et al., 2020; Novadi & Mahbubah, 2021). The score indicates an instrument's reliability if its reliability coefficient is 0.6 or higher. The results of the reliability test are shown in table 2.

Table 2. Reliability test result

Indicator	Cronbach's Alpha	Summary
Importance level	0.702	Reliable
Expectation level	0.707	Reliable
Perception level	0.758	Reliable

As shown in table 2, a reliability test score of 0.7 indicates the robustness of the respondents' responses. The next step was to calculate the importance level. This value was obtained by averaging all attribute values within each importance level. For instance, the calculation of attribute X1, namely office cleanliness, was consistently maintained. Sum up using the Formula:

$$X1 = \frac{(1x0)+(2x0)+(3x27)+(4x45)+(5x25)+}{97} = 3.969 \quad (2)$$

The next cycle was to quantify satisfaction based on perceptions and expectations. Furthermore, these scores were obtained by averaging the attribute values across all satisfaction levels. For instance, the calculation of attribute X1, namely, the cleanliness of the office area, was consistently maintained:
Perception Formula:

$$X1 = \frac{(1x2)+(2x9)+(3x34)+(4x37)+(5x15)+}{97} = 3.557 \quad (3)$$

Expectation formula:

$$X1 = \frac{(1x0)+(2x0)+(3x24)+(4x56)+(5x17)+}{97} = 3.928 \quad (4)$$

The final step was calculating the GAP score, which was used to prioritize service attributes that were expected to be improved. The GAP score was obtained from the difference between perceived and expected values. An example of calculating the GAP for attribute X1, office cleanliness, and office area maintenance, was obtained using the following formula:

$$GAP\ X1 = \text{perseption score of X1} \quad \text{expectation score of X1} = 3.557 \quad 3.928 = \quad 0.371 \quad (5)$$

Results and Discussion

Results

Service quality was quantified into three results: importance level and satisfaction level, which portrayed perceptions and expectation scores, and GAP Servqual, which calculated the differences between perceptions and expectations.

Importance Level Score

The Importance Level Score was calculated using Formula 2. The score for each attribute, starting from the first attribute X1, related to tangibles, the cleanliness of the office area was always maintained, to the last attribute with code X21, namely, the workers' mindset was responsive in delivering service, which was part of the empathy dimension, can be seen in Figure 1.

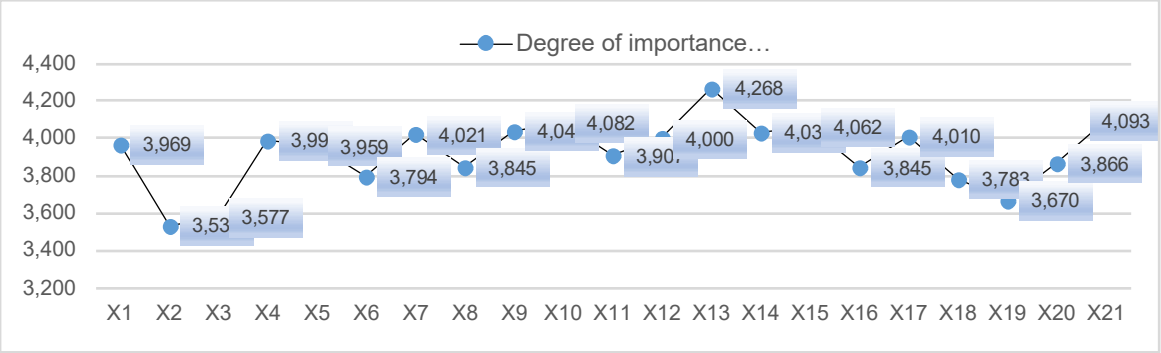

Figure 1. Importance level based on 21 attributes

As shown in Figure 1, the importance level score was presented on an ordinal Likert scale ranging from 1 to 5. The calculated importance score results for all attributes x1 to the last attribute x21 were in the range of 3.5 to 4.5.

Customers' Satisfaction Level

Customer satisfaction was determined by calculating perception and expectation scores based on the customer experience. Additionally, the perception score was calculated using Formula 3, while the expectation score was calculated using Formula 4. The results for the perception and expectation scores are shown in Figure 2.

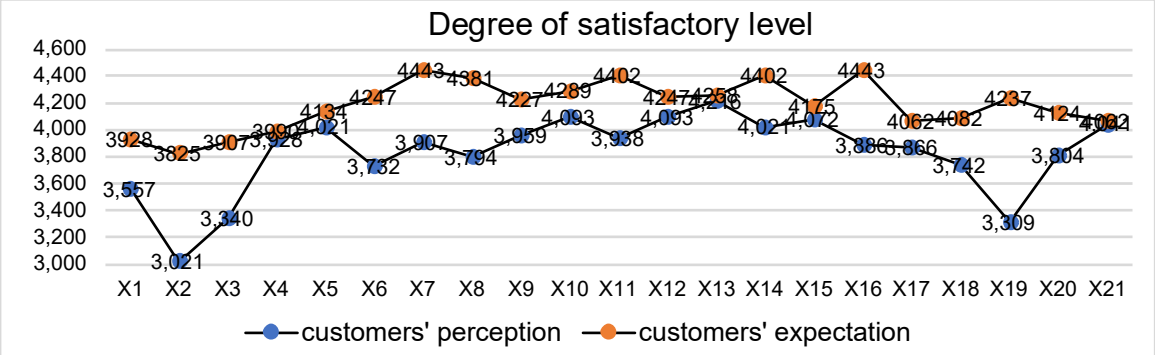

Figure 2. Perceptions and expectations of the customer

As shown in Figure 2, the satisfaction score represents the customer's assessment of Firm D's services compared to their expectations. In general, the lowest score was 3.0, and at least 4 attributes achieved the highest score of 4.4. It also indicated that the perception score was lower than the expectation score.

Gap Result

This Gap value was a calculation result of Formula 5. The Gap score shows the difference between consumer perceptions and expectations of service quality at Firm D, as shown in Figure 3.

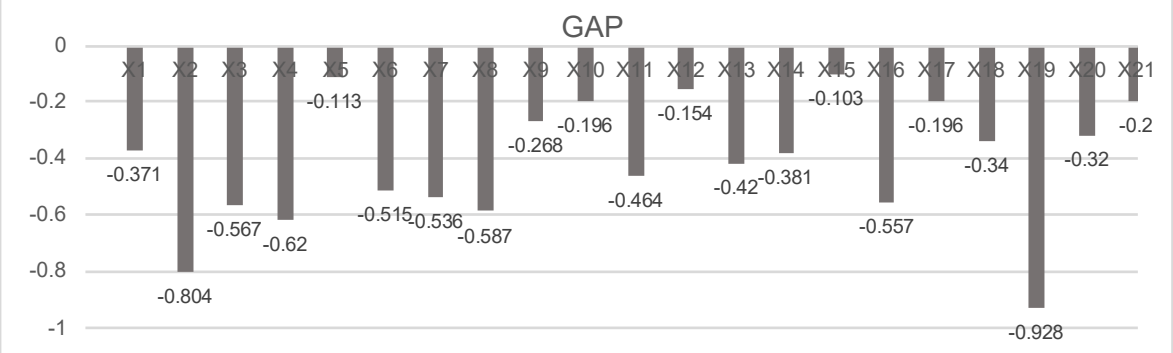

Figure 3. GAP Score

As shown in Figure 3, all GAP scores across 21 attributes were negative. The smallest gap score was -0.103 for attribute X15, namely "The staff have the knowledge and skills to carry out their duties effectively," and the highest was -0.928.

Discussion

The research findings indicate that two essential factors, the importance score and the gap between consumer perceptions and expectations, require broader enlightenment. It is worth noting that the importance level score and the gap score are used in a Pareto chart. Moreover, the Pareto Diagram commonly uses the 80/20 Pareto principle. The 80/20 Pareto principle states that 80% of the effects of an event or incident are caused by 20% of the influencing factors. The Pareto Principle is widely applied in defect analysis and in examining damage causes in components during manufacturing, production, or service (Melkamu et al., 2024). The Pareto diagram of Importance Level values is presented in Figure 4.

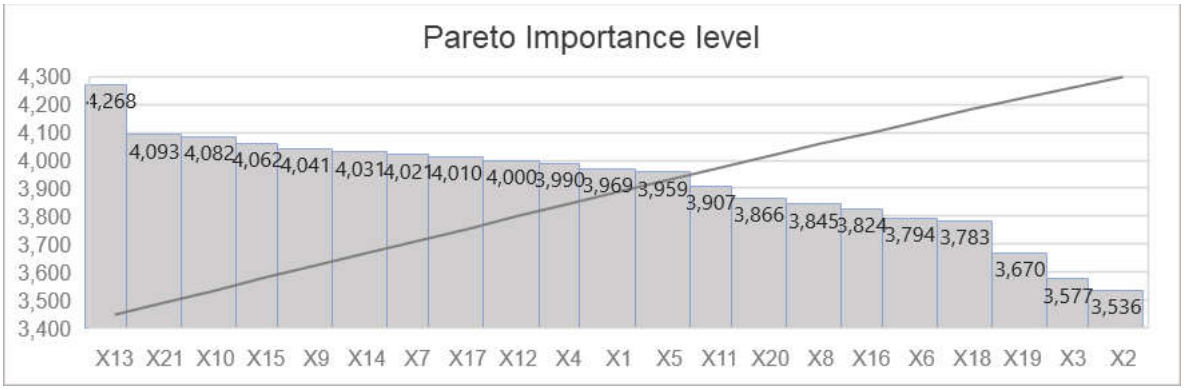

Figure 4. Importance level rank

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The research has indicated that attribute X13, which pertains to staff competence and skills, is the most critical factor consumers consider when selecting courier services at Company D. This element is not only vital on its own but also constitutes an essential part of the company's human resource capabilities, highlighting the coherence and interdependence among these factors. This finding is consistent with the comprehensive literature, which demonstrates that employee competence is a primary driver of perceived service quality in logistics (Rashid & Rasheed, 2024; Rebualos et al., 2024). Elevating workers' capability based on empirical evidence can serve as a benchmark. Enhancing employee skills through competency-based training tailored to specific job requirements has proven effective in boosting performance (Khan et al., 2022). Firm D can analyze to ensure that training materials are aligned with operational reality.

Furthermore, mentoring and coaching programs are practical training programs that accelerate employee skill development. Enterprises can create internal mentoring initiatives by involving experienced staff as mentors to support new hires or those in need of further development (Saad, 2022). Enhancing workers' soft skills, such as communication, is essential for improving customer interactions. Company D might incorporate role-playing exercises and case studies to prepare staff for various scenarios in courier services. Lastly, Firm D can develop policies that include promotion, incentives, and recognition for skills enrichment to support employees in pursuing continuous learning. Firms can also establish an internal certification program recognized for career advancement (Garbers & Konradt, 2013).

As shown in Figure 5, satisfaction levels for the result scores of all attributes are based on negative attribute values. Moreover, the highest negative attribute value indicates that management needs to focus on improvements to ensure customer satisfaction.

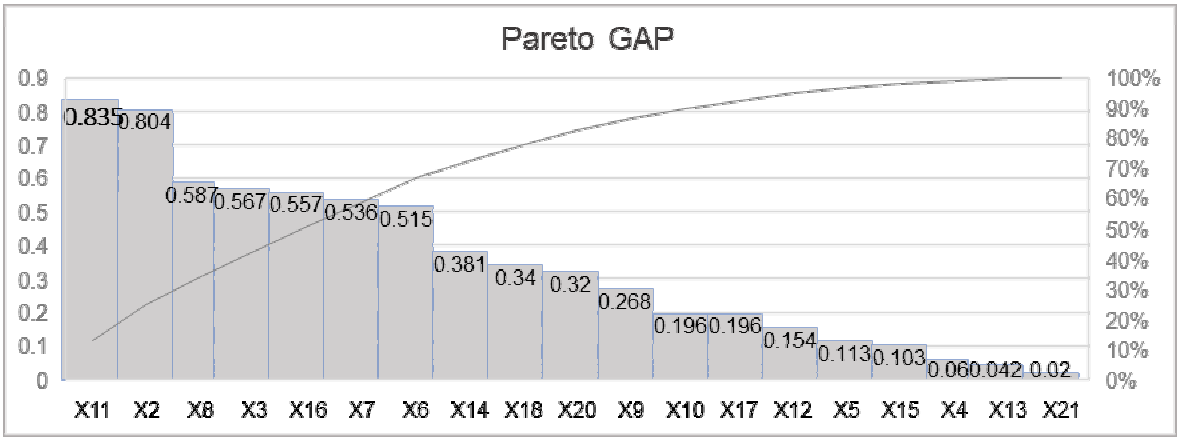

Figure 5. Pareto GAP

This can be seen from Figure 5. Based on the Pareto 80/20 result, the primary issue with the highest negative Gap score in responsiveness is the lengthy resolution of customer complaints, as stated in Attribute X11. Furthermore, employees in courier service companies often face a high volume of complaints, which can lead to slow response times. In addition, the lack of standard procedures for handling complaints creates a problem, as employees are left to manage complaints, workloads, and task priorities, thereby hindering their ability to resolve them quickly (Oru & Madumere, 2022). Hence, implementing a performance monitoring system can mitigate these problems and improve the overall responsiveness to customer complaints.

In addition, empirical studies also found that employees in traditional courier companies often lack access to real-time tracking systems and Customer Relationship Management (CRM) tools (Tochukwu et al., 2024). Without an integrated CRM system, complaint resolution requires manual intervention, prolonging handling times. Digital transformation can improve responsiveness, but many companies do not adopt it due to high implementation costs, further widening the gap between customer expectations for quick responses and the reality of slow complaint handling (Suryani, 2025).

Psychological factors such as employee motivation and job satisfaction also influence responsiveness. Empirical research proves that frontline workers in the service industry often experience burnout due to duplicative complaint-handling tasks (Zhang et al., 2021). This finding highlights the importance of human resource strategies, including benefits and bonus systems, as well as mental health support (Zhang et al., 2021). Mitigating psychological obstacles can help minimize the negative gap in attribute X11. The last action related to organizational culture plays a substantial part in the efficiency of the complaint. Empirical evidence reveals that companies with hierarchical structures tend to have longer complaint resolution times due to bureaucratic matters (Tsai, 2011). In general, the findings of these studies indicate that the problem of slow complaint resolution is influenced by training, workload, technology, motivation, and organizational structure.

The second attribute included in the Pareto 80/20 principle is tangible, specifically attribute X2, namely, the parking area is good and sufficient. As a logistics-based service enterprise, the need for an adequate parking area is not just an additional facility but a critical operational prerequisite that demands primary attention. Delivery vehicles, such as box trucks, vans, motorcycles, and customer vehicles, require fast access and safe parking for loading and unloading packages. An inadequate parking area not only leads to customer dissatisfaction but also adversely affects operational throughput and service speed (Cahyani et al., 2024). Furthermore, physical land constraints in city centers have been identified as a barrier to enterprises expanding their parking areas (Heliantina et al., 2024). Parking gaps trigger an adverse domino effect on last-mile delivery. This situation indicates that parking in unauthorized locations, such as sidewalks and public roads, increases the risk of parcel theft and vehicle damage.

The resolution offered to delivery service company management outlines a strategic approach to address parking gaps by taking the following steps. Firm D may deploy vertical parking and rearrange the layout of logistics areas (Li et al., 2024). Moreover, Firm D can implement technology, such as real-time applications, to guide customers and drivers to available slots. Final recommendations include collaborating with vacant landowners or vacant building owners near office locations to rent temporary parking during peak operating hours, as well as advocating to local governments for logistics land incentives (Dheeven et al., 2024). These interventions collectively address both the physical infrastructure gap and the operational efficiency requirements of a growing courier service enterprise in an industrial regency context.

A proportional analysis of this study's findings with empirical research is described in the respective outlines. Consistent with Al-Balas et al. (2025), who identified responsiveness as the most problematic dimension of healthcare service quality, this study confirms that responsiveness-related attributes constitute the highest-priority area for improvement in courier service contexts. Similarly, Kheddache and Djadli (2025), applying SERVQUAL in Algerian hotels, found that tangible dimensions related to physical infrastructure generated among the largest negative gaps, a precedent reflected in the present study by the parking attribute (X2). Findings across industries and geographic contexts suggest that responsiveness and physical infrastructure are generally essential areas of service quality management and warrant constant managerial attention across service sectors.

Conclusion

The research results are summarized in five points: The first conclusion is that, among the three categories of customer complaints, the moderate category is the most significant, followed by the critical and minor categories. The second conclusion from quantifying service quality using the Servqual

dimensions is that the highest value is in the responsiveness dimension, with a score of 4,216. The second rank is the assurance dimension, with a score of 4,072, followed by the empathy dimension, with a score of 4,041. In addition, the tangible dimension ranks fourth with a score of 4.02, and the reliability dimension ranks fifth with a score of 3,959.

The GAP analysis of perceptions and expectations, as the third finding, shows that the quality of service provided has not met consumer expectations, as evidenced by the negative value. The service quality dimension with the smallest GAP value is empathy. Officers' attitude and attention toward customers are good and responsive in serving, with a gap value of -0.20. In addition, the importance analysis results indicate that the most important attribute for customers is the excellent staff category.

The fourth finding, the SERVQUAL analysis results, showed that the attribute with the highest GAP concerns the resilience of staff in responding to customers' complaints. This finding indicates a significant gap between customer expectations and the actual service provided. Based on the importance analysis results, consumers expect company employees to provide fast, attentive, and caring service when customers encounter problems. The last finding, based on integrating the importance-level analysis with the GAP analysis, confirms that the most critical service quality deficiencies are concentrated in the responsiveness and tangible dimensions, both of which are ranked highly in customer priority.

In addition, the GAP analysis indicates that management is expected to improve performance, provide better customer care, expand parking, and maintain trust to ensure goods arrive safely at their destinations. The findings can be used as input for formulating policies to improve service quality. Management is expected to improve services by focusing on the most negative values to ensure customer satisfaction. Management is also expected to make immediate improvements, given the current competitive nature of delivery services. From a theoretical perspective, this study validates the applicability of the SERVQUAL framework and the Pareto principle as complementary analytical tools for analyzing service quality absences in courier service enterprises operating in industrial safeguard zones of developing economies. The findings contribute to the empirical literature on logistics service quality in Southeast Asia and present a replicable operational background for related studies.

The limitations of this study are as follows. This research is based on a single case study with the research object located in a specific region. Further exploration by adding case studies that combine branches of several logistics firms in Indonesia will enrich the research by examining consumer characteristics across regions with different cultures. The second limitation is that this study measures only external factors of customer satisfaction, while internal factors are not measured. Further research to measure internal quality using approaches such as Six Sigma, Statistical Process Control, and Lean will enrich empirical case studies of service enterprises. The final recommendation for future research is to incorporate structural equation modeling to investigate the influence of the SERVQUAL dimensions on customer satisfaction and loyalty, thereby extending the narrative results of this study and clarifying the analytical modeling.

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