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Service Quality Analysis in Small Maintenance and Repair Company Using Lean Six Sigma Approach

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Abstract

This study examines service quality in a small maintenance and repair company, using lean six sigma to identify problems and identify errors causing inconsistent service quality. The study used a qualitative approach, incorporating descriptive analytics, to analyze data from observations, customer interviews, and employee interviews in CV. ABC. DMAIC framework is used to find the root cause of the problem, and provides best possible suggestions to improve the quality of the company's services. In this study, it was found that the problem that caused the inconsistent level of service quality was a problem in administrative management there were 3 main errors, there are inaccurate expenses tracking, inaccurate invoices, incomplete job documentation. In improve phase that use FMEA, it was found that the company must further improve job documentation to improve service quality because it has the highest Risk Priority Number

Kata Kunci: Lean Six Sigma; FMEA; Kualitas Layanan; Pemeliharaan dan Perbaikan; Manajemen Administrasi

Abstract

Penelitian ini meneliti kualitas layanan di sebuah perusahaan pemeliharaan dan perbaikan bersekala kecil, menggunakan lean six sigma untuk mengidentifikasi masalah dan mengidentifikasi kesalahan yang menyebabkan kualitas layanan yang tidak konsisten. Penelitian ini menggunakan pendekatan kualitatif, dengan menggunakan analisis deskriptif, untuk menganalisis data dari hasil observasi, wawancara pelanggan, dan wawancara karyawan di CV. ABC. Kerangka kerja DMAIC digunakan untuk menemukan akar penyebab masalah, dan memberikan saran terbaik untuk meningkatkan kualitas layanan perusahaan. Pada penelitian ini, ditemukan bahwa masalah yang menyebabkan tingkat kualitas pelayanan yang tidak konsisten adalah masalah pada manajemen administrasi terdapat 3 kesalahan utama, yaitu pelacakan pengeluaran yang tidak akurat, faktur yang tidak akurat, dokumentasi pekerjaan yang tidak lengkap. Pada fase improve yang menggunakan FMEA, ditemukan bahwa perusahaan harus lebih meningkatkan dokumentasi pekerjaan untuk meningkatkan kualitas pelayanan karena memiliki Risk Priority Number yang paling tinggi.

INTRODUCTION

Maintenance and repair service is crucial in every sector of industry as it can increase machine life cycle, reduce machine downtime, cost, quality improvement, enhance quality, and improve production rhythm (Achouch et al., 2022; Zonta et al., 2020). Maintenance and repair industry supports company operations especially in, compliance with health, safety, security, and environmental regulations, enhancing the company's competitiveness (Wardana & Lukitosari, 2024). But in today's competitive business landscape, such companies face numerous operational challenges that can hinder their performance, growth, and sustainability, and it will impact the company's competitive advantage (Farida & Setiawan, 2022), The purpose of operations is to meet customer's satisfaction through products and services that are provided by the company (Gaudenzi et al., 2021), but in the service industry, companies should focus on the goods also as physical evidence that support the service products to enhance company performance (Amalia et al., 2024; Huda et al., 2023; Jurnal et al., 2022).

The research will explore the service quality components of CV. ABC, a small maintenance and repair company in Boja, Kendal, Central Java that was established in 2008. This company offers services like maintenance or repair service for industrial machines such as hot press machines, press dryer machines, sending machines, and other machines in small to medium industries. The company has built a strong track record for providing impeccable services to regional and national clients in different industries throughout the years. The customer comes from plywood, animal food, and construction companies. Despite its record of success, the business has recently faced difficulties in sustaining a constant level of service quality that is indicated by the decrease of company sales in 2023 by 55% from 2022 (Company report, 2023)

Based on interviews conducted with the company owner, the company had only focused on improving performance in production activities, such as adding production machines to improve quality. The company also conducted periodic training for employees so that the company's production process is more effective, efficient, and measurable. This research focuses on the company's consumer side by conducting interviews with customers. Results show that 83% of customers agree that the company provides customized solutions to meet their specific needs. However, this doesn't necessarily mean that the services provided are in line with customer expectations, as evidenced by customer surveys. Based on the customer survey, 67% of customers highlight the company to improve the administrative aspects, such as transparency, clarity, and the amount of the service cost. The company needs to improve their confirmation of the progress of the customers products and improve their consultation process to make the customer easily understand the consultation process. 33% of customers also hope that the company can conduct site visit directly to identify problems that exist with customers, 17% of customers also hope that the company can provide certainty when a spare part is available; and 30% of customers need the company to provide delivery service and a website to reach customers.

Table 1. Survey Table. Explain the results of interview for Survey

Background		Frequency / Month	**< 1**	**1**	**2**	**4**	5
			16,7%	50%	16,7%	16,7%	-
		Type of service	**Make & Repair**	**Make & Maint.**	**Repair**	**Maint.**	**All**
		(Machine Making, Machine Repair, and Machine Maintenanc	33,3%	16,7%	33,3%	-	16,7%
		Years as a customer	**< 1**	**> 2**	**> 5**	**> 8**	**> 10**
				50,0%	16,7%	16,7%	16,7%
Survey Results							
1 = Strongly Disagree 5 = Strongly Agree			**1**	**2**	**3**	**4**	**5**
Service Expectation	Tangibility	Good workplace appearance.	-	-	-	33,3%	66,7%
		Are uniforms necessary for the appearance of our	-	16,7%	33,3%	16,7%	33,3%
	Reliability	Punctuality is important in the completion of work	-	-	-	-	100%
		Our responsibility is necessary in case of failure in	-	-	-	16,7%	83,3%
		Warranty is important to you	-	-	16,7%	66,7%	16,7%
	Responsiveness	Speed in handling problems is important	-	-	-	-	100%
		You prefer to come directly if you can't contact us	-	-	16,7%	33,3%	50%
	Assurance	Information related to technician qualifications is important	-	16,7%	16,7%	33,3%	33,3%
		Information on work progress is important.	-	-	33,3%	50%	16,7%
	Empathy	We meet your specific needs well	-	-	-	16,7%	83,3%
		The solutions we provide match your needs.	-	-	-	16,7%	83,3%
Service Experience	Administrative Aspect	Our invoice has all the information you need	16,7%	16,7%	-	33,3%	16,7%
		We always confirm the progress of the goods	16,7%	16,7%	-	33,3%	16,7%
		You can easily contact us for consultation	-	16,7%	-	50,0%	33,3%

The issue of service quality has been a primary focus in various previous studies, especially in service companies (Yoga Pamungkas, 2023). As a solution to achieve high-quality performance, companies can also implement a lean approach aimed at reducing waste, improving process efficiency, and providing added value to customers (Vanichchinchai, 2022), Lean manufacturing principles, including value identification, waste elimination, and flow generation, reduce lead times, inventories, knowledge management, problem-solving, efficiency, quality, and performance in learning organizations. (Kristensen et al., 2022). In other study (Machingura et al., 2024), Lean manufacturing in service industries improves customer satisfaction, sales, profitability, and business performance. Six Sigma, a systematic process improvement approach, addresses quality issues and enhances efficiency, focusing on sustainability and better results (Truscott, 2003). Six sigma also can be used for stabilize and develop service quality company through the DMAIC (define, measure, analyze, improve, control) approach (Nwagbara, 2020), and enhanced the performance and service quality of the company (Noronha et al., 2023).

The combination of six sigma and lean approach is called Lean Six Sigma (LSS), LSS framework, a combination of Lean value stream mapping and Six Sigma structured problem-solving, and it is designed to facilitate continuous improvement (Trubetskaya, McDermott, & Brophy, 2023). In today's competitive market, LSS is a crucial business strategy aimed at improving the bottom line and customer satisfaction, mistake-proofing, on-time shipping, waste reduction, and consistency (Taghizadegan, 2006). Furthermore, the continued use of six sigma can improve the overall process of the company (Bloj et al., 2020a), and to minimize waste, company can illustrate solutions by reviewing the company's processes, and improving process cycle efficiency, lean six sigma DMAIC approach by evaluating the existing processes (Adeodu et al., 2023). But not only use for product-based industries LSS can be used for service industries, in financial service, organizational performance is increase by lean six sigma

program implementations (Trubetskaya, McDermott, & Ryan, 2023). In another study, it was mentioned that the use of LSS tools in administrative processes, revealing their widespread application across all sectors, that used process maps, SIPOC, and CTQ, it also emphasizes waste identification, stakeholder analysis, and statistical methods like Kruskal Wallis test and x2 test in public administration and healthcare (Ruwanpura et al., 2023).

To support the LSS to evaluating waste or non-value added in the operation of the organization can also incorporate failure modes and effects analysis (FMEA). FMEA offers valuable guidance on reducing lean waste risk and identifying critical waste that impacts company performance (Sutrisno et al., 2020). The literature study uses FMEA to evaluate potential failure modes, prioritize them, and propose corrective actions using a risk evaluation methodology and implementation approach, focusing on component availability with Risk Priority Number (Sagnak et al., 2020). Lean Six Sigma and FMEA methodology can reveal factors causing workplace hazards, demonstrating the effectiveness of these methods in addressing human, equipment, environmental, and system issues (Haekal, 2021). The other study uses fuzzy logic and analytic network processes to identify and assess risks in uncertainty, integrating risk management into process quality evaluation for consistent product or service quality, and links risk with Six Sigma mathematical model. (Kar & Rai, 2024). The use of Lean Six Sigma and FMEA is still limited to the service industry, especially in repair and maintenance companies. The tools have the potential to enhance operational efficiency, reduce occupational risks, and improve service quality, particularly beneficial for small maintenance and repair companies struggling to maintain a consistent level of service quality. This research aims to implement the LSS and FMEA methodologies in CV. ABC by identifying the most dominant activities that cause inconsistent levels of service quality, improve company operations, identify waste and non-value-add activities in the company by analyzing existing processes, and use FMEA to support LSS by evaluating potential failure, find the most significant issue-causing factors based on the RPN, and make the best solutions that are possible to implement in the company to improve and develop the service quality of the company.

RESEARCH METHODS

This study uses qualitative method, by collecting data to analyze the most potential error in the problem, observation to identifying the company process, and interview the customers and the employees of the company for identifying the problem of the company. This study uses purposive sampling with 12 respondents who are customers of CV. ABC (Memon et al., 2024). The data was analyzed using descriptive analytics to describe the results of the qualitative data collection that has been carried out in this study, to obtain comprehensive data results and support existing qualitative findings(Alabi & Bukola, 2023). The structured interview with question for the customers consists of 5 dimensions of service quality such as Tangibles, Reliability, Responsiveness, Assurance, and Empathy (AlOmari, 2021).

This study analysis tools to evaluating the existing company process and find the real problem to help it develop and improve the service quality of the company. LSS and FMEA approaches are used to help develop and improve the service quality by identifying the potential problem, waste, and non-value add activities in the company and found the best possible solutions so company can develop and improve the service quality of company. LSS and FMEA approaches to improve service quality using DMAIC methodology:

Table 2. DMAIC process

DMAIC	Problem analyzed	Tools
Define	Identify the problem that address in interview section with the customers and make it into research outline	Project Charter
Measure	Measure the existing process that focus on error that might appears on company process	SIPOC Diagram
Analyze	Analyze the existing process categorize each activity and find the root causes of the problem	Process Activity Types Table and Fishbone Diagram
Improve	Potential failure and risk and prioritize them based on the Risk Priority Number (RPN),	FMEA
Control	Make a priority risk, and suggest the best possible solution to improve quality service	Table of risk level

RESULTS AND DISCUSSION

RESULTS

Define

The define phase of this study uses Project charter to explain the problem statement of the study, project scope of the study, Objectives of the study, Key Process Measurement, Timeline, Deliverables, Leveraging Opportunities, and Key Stakeholders. The details can be seen on Table 3.

Table 3. Project Charter

Problem Statement	Project Scope	Objectives	Key Process Measurement
The company faced challenges in administrative management, where customer requests were directly forwarded to mechanics without proper record keeping by the administration.	Develop a more organized administration system to ensure all jobs are properly recorded and improve communication between the administration and the mechanic team	• Improve administrative management. • Integrate existing data from to optimize company operations. • Improve communication between production and administration teams with tools.	• Job document-tation rate • Invoice accuracy rate • Expense tracking rate

Timeline		Deliverables	Leveraging Opportunities	Key Stakeholders
Define	October, 1	• Job record form • Process data • Process steps • Integrated job data • Internal Information	• Tools • Standardized work flow • Project plan • Achieve Operational Excellence by improving performance	• Owner • Adminis-tration • Mechanics • Customers
Measure	October, 5			
Analyze	October, 26			
Improve	November, 16			
Control	November, 27			

Measure

The second step in DMAIC method is measure, to do this researcher uses SIPOC (Supplier, Input, Process, Output, customers) diagram that show 3 types of risk in administration management error, this diagram addresses job documentation error such as uncomplete job documentation, inaccurate invoice, and the last one is inaccurate expanses.

Analyze

In analyzing phase this study using table that explain operational activities in CV. ABC from customer request to customer payment and categorize each activity into 3 types of activity the first one is value-added (VA) activity, essential non-value added (ENVA), and non-value-added (NVA).

Table 4. Process activity types

Sequence	Activity	Proof	Types	Risk
1.	Received customer request		VA	
2.	Give feedback to customer request		VA	
3.	Mechanic and customer do consultations		VA	1
4.	Customer request to doing problem survey		VA	
5.	Mechanic doing the problem survey		VA	1
6.	Mechanic doing problem identification		VA	
7.	Mechanic doing problem confirmation		VA	
8.	Mechanic list the required spare parts		VA	
9.	Administration making offer latter		ENVA	1
10.	Customer accepted the offer latter		VA	
11.	Mechanic order spare part from suppliers		VA	
12.	Mechanic pick-up the ordered spare parts		NVA	
13.	Spare parts arrived		ENVA	3
14.	Workmanship process		VA	1
15.	Workmanship process successful		VA	
16.	Mechanic creates delivery note	Delivery note	ENVA	1
17.	Product delivered to customer		VA	
18.	Customer doing machine test		VA	
19.	Machine test successful		VA	
20.	Administration and mechanic compile product prices		ENVA	2
21.	Administration make invoice		ENVA	2
22.	Administration sends invoice to customer	Invoice receipt	ENVA	2
23.	Customer pays the invoice	Transfer receipt	VA	2

This study also used Fishbone diagram (Figure 1.) to analyze the root causes of each administration error there are 4 categories that use on the fishbone diagram there are People, Process, Technology, and Policies.

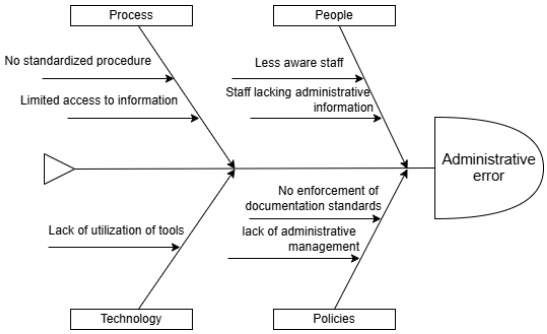

Figure 1. Fishbone diagram of Administrative Error

Improve

To find the highest risk in the improve phase used FMEA (Failure Mode and Effects Analysis) to get RPN (Risk Priority Number) of each administrative error that address in analyze phase. In this phase, failure mode was address on define phase, cause of failure was address on fishbone on Figure 1. There are 3 indicators to find the RPN the first one is S (Severity), O (Occurrence), D (Detection).

Table 4. Failure modes and effects analysis of Administration error

Failure Mode	Effect of Failure	Cause of Failure	Recommended Action	S	O	D	RPN
Inaccurate expenses tracking	Potential company loss Unrealized financial records	• Lack of awareness • No standardized • Lack of utilization of tools • No clear guidelines	On the job training Create SOP Using check box Create SOP	7	8	6	336
Inaccurate invoice	Under-charging/ Overchargeing lost customer trust	• Lack of information • Depends on mechanics • Lack of administrative management • Manual without error checking tools	Job record form Data digitalization Create SOP Using review option on excel	9	4	6	216
Incomplete job document-tation	Customer disatisfactions Unable to track job status	• Lack of awareness • No defined process • Lack of utilization tools • No enforcement	On the job training Create SOP Job record form Create SOP	7	9	8	504

Control

Based on following phase, risk level table is used in control phase to highlight the results on every phase Based on risk table on Table 5. address that highest risk is incomplete job documentation that have 504 points with high risk level.

Table 5. Risk Level Table of Administration Management Error

Risk	Category	RPN	Risk Level	Pareto	Improvement
Incomplete job documentation	Operational	504	High	18% are the cause of administrative errors	On the job training, Create SOP, Job record form
Inaccurate expenses tracking	Financial	336	Medium	45% are the cause of administrative errors	On the job training, Create SOP, Using check box
Inaccurate invoice	Financial	216	Low	36% are the cause of administrative errors	Job record form, Data digitalization, Create SOP, Use review option on excel

DISCUSSION

Based on the results, this research uses a project charter in Table 3. to find problems that exist at CV. ABC based on a customer survey where 67% of customers highlight the company to improve the administrative aspects, which is the main focus of this research (Bloj et al., 2020b). After conducting observations and interviews with key stakeholders of CV ABC, the company faced challenges in administrative management, where customer requests were directly forwarded to mechanics without proper record keeping by the administration, with the project scope to develop a more organized administrative system to ensure all work is properly recorded and improve communication between the administration and the mechanics team, the other study says that communication is crucial in controlling activities, and its effects administrative management performance (Huiza et al., 2023).

SIPOC diagram is used to measure administrative errors that exist in the existing process at CV. ABC (Silalahi1 & Pasaribu2, 2024), there are 3 errors that exist in the existing process at CV. ABC, namely uncomplete job documentation, inaccurate invoices, and the last one is inaccurate expanses. Process activity types in Table 4. is used for the next phase, namely the analysis phase that explains operational activities in CV. ABC by listing the activities in CV. ABC from customer request to customer payment, the author and CV. ABC employees categorize each activity (Rosyid et al., 2024), there are 3 types of activities, the first one is value-added (VA) activity, second one is essential non-value added (ENVA), and the last one is non-value-added (NVA) (Klosova & Kozlovská, 2021). Fishbone diagram Figure 1. is also used in the analysis phase (Niemann et al., 2024), and it is found that the causes of the administration error are lack of utilization tools to help the process, there is no clear guidelines or Standard Operating Procedure (SOP), low awareness of the importance of administrative management, and limitations to access the administrative information.

The improve phase is aimed by calculating the RPN of each error that has been found in the measure phase as a fealure mode, which contains Incomplete job documentation, Inaccurate expenses tracking, Inaccurate invoice (Kar & Rai, 2024). Researchers and CV. ABC employees identify the Effect of Failure, Cause of Failure, Recommended Action, and determine the values for S (Severity), O (Occurrence), D (Detection) for each fealure mode (Alijoyo et al., n.d.). Based on Table 4. the highest RPN is Incomplete job documentation that

has 504 points, the highest severe of the failure's effect is Inaccurate invoice, the very likely failure is to occur is Incomplete job documentation, and the very hard to detect the failure is Incomplete job documentation.

Risk level table of administration management error in Table 5. Is used in control phase, Table 5. is the result of the analysis of Table 4. data which is used to rank what types of errors should be prioritized by CV. ABC to improve the administrative management in order to improve the service quality of CV. ABC (Hu & Salim, 2023). Based on Table 5. this study suggest that company have to doing on the job training for the staff about how important is job documentation, creating SOP to state clearly what staff have to do for job documentation, the company can use job record form as a tool to help the job documentation that contain executive summaries of customer request, what raw material that have to use, the timeline, the job information, customer information.

CONCLUSIONS AND RECOMMENDATIONS

Lean Six Sigma is powerful tool to address problem and make improvement to company operational. In this study Lean Six Sigma is used to help to develop service quality that focusing on administrations management in maintenance and repair company CV. ABC. Each phase of DMAIC that mention in this study describes how Lean Six Sigma is used, by identify the main problem, find the root cause of the problem, and suggested company how to solve the problem with best solution to improve the service quality by improving the administration management of the company. This study suggested company to more focus on job documentation to develop administration management. From the result this study underlines the root cause of the problem are lack of utilization tools to help the process, there is no clear guidelines or Standard Operating Procedure (SOP), and low awareness of the importance of administrative management. This study recommend company to on the job training, create SOP, Job record form, company can also use kanban board to get a clear project overview status. Based on results and discussion, administrative management is very important to do in service company such as CV. ABC to develop their service quality, administrative management helps company to dataset their job orders, expenses, invoices that can help company to measure their process performance, evaluate their operations process, and improve their operations process based on data.

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