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Implementation of total quality management and importance-performance analysis for technical service optimization in a maintenance workshop: a company case study

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Abstract

Customer satisfaction is a key factor of success in service-based industries and is equally important in technical service environments such as a mechanical repair workshop, which provides civil works, welding, machinery, and valve maintenance services. This study aims to assess service quality and identify the primary factors influencing customer satisfaction, with the objective of formulating strategic improvements tailored to the workshop setting. A quantitative research approach was adopted, incorporating the SERVQUAL dimensions and the Total Quality Management (TQM) framework, while customer loyalty was measured using the Net Promoter Score (NPS). The study involved 93 internal respondents from various organizational units, with work experience ranging from less than five years to more than twenty years. Results indicate a high level of satisfaction, with a net promoter score of 57.29% and an Internal Customer Satisfaction (ICS) index of 86.9%. Multiple linear regression analysis showed that service quality and total quality management collectively explained 84.3% of the variance in customer satisfaction. Importance and Performance Analysis (IPA) identified education and training, customer focus, and reliability as the top strategic improvement priorities. From an operational perspective, the most frequently requested services included pump shaft fabrication (item code 63-GA-6004, 30 hours), shaft sleeve fabrication (63-GA-6004, 16 hours), and shaft sleeve fabrication (56-GA-4002, initially 36 hours). Following the implementation of these improvements, the workshop achieved a 20 percent reduction in average processing time and completed 182 service activities within two months, significantly enhancing operational efficiency and customer satisfaction.

Keywords:
Internal customer satisfaction index, net promoter score, total quality management, importance performance analysis.

1 Introduction

The service industry relies heavily on customer satisfaction for its success, so it must deliver the best, fastest, and most reliable service to meet customer expectations. Competing businesses continuously strive to provide better service quality and build a strong brand image to achieve customer satisfaction. This is because customer satisfaction is essential for maintaining customer loyalty and creating a positive reputation [1, 2].

The maintenance workshop services of a company provide internal services and services to other companies in the areas of machinery, valve repairs, welding, and civil works. In 2023, workshop carried out 2,081 service activities. The most frequently requested service activity was pump shaft fabrication, with item code 63-GA-6004, which had a processing time of 30 hours. Shaft sleeve fabrication for the same item code (63-GA-6004) had a processing time of 16 hours, while shaft sleeve fabrication for item code 56-GA-4002 required 36 hours to complete.

However, various complaints were received regarding the services provided, such as product quality not meeting customer expectations, mismatched raw materials, and delays in product completion time. Fig. 1 depicts the customer complaints received regarding the workshop service, categorized by the proportion of complaint reasons. Improvements are necessary to enhance customer satisfaction, which can be achieved by measuring customer satisfaction using the Internal Customer Satisfaction Index (ICSI) method.

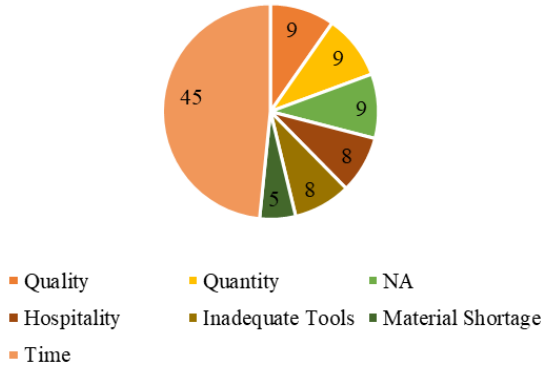

Fig. 1. Customer complaint.

The ICSI is a method used to determine the overall level of user satisfaction by assessing the performance and importance levels of product or service attributes measured within a specific time frame, to improve services that provide added value to customers [3]. The ICSI method is often elaborated with the Net Promoter Score (NPS) and service quality methods. The NPS is an index used to measure the likelihood that customers will recommend a company's product or service to others [4]. The net promoter measurement results categories consist of promoters, who are consumers likely to promote the service or product to others, passives, and detractors, who are consumers likely to prevent others from using the product or service [5]. Service quality is the customer's perception of how well the provided service can meet or exceed customer expectations [6]. Service quality has 5 dimensions: reliability, responsiveness, assurance, empathy, and tangible [7]. Service quality improvement, especially in the service industry, is closely related to the principles of total quality management.

Total Quality Management (TQM) is a concept that focuses on fulfilling customer needs through quality control and continuous improvement of ongoing processes [8]. It aims to ensure that customer satisfaction is the main priority of the organization [9]. Generally, there are 10 key indicators in TQM: customer focus, obsession with quality, scientific approach, long-term commitment, teamwork, continuous improvement, education and training, controlled freedom, unity of purpose, and employee involvement and empowerment [10].

Research by Firmansyah et al. [11] analyzed the influence of service quality on customer satisfaction using the Customer Satisfaction Index (CSI) method, full-time equivalent, and importance performance matrix at the Time Care Service Center. The research showed a CSI figure of 85.71% and a Full Time Equivalent (FTE) value of 2.22 > 1.28. A TQM assessment of service performance at a national bank with 199 respondents was conducted using service quality variables and market orientation. The research showed that TQM influences service quality, market orientation, and service performance [12]. Meanwhile, the relationship between NPS and customer loyalty in service performance has been observed by Sri Rahayu et al. [13], which was conducted at a library in Indonesia with 200 respondents. The results showed that the net promoter score was 8, placing it in the passive category, and there was a significant relationship between loyalty and the net promoter score [13]. This study aims to measure service quality, net promoter score, and TQM in the maintenance workshop of the company to improve service delivery and meet customer expectations.

This research is essential due to the increasing number of influential factors in the service industry, particularly within maintenance workshop services. The aim is to identify the most significant factors affecting service quality in the workshop business and to implement a comprehensive

methodological approach to improving business processes. This includes developing strategies to accelerate key mechanical tasks—specifically pump shaft fabrication, which currently requires 30 hours, and shaft sleeve fabrication, which can take up to 36 hours—thereby improving overall work hours and service quality.

2 Research methodology

This study aims to measure service quality in maintenance workshop services. The measurement focuses on service quality performance, TQM, and the calculation of the net promoter score to determine the quality category perceived by customers. This study adopts a quantitative research approach to examine the relationship between service quality dimensions and TQM on customer satisfaction and customers' likelihood to recommend maintenance workshop services. The TQM methodology is applied to establish a customer-centric and systematic quality management framework that aligns with customers' perceptions of service quality, as measured through the service quality dimensions. Overall customer perceptions of service quality are translated into customer loyalty, which is represented by the likelihood to recommend the maintenance workshop services.

Data collection for the study was conducted through primary sources using a questionnaire filled out by respondents from workshop units and secondary data were obtained from records. The questionnaire was designed based on the service quality model, which measures service quality across five dimensions: tangibles, reliability, responsiveness, assurance, and empathy. The variables used in this study are shown in Table 1.

Table 1. Research variables and indicators

Variable	Indicator	Measurement scale
Total quality management	Focus on customers	Likert scale (1-5)
	Scientific approach	
	Continuous improvement	
	Obsession with quality	
	Teamwork	
	Education and training	
Service quality	Reliability	
	Responsiveness	
	Assurance	
	Empathy	
	Tangible	
Net promoter score	Customer loyalty	Scale 1-10

The data were collected from a population of workshop service users using a sample size determined by Slovin's formula. The population of workshop service users in 2023 totaled 326. The number of respondents was determined using Eq. (1) [14].

$$n = \frac{N}{1 + N\,e^2} \tag{1}$$

The number of respondents was calculated with a 10% standard error, resulting in 77 respondents (Eq. (2)). For data completeness, data was collected from 93 respondents. The respondents of this study are employees from various work units within who have experienced the maintenance workshop services, with work experience ranging from 0-5 years to 21-25 years. The collected data underwent validity and reliability testing to determine whether the instrument used was appropriate and consistent for the research purpose.

$$n = \frac{326}{1 + 326 \cdot 0.1^2} = 77 \text{ respondents} \tag{2}$$

The NPS is calculated by subtracting the proportion of respondents who are unlikely to promote the service and may discourage others from using it from the proportion of respondents who are likely to promote the service. Customer satisfaction, as perceived by clients, was assessed using service quality dimensions and the TQM methodology. The significance of each variable was also evaluated using linear regression analysis, and the results were mapped based on importance using the Importance and Performance Analysis (IPA) method. Improvement strategies were then formulated to enhance variables with high importance but low performance in the workshop service.

3 Results and discussion

This research adopted a descriptive quantitative approach to explain service quality and total quality management's significance on customer satisfaction. The recap of the data collection and processing process is depicted in Table 2.

Table 2. Recap of data collection and processing

r	Description
Target population	Employees who are workshop service users at
Sampling method	Determined with Slovin's formula
Sample size	93 respondents
Data collection tool	A structured questionnaire based on service quality dimensions, TQM, and likelihood of promoting service
Data collection method	In person at the workshop station
Validity and reliability testing	A validity and reliability test was conducted to ensure validity and consistency
Data analysis method	Descriptive statistics for demographics and satisfaction levels. Linear regression to assess variable significance NPS to measure customer loyalty. IPA to prioritize improvements
Improvement strategy basis	Variables with high importance and low performance identified through IPA

3.1 Validity test

This study's initial data processing stage is to conduct a questionnaire validity test. The test is performed to determine how valid the questionnaire is to be used and to determine whether it is suitable for distribution or whether there are still deficiencies [15].

The validity test results show that all question items have a value of $R_{count} > R_{table}$, which means that all question items are declared valid. The highest R_{count} value is 0.963 for question items with code RS1, and the lowest is 0.850 for question items with code T3 related to adequate machines and tools (Table 3).

Table 3. Validity test of research questionnaire

Variable	Code	R_{count}	R_{table}	Information
Focus on customers	FTP-1	0.887	0.2039	Valid
	FTP-2	0.882	0.2039	Valid
	FTP-3	0.918	0.2039	Valid
	FTP-4	0.913	0.2039	Valid
Scientific approach	PI-1	0.893	0.2039	Valid
	PI-2	0.926	0.2039	Valid
	PI-3	0.888	0.2039	Valid
Continuous improvement	PB-1	0.906	0.2039	Valid
	PB-2	0.952	0.2039	Valid
	PB-3	0.942	0.2039	Valid
Obsession with quality	OTK-1	0.894	0.2039	Valid
	OTK-2	0.941	0.2039	Valid
	OTK-3	0.915	0.2039	Valid
Teamwork	KT-1	0.952	0.2039	Valid
	KT-2	0.962	0.2039	Valid
	KT-3	0.939	0.2039	Valid
Education and training	PP-1	0.907	0.2039	Valid
	PP-2	0.940	0.2039	Valid
	PP-3	0.898	0.2039	Valid
Service performance	KP-1	0.944	0.2039	Valid
	KP-2	0.933	0.2039	Valid
	KP-3	0.927	0.2039	Valid
Tangibles	T1	0.877	0.2039	Valid
	T2	0.890	0.2039	Valid
	T3	0.850	0.2039	Valid
Reliability	R1	0.910	0.2039	Valid
	R2	0.903	0.2039	Valid
	R3	0.868	0.2039	Valid
Responsiveness	RS1	0.963	0.2039	Valid
	RS2	0.953	0.2039	Valid
	RS3	0.910	0.2039	Valid
Assurance	A1	0.946	0.2039	Valid
	A2	0.948	0.2039	Valid
	A3	0.949	0.2039	Valid
Empathy	E1	0.935	0.2039	Valid
	E2	0.917	0.2039	Valid
	E3	0.924	0.2039	Valid

3.2 Reliability test

The reliability test aims to see whether the questionnaire is consistent if repeated measurements are carried out using the

questionnaire [16]. The questionnaire's reliability level is related to the accuracy and level of trustworthiness of the questionnaire based on previously determined criteria. Cronbach's alpha formula is used [15] to assess the instrument's reliability level. The requirements for decision-making to determine reliability testing are that if the value of r (Cronbach's alpha) is greater than 0.60, the indicator is considered reliable. Conversely, the indicator is considered unreliable if the r (Cronbach's alpha) value is less than 0.60. The reliability test results show that all indicators have an r value greater than 0.6. The highest Cronbach alpha value is 0.984 for the customer focus, tangible, and empathy variables, while the lowest is 0.983 for the scientific approach, continuous improvement, and obsession with quality (Table 4).

Table 4. Research questionnaire reliability test

Variable	Cronbach alpha (CA)	Standar (CA)	Information
Focus on customers	0.984	0.6	Reliable
Scientific approach	0.983		Reliable
Continuous improvement	0.983		Reliable
Obsession with quality	0.983		Reliable
Teamwork	0.983		Reliable
Education and training	0.983		Reliable
Tangible	0.984		Reliable
Reliability	0.983		Reliable
Responsiveness	0.983		Reliable
Assurance	0.983		Reliable
Empathy	0.984		Reliable
Service performance	0.983		Reliable

3.3 Net Promoter Score

NPS calculations are based on the possibility of recommending a service or product independently, with a general assessment ranging from 0 to 10 [17]. The results of the promoter, passive, and detractor calculations as shown in Table 5 are then used to calculate the NPS, which is done using Eq. 3 [18].

$$\text{NPS} = \%\text{Promoters} - \%\text{Detractors} \quad (3)$$

The calculation results by Eq. (3) is shown an NPS value of 57.29%. This means that the service/product being measured has excellent customer satisfaction, with most respondents giving positive reviews and tending to recommend the product/service to others.

Table 5. NPS result percentage

Information	Total	Percentage
Promoter	59	61.46%
Passive	30	31.25%
Detractor	4	4.17%

3.4 Internal Customer Satisfaction Index

The ICSI measures service quality based on internal clients [19]. The ICSI recapitulation is in Table 6. Next, the internal customer satisfaction index value is calculated using Eq. 5 [20].

Table 6. ICSI recapitulation

Variable	Attributes/indicators	Interest	Satisfaction	Score
Total quality management	Focus on customers	4.53	4.31	19.524
	Scientific approach	4.46	4.41	19.668
	Continuous improvement	4.49	4.41	19.800
	Obsession with quality	4.44	4.33	19.225
	Teamwork	4.53	4.39	19.886
	Education and training	4.52	4.24	19.164
Service quality	Reliability	4.47	4.16	18.595
	Responsiveness	4.51	4.32	19.483
	Assurance	4.5	4.39	19.755
	Empathy	4.49	4.42	19.845
	Tangible	4.59	4.39	20.150
	Total score	49.53		215.099

$$\text{ICSI} = \frac{\text{Total from CSI}}{5\ (\text{Total from expectation column})} \times 100\% \quad (4)$$

The ICSI results show customer satisfaction of 0.868 or 86.8% (Eq. 4). This means respondents are very satisfied with the service because the CSI value is > 81% [20].

3.5 Importance Performance Analysis

IPA provides and displays information related to factors in services that need to be improved according to consumers and significantly affect customer satisfaction levels [21]. IPA is useful for analyzing current regulatory situations and helping with accurate decision-making. IPA aims to determine priority attributes for improvement based on 4 categories, namely Quadrant I (very important and low performance), Quadrant II (very important and high performance), Quadrant III (less important and low performance), and Quadrant IV (less important and high performance) [22]. The results of the IPA calculation are in Table 7.

The IPA diagram in Fig. 2 shows that 3 attributes are the main priority in quadrant one, namely education and training, customer focus, and reliability, because the importance value is still lower than satisfaction and significantly influences customer satisfaction. In Quadrant II, 2 attributes are maintained, namely empathy and teamwork. Quadrant III contains tangible variables and obsession with quality, and Quadrant IV consists of responsiveness, assurance, continuous improvement, and scientific approach attributes.

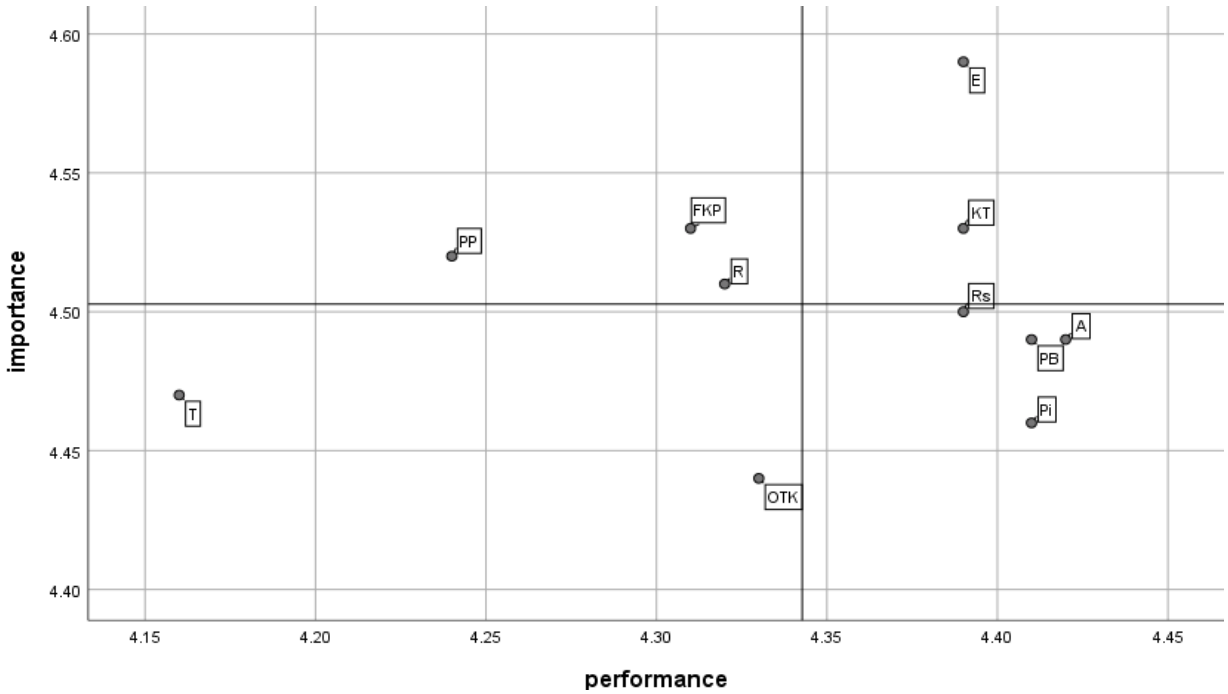

Fig. 2. Results of the science Cartesian diagram.

Table 7. Science results recapitulation

Variable	Attributes/indicators	Interest	Satisfaction	Gap
Total quality management	Focus on customers	4.53	4.31	0.22
	Scientific approach	4.46	4.41	0.05
	Continuous improvement	4.49	4.41	0.08
	Obsession with quality	4.44	4.33	0.11
	Teamwork	4.53	4.39	0.14
	Education and training	4.52	4.24	0.28
Service quality	Tangible	4.47	4.16	0.31
	Reliability	4.51	4.32	0.19
	Responsiveness	4.5	4.39	0.11
	Assurance	4.49	4.42	0.07
	Empathy	4.59	4.39	0.2
	Average	4.50	4.34	0.16

3.6 Simultaneous test of multiple linear regression and TQM

The simultaneous test aims to see whether the independent variables simultaneously affect the dependent variable [23]. The results of the simultaneous test show that the F_{count} value is 40.779 > F_{table} 1.909 and the significance value is 0.000 < 0.05, so it is found that there is an influence of quality management and service quality on customer satisfaction from the company maintenance workshop services.

3.7 Multiple linear regression, partial test TQM

The T statistical test, known as the partial test, is conducted on independent and dependent variables to determine whether the regression model equation formed partially by the independent variables significantly affects the dependent variable [23]. The results of the partial test show that 2 attributes have a significant impact on customer satisfaction, namely the continuous improvement attribute and reliability with a significance value of ≤ 0.05, while 9 other attributes have a significance value of ≥ 0.05 with the highest value being the empathy attribute of 0.872 and the lowest on the assurance attribute of 0.132 (Fig. 3).

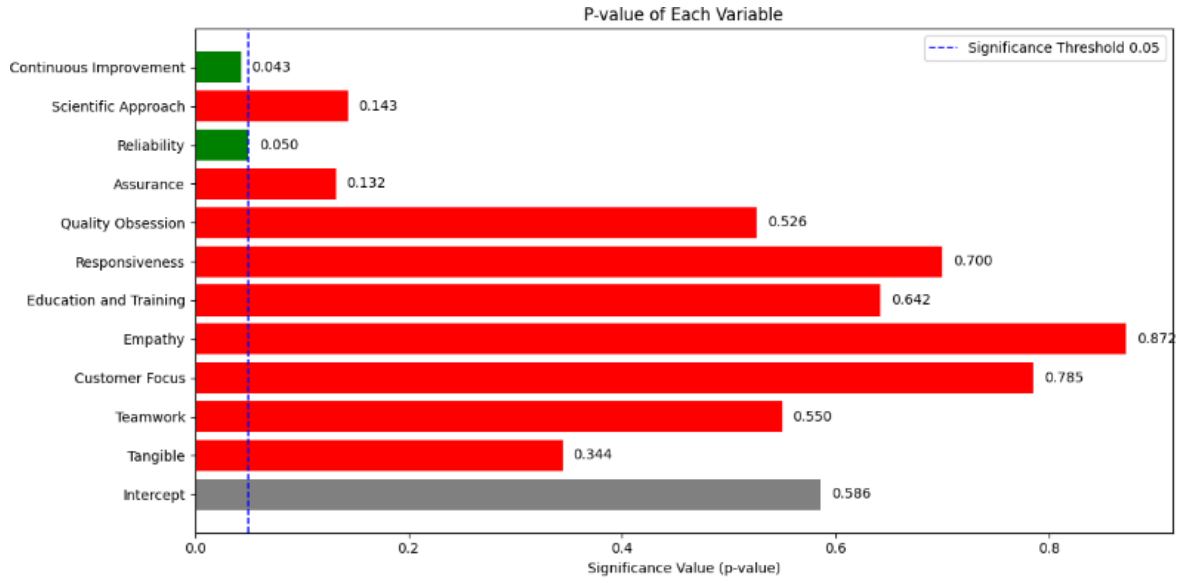

Fig. 3. Partial regression test results.

3.8 Determination test

The determination test is used to determine how much the independent variable can explain the dependent variable, so it is necessary to know the value of the determination coefficient (Adjusted R-square) [24]. The R-squared value ranges from 0 to 1, on a scale of no contribution to having a significant contribution. The research determination test is in Fig. 4.

TQM and service quality variables influence 0.847 or 84.7% of customer satisfaction, while there are 15.3% of unknown variables to explain the factors that affect customer satisfaction of maintenance workshop services.

3.9 Customer satisfaction improvement strategy

The formulation of customer satisfaction improvement strategies for the the company maintenance workshop services is carried out to improve maintenance workshop services. Variable improvement strategies in Quadrant I are in Table 8.

The implementation trial was conducted on the activities in 2025 January and February. Sampling was carried out on services at the Machine and Valve repair workshop, with work including fabrication and maintenance services—the maintenance workshop service activities of the company in January and February consisted of 197 activities, with 92.8% or 183 activities with a completed status and 14 activities with a status in progress. The maintenance workshop service provides a 1-week warranty period for submitting complaints. During that time, no complaints were submitted to the workshop service, so the strategy implemented successfully reduced consumer complaints. Further implementation was carried out by comparing similar jobs. The comparison of work duration is in Table 9.

Table 9 shows improvement in the duration of work of a project at the Machine and Valve repair workshop during the improvement trial implementation. The sampling trial shows improvement in project duration with a 50% decrease in the induration of the pump shaft fabrication job. Furthermore, the shaft sleeve fabrication work item showed a gradual improvement pattern. There was a decrease in work duration from 16 hours to 16-12 hours. The decreasing trend in work duration indicates increased work effectiveness and experience over time. The division of work into several sessions is also interpreted as an effort to improve quality control and resource management. In the shaft sleeve fabrication work item II, the work duration, which varied between 10-36 hours, decreased to 5 hours, indicating a significant increase in efficiency, stability, and predictability of the process. Improvements involve adopting new technologies, design improvements, and restructuring work stages to reduce work complexity (Fig. 5)

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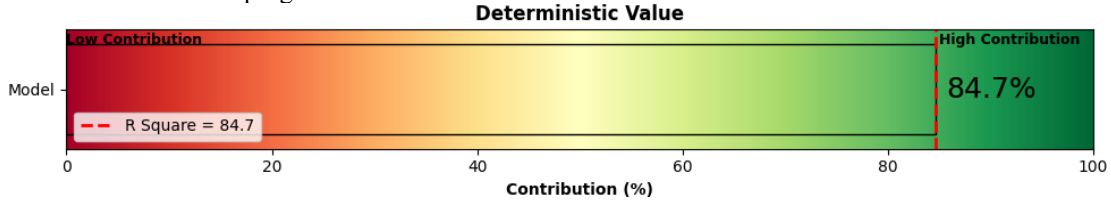

Fig. 4. Determination test results.

Table 8. Customer satisfaction improvement strategies

Variable	Problem	Recommended strategy
Customer Focused	Customer complaints are handled quickly and effectively Customer needs and expectations are identified quickly Meet customer needs Customers are asked regularly about their expectations of products and services	1. Building 3-way interaction between service requesters, planners and implementers of work in (meetings, direct or indirect coordination) 2. Operational management strategies such as administrative completeness, work drawings, location, materials used, schedules and other technical documents
Learning and Development	Company workshop service workers know the critical processes of the products they manufacture 's workshop service workers have adequate skills 's workshop service workers use tools and software	1. Transfer of knowledge from each specific activity to explain problems, processes and tricks in carrying out activities 2. Training to workers both from within or external training to support the work process 3. Benchmarking with other superior units or companies that have similar processes
Reliability	Maintenance workshop services use adequate technology or tools Are the maintenance workshop service workers reliable? Is the repair shop easy to communicate with?	Operational reliability strategy 1. Equipment rejuvenation or modification 2. Regular maintenance and repair 3. Availability of consumables and supporting equipment 4. Monitoring and reporting

Table 9. Duration of work before and after repair

Item	Job description	Before		After	
		Date of employment	Duration (hours)	Date of employment	Duration (hours)
63-GA-6004	Pump shaft fabrication	19/03/2024	30	02/01/2025	15
63-GA-6004	Shaft sleeve fabrication	02/05/2024	16	03/01/2025	16
				06/01/2025	15
				10/01/2025	14
				22/01/2025	12
56-GA-4002	Shaft sleeve fabrication	05/05/2024	10	20/02/2025	5
		05/06/2024	15	20/02/2025	5
		13/06/2024	36		
		29/08/2024	14		
		02/10/2024	20		

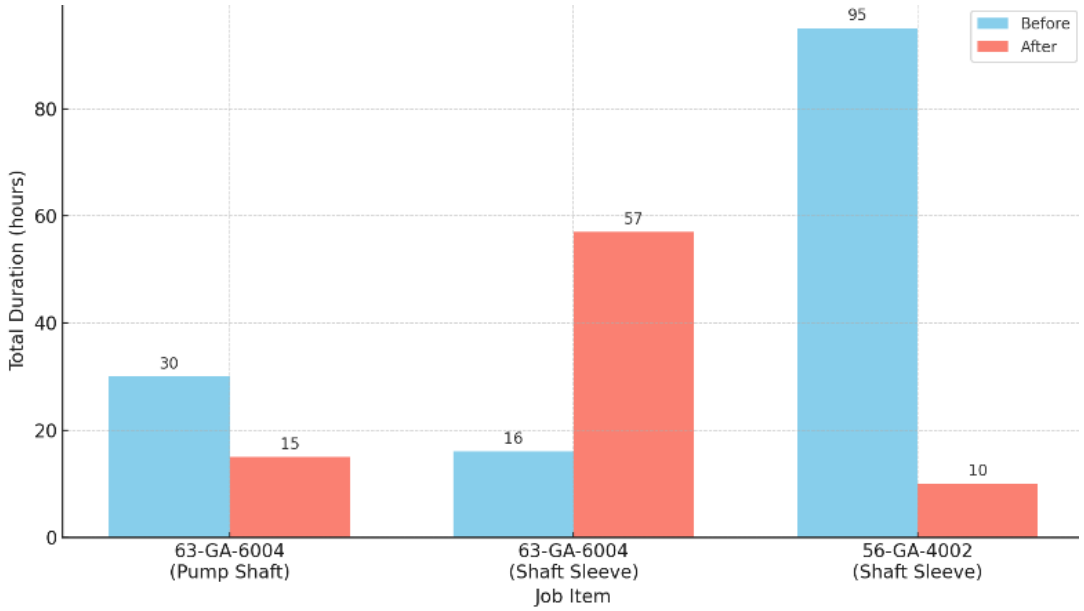

Fig. 5. Comparison of job duration: before and after.

The fabrication process of a pump shaft demands a very high level of precision. This includes strict dimensional tolerance control, precision lathe machining, turning operations using Computer Numerical Controlled (CNC) machines, and additional technical treatments such as dynamic balancing to ensure rotational stability and component lifespan. Failure in shaft fabrication can lead to imbalance, excessive vibration, and a significant decline in overall system performance. Likewise, the shaft sleeve, as a protective element for the shaft, must also be manufactured with high accuracy in terms of outer diameter and surface roughness to ensure compatibility with the sealing system and prevent leakage.

Therefore, the improvement of maintenance workshop services in this technical context is closely related to strategies structured around three main variables: Customer Focused, Learning and Development, and Reliability. In the Customer Focused aspect, understanding the technical needs of the customer, including specific demands for the final output of shaft and sleeve fabrication, must be managed through the establishment of active three-way communication between service requesters, planners, and executors. This strategy is supported by the completeness of technical documents such as work drawings and dimensional specifications, which are essential to ensure that the work results meet customer expectations.

In the Learning and Development aspect, improving the quality of machine component fabrication, such as shafts and shaft sleeves, greatly depends on the technical competence of the workers. Therefore, knowledge transfer regarding precision turning techniques, tolerance measurement, and specialized training on balancing and surface finishing procedures becomes crucial. In addition to internal training, benchmarking against other advanced units or similar companies can provide valuable insights to adopt best practices that ensure fabrication precision.

The Reliability aspect is enhanced through operational strategies such as equipment rejuvenation, scheduled maintenance, and the availability of materials and supporting tools. In the context of shaft and sleeve fabrication, the reliability of lathe machines, turning operations using CNC machines, precision measuring tools, and quality control documentation systems significantly affect the final success of the work. Routine monitoring and technical reporting not only serve as tools for internal quality assurance but also act as a critical means of technical communication with the customer.

The results of the study found that the NPS value of the company's maintenance workshop services was 57.29%, indicating that respondents tend to provide recommendations to others in using maintenance workshop services, reflecting on research by Baquero [25] which concluded that NPS is very relevant in measuring customer loyalty in service-based services because it can predict sustainable business growth with a positive correlation of 0.72 to customer retention ($p < 0.01$). ICSI calculations show that 86.8% of respondents stated that they were satisfied with the services provided. This aligns with research by Sari & Hermawansyah [20], which stated that a CSI value of >81% is included in the very satisfied category. Gap analysis with the IPA method was then used to evaluate the performance of maintenance workshop services with TQM variables and customer satisfaction through a Cartesian diagram. The indicators obtained in Quadrant I as a priority for improvement are education and training, customer focus, and reliability. This is in line with research by Wulandari et al. [26] that continuous improvement of aspects of workforce education and service reliability contributed significantly to increasing customer satisfaction by 15% in six months. Multiple linear regression analysis shows the influence of TQM and service quality on customer satisfaction. The determination value of the model built is 84.7%. The results of the partial test show that customer satisfaction is influenced by continuous improvement and reliability indicators, with a significance value of <0.05. This is because encourages improving product quality to improve customer satisfaction. Quality improvement is influenced by process reliability, which uses adequate technology and tools. This aligns with research by Triyanto & Kurniawan [27], which emphasizes the importance of continuous improvement in achieving customer satisfaction and the need for technology and innovation support to gain a competitive advantage.

The proposed improvement strategies were implemented on a trial basis during January and February 2025. Sampling conducted in the Machine and Valve repair workshops indicated an increase in service efficiency, particularly in the duration of repair jobs, which is essential for meeting customer demand and expectations. These results suggest that the improvement strategies are effective and applicable for enhancing the system's performance.

4 Conclusions

This study evaluates service quality and customer satisfaction in the maintenance workshop services of the company. The results demonstrate a high level of internal customer satisfaction and identify key areas for strategic improvement and operational efficiency. These are reflected by a NPS of 57.29 and the ICSI reaching 86.9%. The coefficient of determination (R^2) of 84.3% indicates that service quality and the implementation of TQM influence customer satisfaction within the maintenance workshop service context. The IPA identified three primary priority areas for improvement: education and training, customer focus, and service reliability. The implementation of these improvement strategies had a tangible impact on workshop performance. The processing time for the pump shaft fabrication activity (item code 63-GA-6004) was reduced from 30 hours to 15 hours. The shaft sleeve fabrication for the same item code showed a gradual reduction in duration, from 16 hours down to 12 hours. A similar trend was observed in the shaft sleeve fabrication for item code 56-GA-4002, where previous job durations ranged from 10 to 36 hours and were reduced to 5 hours. These improvements demonstrated enhanced process efficiency, strengthened technical skills, and more effective workflow management. Overall, the implementation of the improvement strategies succeeded in reducing the average processing time by 20% and increasing the number of completed jobs to 182 activities within two months, which directly contributed to improved operational efficiency and customer satisfaction.

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