

Optimizing Quality Management Systems in Manufacturing: Internal and External Defects Minimization Strategies Case

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Abstract

This study examines the efficacy of the Quality Management System in a paint manufacturing setting, with a specific emphasis on reducing both internal and external defects. The research examines the dedication of senior management, the correlation between cost and quality, and obstacles to the sustainable operation of the Quality Management System (QMS) in order to tackle the ongoing problem of faulty products. The study employs a mixed-method approach, combining quantitative analysis of employees' perspectives from different branches with qualitative evaluation of internal rejects and customer complaint processes. The findings indicate that there are varied opinions about the level of dedication from senior management towards the Quality Management System. It is also evident that there are significant financial consequences associated with quality failures. Additionally, there are notable obstacles that hinder the long-term viability of the QMS, such as employees' comprehension and training. Suggested measures involve increasing the involvement of senior executives, enhancing the training program for Quality Management System, and establishing well-defined channels for communication. Future research should expand the range and comprehensiveness of Quality Management System (QMS) studies, investigating different models and their influence on staff training, commitment from leadership, and organizational culture in order to strengthen the effectiveness of QMS.

Keywords

Quality Management System, Operations Efficiency, Internal Defects, External Defects, Organizational Performance

1. Introduction

Every year, the market experiences a number of product recalls and consumer advisories concerning manufactured goods that display notable defects (Mukherjee et al. 2021; Nicol 2021). These products, which have been identified as potentially dangerous or not meeting the established quality standards, need to be removed from the market. Afterward, they are sent back to the manufacturing entity for either replacement or refund, guaranteeing consumer safety and compliance with quality standards. Wolniak (2019) and later Sanchez-Lizarraga et al. (2020), creating a management system based on the criteria of International Organization and Standardization (ISO) 9001 offers a basis for an organization to define customer requirements and use the principles of customer focus, process approach and evidence-based decision-making to meet and develop these requirements and improve (Salim et al. 2019), therefore countering the production of defective products. This implies that the organization has guaranteed that the client requirements are identified and that the structure of the item meets the necessities. The controls, screens and measures are the procedures utilized all through the company to ensure they are working as arranged, if not to address any issues (Mok and Chowdhury 2019).

1.1 Problem Statement

Despite the implementation and rigorous enforcement of a quality management system by Company X, the company is still grappling with the persistent issue of producing defective products. These non-conforming goods do not meet the established process and product specifications, and as a result, continue to reach the end consumers. This ongoing problem is contributing to a significant increase in performance costs, which, in turn, has led to substantial job losses and a decline in the company's market share. Identifying and understanding the underlying issues related to process and product quality is crucial for Company X, as it will bolster efforts to rectify the situation and mitigate the production of defective goods.

1.2 Research Aim, Questions and Objectives

The purpose of this research is to scrutinize the effectiveness and pinpoint deficiencies within the Quality Management System, thereby evaluating its impact on organizational performance. Implementing these principles is instrumental in creating products and services that are safe, reliable, and of high quality. These principles are pivotal in boosting productivity by reducing errors and waste. They facilitate the entry of products into different markets and promote the development of global trade on an equitable basis. Moreover, these standards play a crucial role in safeguarding consumers and end-users of products and services by ensuring that certified products meet internationally established minimum standards.

The objectives of this study are established to achieve the following: (1) To identify and understand the commitment of senior management towards the Quality Management System, (2) To assess the relationship between cost and quality in the context of an effectively implemented Quality Management System within the organization, and (3) To identify barriers that impede the sustainable operation of a Quality Management System.

Building on these objectives, the study aims to address and provide answers to the ensuing research questions: (1) How does the commitment of top management influence the effectiveness of the Quality Management System? (2) What is the impact of an efficiently applied Quality Management System on the quality-related costs within an organization? And (3) What are the primary factors that obstruct the sustainable implementation and operation of a Quality Management System?

1.3 Limitations of the Study

Like any academic investigation, this research report is bound by specific constraints, which the researcher acknowledges but could not manipulate (Ross & Bibler Zaidi 2019; Abbadia 2022; Viera 2023). Initially, the data is obtained from a comparatively limited sample size, thus the conclusions drawn may not be entirely definitive as they do not encompass the viewpoints of all employees at Company X. This constraint gives rise to concerns regarding the applicability of the study's findings. Furthermore, the reliability of the data could depend on the specific Quality Management System (QMS) model used. Given the circumstances, the selected Quality Management System (QMS) model may not have been optimally aligned, potentially impacting the results of the study. Furthermore, the research fails to provide specific information regarding the time it takes for Company X to handle complaints, instead assuming that their response times are not timely. This assumption introduces a degree of subjectivity and uncertainty, as it lacks empirical evidence or precise time measurements.

1.4 Significance, Rationale and Background of the Study

The study's findings offer significant benefits to Company X, particularly in the context of the company's commitment to meeting or surpassing customer expectations—an essential factor for its survival in a highly competitive market. The integration of an effective Quality Management System (QMS) into the company's business processes is justified by the necessity to produce high-quality products. The insights provided by the results are invaluable; they not only elucidate the manner and reasons certain business processes may hinder the production of high-quality final products but also assist the organization in establishing, maintaining, and continually enhancing these processes. Consequently, this contributes to the overall efficiency and performance improvement of the organization.

2. Literature Review

The long-term success of a business depends on its ability to provide high-quality products and services. The International Organization (ISO) assists organizations worldwide by utilizing ISO 9000 as a universal quality standard guideline. Implementing a Quality Management System (QMS) ISO 9001 enhances the performance of an industry by promoting a systematic approach and meeting both industry standards and customer requirements. This contributes

to the production of products that meet parameters such as comfort, safety, and quality (Ingason 2015). The purpose of the research is to evaluate the effectiveness of the quality management system in identifying and addressing both internal and external failures. This is achieved through the analysis of the writing, which helps to identify the areas where the issue may be located within the framework according to Ramphal (2015).

The environment of an organization always influences any course of action taken. The organization's scope and direction are determined by the environment in which it operates (Saleem 2011). ISO 9001 clause 4 focuses on the context of the organization hence directly related to internal and external customer satisfaction. The organization must isolate, review, and monitor all internal and external forces that directly affect its ability to achieve the intended purpose of its Quality Management System (QMS).

2.1 Understanding the Organizational Context and Competitor Analysis

As highlighted by Biswas (2019), for an organization to be in compliance with Requirement 4.1 of ISO 9001:2015, it is essential for the organization to have a comprehensive understanding of the challenges that are posed by external factors, particularly competition. Duchek (2020) noted that resilience and adaptability are characteristics that can be exhibited by an organization when it is able to respond to the emergence of new competitors in the market in a manner that is both effective and economical. William Ford emphasizes that in order to maintain market dominance, it is essential to identify competitive forces and respond to them in a strategic manner (Kotler and Armstrong 2021).

2.2 The specifications and anticipations of the clientele

Understanding and satisfying the requirements and expectations of relevant parties, particularly customers, is essential in accordance with the requirements outlined in requirement 4.2 of the ISO 9001:2015 standard (Andres-Jimenez et al. 2020). The standard emphasizes the significance of incorporating quality into all of the processes that are carried out by the organization in order to not only meet but also surpass the expectations of the customers, leading to the development of a robust and devoted relationship between the organization and its clientele (Evans 2011).

One of the most important aspects of ISO 9001:2015 is customer satisfaction, and performance evaluation is an essential component in gaining an understanding of and successfully meeting the expectations of customers. There are a number of approaches that are utilized in order to ascertain and guarantee that customers are content with the products and services offered by the organization (Nolan 2018). These approaches include warranties, feedback, surveys, and reports.

2.3 Human Participation and Involvement in Organizations

According to ISO 9001:2015, a significant emphasis is placed on the engagement of people in order to effectively fulfill the requirements of customer satisfaction (Keen 2018). In spite of the fact that the standard devotes a significant amount of attention to the satisfaction of customers, it only makes a passing reference to the involvement of employees, which indicates that there is room for improvement in the field of quality management (Janion 2019).

When it comes to the successful implementation of quality management practices, the inclusion of workers is widely acknowledged as a crucial determining factor (Seyedi et al. 2019; Stanojeska et al. 2020; Khalid et al. 2022). According to Bakotić and Rogošić (2015), the participation of workers is an essential component in the successful implementation of a process approach, a system approach to management, continuous improvement, and a factual approach to decision-making within an organization.

2.4 Managing risks within quality management systems (QMS) is the sixth point.

Introducing a more nuanced understanding of risk, ISO 9001:2015 relates it to the uncertainty that comes with achieving quality management system objectives (Shields 2023). Ispas et al. (2023) stress that the standard encourages organizations to identify, analyze, and respond to opportunities and risks in a proactive manner. It does this by promoting a risk-based thinking approach (Ispas et al. 2023; Dellana et al. 2019). This strategy encompasses every aspect of the organization, thereby improving the capacity for decision-making and the accomplishment of goals through its implementation (Tomic and Spasojevic Brkic 2019).

Within the framework of the quality control program, it is of the utmost importance to effectively communicate risks, both domestically and internationally (Mostafa 2019; Ab Wahid 2019; de Carvalho and Dumke de Medeiros 2021).

One of the most important aspects of a comprehensive risk management strategy is making certain that all relevant personnel are kept informed about residual risks even after risk management measures have been put into place.

2.5 Planning for the future and conducting a SWOT Analysis

When it comes to aligning with the standards of ISO 9001:2015, strategic planning, which includes the use of tools like SWOT analysis, is absolutely necessary (Hrbáčková & Tuček 2019; Barbosa et al. 2021; Toke and Kalpande 2021; Martins et al. 2021). Organizations are able to take preventative measures to mitigate potential impacts by identifying and planning for risks and opportunities (Barbosa et al. 2021; Toke and Kalpande 2021; Martins et al. 2021). This helps to ensure that customers have access to products and services of a high quality and that they are consistently available (Barbosa et al. 2021).

2.6 An Integrative and Holistic Method of Quality Management

As cited by Ramdass and Masithulela (2018), Naveh (1999) relates that it is imperative to recognize the equal importance of other elements such as people involvement, leadership, process approach, systematic management, factual decision-making, continuous improvement, and mutually beneficial supplier relationships in order to achieve a holistic and effective quality management system. Although customer focus is a key component of the ISO 9001 framework, it is also essential to acknowledge the importance of other elements.

2.7 Internal and External Costs of Failure

According to Ramakrishna and Alzoubi (2022), internal and external failure costs pertain to the costs incurred due to defects that are detected before the product is delivered and those that are identified after the customer has received the product, respectively. These costs arise from the failure to fulfill the explicit requirements or implicit needs of the customer, both internally and externally (Alglawe et al. 2017).

The literature (Machowski and Dale 1998; Love and Li 2000; Kazar et al. 2022) cites possible components of internal failure costs as (1) waste which refers to the presence of unnecessary work or the accumulation of stock caused by errors, inadequate organization, or ineffective communication; (2) scrap which refers to faulty products or materials that are irreparable and cannot be used or sold, (3) revision or rectification which refers to a process that entails the correction of flawed materials or mistakes. External failure costs may encompass (1) complaints which include all the activities and expenses involved in managing and addressing customer grievances, (2) encompassed in this are the management and examination of products that have been rejected or recalled, along with the accompanying expenses for transportation (Kent, 2016; Vaklifard and Khozein 2012).

3. Methodology

The study makes use of a mixed-methods approach, which incorporates both qualitative and quantitative research methodologies throughout its course. For the purpose of providing a structured and statistical analysis of the data, the quantitative approach is utilized to quantify opinions, thoughts, and other defined variables, according to Wisdom and Creswell (2013). When compared to the quantitative approach, the qualitative approach is utilized to acquire a profound comprehension of individual experiences, thoughts, opinions, and trends. This approach provides a perspective that is more nuanced and interpretive as noted by Wisdom and Creswell (2013). For this study, secondary data from reports reflecting the internal and external failure cost from four branches, namely Johannesburg (JH), Cape Town (CT), Durban (DBN) and Port Elizabeth (PE), were reviewed and analyzed.

The research sample is comprised of fifty employees who were chosen at random from a total of four different branches. During the process of analyzing the data, the objective is to provide a meaningful description, demonstration, or summary of the information, which will allow for the identification of patterns and insights as explained by Willemsse (2009). When it comes to this particular study, descriptive statistics are utilized to analyze and interpret the data, thereby presenting the findings in a manner that is both clear and understandable.

The study used a structured questionnaire with three sections to holistically assess the organization's Quality Management System (QMS). Section 1, "Quality Management System (QMS) Sustainability and Policy," examined QMS's longevity and guiding principles, including Q-1's sustainability, Q-2's quality policy support, Q-3's promotion of continual improvement, Q-4's practice, and Q-5's impact on improvement programs. Section 2, "QMS Efficacy and Organizational Learning," assessed QMS's ability to enable improvements (Q-6), provide tools (Q-7), reduce rejects (Q-8), learn from mistakes (Q-9), and address recurring issues (Q-10). Section 3, "Organizational Culture and Engagement in QMS," examined QMS's cultural aspects, including a quality culture (Q-11), its integration throughout

the organization (Q-12), open and honest communication (Q-13), senior management involvement (Q-14), and staff QMS training (Q-15).

Participants could rate their agreement with the statements on a 5-point Likert scale from 'Strongly Disagree' (1) to 'Strongly Agree' (5). This scale helped capture employees' complex views on the company's QMS implementation and related issues.

The results are presented in the form of graphs and tables, which represent the data that was collected and provide a visual interpretation of the findings. A validation of the analysis that is presented in this paper is carried out with the assistance of Microsoft Excel 2016, which guarantees the accuracy and dependability of the findings.

4. Findings and Discussions

4.1 Findings from the Quantitative Analysis

Section 1: QMS Sustainability and Policy

QMS sustainability and policy survey results are cautiously optimistic about the organization's QMS integration as shown in Figure 1 and Table 1 below. Despite 36% disagreement, Q-1 respondents' mean response score on QMS sustainability was 3.22. In Q-2, organizational support for a sustainable quality policy is highly rated (90%), with a mean score of 4.10. Q-3 also shows a 94% agreement rate and a mean of 4.18 in the policy's role in promoting continuous improvement. In Q-4, opinions on continual QMS principles are divided, with a mean of 3.04 and 46% dissenting. In Q-5, which has a mean score of 4.20, there is unanimous agreement that QMS improves performance improvement programs. This indicates staff acceptance and implementation of QMS, demonstrating a consensus on its benefits.

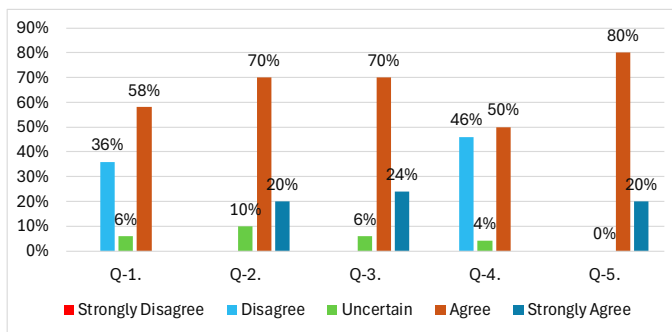


Figure 1. Frequency Distribution for Section 1

Table 1. Section 1 – Mean and Std. Dev

Section 1	Mean	Std. Dev
Q-1.	3,22	1,5946
Q-2.	4,10	2,0711
Q-3.	4,18	2,0251
Q-4.	3,04	3,1839
Q-5.	4,20	1,6562

Section 2: QMS Efficacy and Organizational Learning

The data in Section 2 on QMS Efficacy and Organizational Learning provides a multifaceted view of quality management in the organization as depicted in Figure 2 and Table 2. Q-6 shows that respondents recognize QMS's role in improving, with a mean score of 3.54, but 20% disagree. Q-7, with a high mean score of 4.18 and 96% agreement, shows QMS's provision of quality enhancement tools. In Q-8, QMS's effectiveness in reducing rejects is criticized, with 90% disagreeing and a mean score of 2.00. This emphasizes the need for QMS improvement. Q-9 shows 60% disagreement and a mean score of 2.74 for organizational learning skepticism about learning from past mistakes. Q-10's mean score of 4.20 indicates that recurring organizational issues warrant further attention.

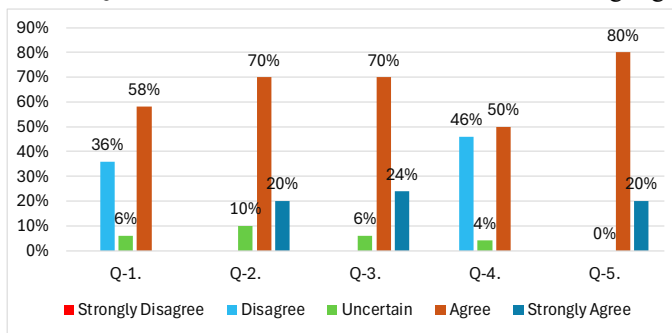


Figure 2. Frequency Distribution for Section 2

Table 2. Section 2 – Mean and Std. Dev

Section 1	Mean	Std. Dev
Q-6.	3,54	1,2887
Q-7.	4,18	1,0115
Q-8.	2,00	0,6389
Q-9.	2,74	1,6989
Q-10.	4,20	0,8853

Section 3: QMS Efficacy and Organizational Learning

Section 3 examines Organizational Culture and Engagement in QMS, where opinions differ as shown in Figure 3 and Table 3. For Q-11, 60% of respondents say the organization has a good culture, but 40% disagree, suggesting that the culture may not be widely recognized or valued. The response to Q-12 shows a large 90% dissent, suggesting that the quality culture may not be consistent across the organization. Q-13 shows that 86% of respondents deny open and honest communication, suggesting communication issues. Q-14 shows that 60% of participants do not think senior management is involved enough in the QMS drive, suggesting a leadership-quality management disconnect. Finally, 70% disagreed on Q-15, indicating a need for better QMS training for staff. These responses, with mean scores of 2.18 to 3.20 and moderate standard deviations, indicate widespread uncertainty or dissatisfaction with the organization's quality culture and communication.

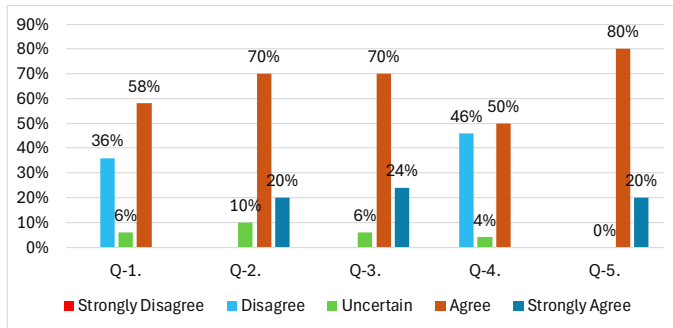


Figure 3. Frequency Distribution for Section 3

Table 3. Section 3 – Mean and Std. Dev

Section 1	Mean	Std. Dev
Q-11.	3,20	1,6562
Q-12.	2,20	1,1815
Q-13.	2,18	1,2540
Q-14.	2,66	1,5775
Q-15.	2,54	1,5948

4.2 Findings from the Qualitative Analysis

Internal Failures – Rejects and Costs

The Johannesburg branch had the most internal rejects, 46 from January to October. The highest rejection rates were 9 and 10 in January and August. These rejects cost the Johannesburg site R2.5 million, or R280,000 per month in lost sales revenue.

Cape Town produced two rejects every other month from January to September, totaling 8. June saw three rejects, the peak. Financial analysis showed that these internal rejects cost the Cape Town site R334,000 over five months, meaning a monthly sales revenue loss of R69,000.

In contrast, the Durban site had only 3 internal rejects from January to September, a trend of one reject every third month. These rejects at the Durban site cost R169,000 for three months, resulting in an R56,000 monthly sales revenue loss.

Port Elizabeth had 6 internal rejects from January to June, one per month. This site had the second-lowest internal reject rate. The financial impact was R225,000 over four months, with a potential monthly sales revenue loss of R56,000.

Internal Failures – Rejects and Costs

The qualitative review included an examination of customer complaints processed through the organization's call center and logged within the HEAT system. Each complaint undergoes a thorough laboratory evaluation to verify its validity.

When a complaint is validated, the Site Field Technical Manager (SFTM) is responsible for initiating a quarantine/withdrawal request, documented on a 'Faulty Product Quarantine & Withdrawal Notice', which is then communicated to the National Field Technical Manager (NFTM) along with an initial investigation report.

Subsequently, the SFTM engages with the Development Manager to assess the feasibility of reworking the product. The course of action is determined by the specific nature and severity of the non-conformance.

Conversely, if a complaint is deemed unjustified, the SFTM must relay the findings to the Technical Support Center (TSC), which then informs and works with the customer to conduct further tests and finalize the investigation.

The analysis of complaint data indicated Johannesburg as the site with the highest number of logged complaints, succeeded by Durban, Cape Town, and Port Elizabeth in descending order as shown in Figure 4 below. From January to October, a total of 3,040 complaints were recorded across all sites, but only 32 were substantiated as faults attributable to the company, leading to the withdrawal of the affected stock.

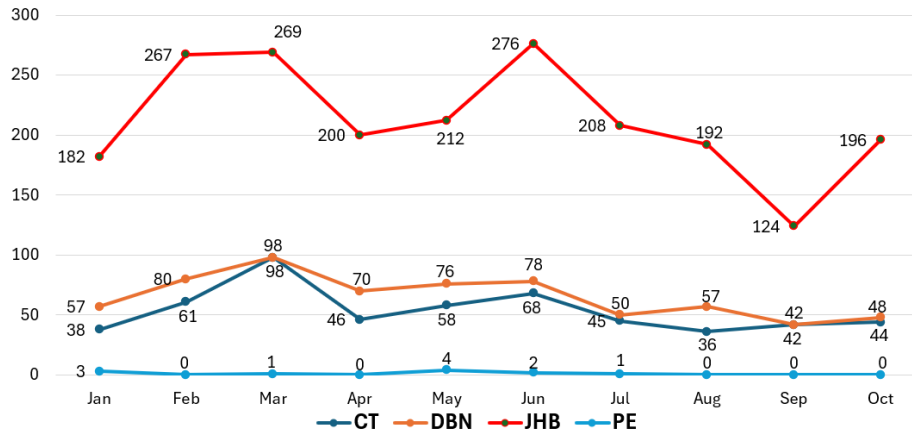


Figure 4. Complaints Trend Analysis

4.3 Discussions

The main drawback of pursuing ISO 9001:2015 QMS certification is the exclusive focus on meeting customer requirements. (Figure 4). Although this strategy may result in a greater portion of the market being captured, it fails to consider other crucial tenets of the quality management system. Company X finds customer demand and adherence to the ISO 9001:2015 standard to be motivating factors, although their endeavors in this realm seem to be minimal. ISO 9001:2015 certification is widely regarded as an essential requirement for businesses, often leading them to pursue it even when choices are limited. This is supported by Neely et al. (1995) and more recently by Urbaniak et al. (2021), Marco et al. (2021), Janjić et al. (2022), Poligkeit et al. (2023), and Pathak and Kothari (2024) who stated that that original equipment manufacturers (OEMs) require ISO certification for business transactions.

The results are consistent with previous studies and criticisms of ISO 9001:2015, as mentioned by Neely et al. (1995), and later by Gryna and Juran (2001). According to this study, Company X's reputation improved after certification, as depicted in Figure 2 (refer to Q-7), quality management system has successfully improved processes and product quality.

Nevertheless, consumers are still receiving products of inferior quality due to the staff at Company X having a limited comprehension of QMS. The lack of sufficient training and proper initiation into the system results in the continuation of the same problems, as demonstrated by Figure 2 (refer to Q-8 and Q-10) and Figure 3 (refer to Q-15). Furthermore, there has been an increase in failures at different company sites, which can be attributed to a lack of strict adherence to QMS protocols.

5. Conclusion and Recommendations

5.1 Conclusion

The study investigated the dedication of top-level executives, the correlation between expenses and excellence, and the obstacles to establishing a durable Quality Management System (QMS) within an organization. The study conducted both quantitative and qualitative analyses to determine the varying perceptions of senior management's dedication to Quality Management Systems (QMS). It also emphasized the financial consequences of QMS inefficiencies, specifically in relation to internal rejects and the resulting costs. The city of Johannesburg experienced the most substantial financial repercussions in this regard.

The research identified significant barriers to the long-term viability of the Quality Management System (QMS), such as employees' inadequate comprehension of the QMS, inadequate training, and inconsistent compliance with QMS

protocols. These challenges are worsened by differing interpretations of quality culture among different levels and locations within the organization.

5.2 Recommendations

The study's findings and conclusions suggest the following ways to improve the QMS and organizational performance:

- Enhance senior management skills Prestige and dedication: Senior executives should participate more in QMS initiatives. Actively participating in QMS activities, supporting quality improvement initiatives, and communicating the importance of QMS in the organizational strategy can achieve this. This would boost top-level dedication and promote excellence throughout the organization.
- Improve QMS training and understanding for staff: Ensure that all employees, especially new hires, understand QMS principles, practices, and benefits through extensive training. Training should be ongoing and flexible to meet changing standards and company needs. QMS execution and longevity require a well-informed workforce.
- Clear communication channels: Open and transparent communication channels allow QMS process and modification information to be shared freely. This will ensure that all employees understand quality standards, their QMS responsibilities, and their role in the system's success.
- Regularly inspect and evaluate QMS: Regularly assess the Quality Management System (QMS) to identify and fix inefficiencies. In order to prevent internal rejections and customer complaints, this should involve investigating their causes. The Quality Management System will remain relevant and effective with regular audits.
- Foster a high-quality, unified culture: Develop an organizational culture that values quality across all departments. This involves incorporating quality goals into the corporate mission, rewarding quality achievements, and encouraging proactive quality improvement.
- Maximize cost-quality trade-off efficiency: Examine the cost-quality relationship to find areas where cost can be cut without compromising quality. Cost-effective quality control can boost efficiency and profitability.
- Take on Site-Specific Challenges: Address each location's unique challenges and shortcomings identified by the internal failure analysis. Individualized approaches must be developed for each location to address specific challenges and improve QMS efficiency.

To overcome the limitations, future research should broaden and deepen Quality Management Systems (QMS) studies. The findings could be applied to Company X's employees or multiple organizations by increasing the sample size. Comparing QMS models across settings can reveal best practices and adaptable principles. Data on Company X's complaint resolution times will make the study more accurate and objective. QMS effectiveness must also be examined in relation to staff training, leadership commitment, and organizational culture. Such extensive research would provide valuable insights and practical solutions for improving QMS in organizations.

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