A study on Challenges in Maintaining Product Quality During the Manufacturing Process of Sunflower Refined Oil with Special Reference to Jayem Automotives Pvt. Ltd., Coimbatore

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ABSTRACT

This study focuses on analysing the challenges faced in maintaining product quality during the manufacturing process, with special reference to Jayem Automotives Pvt Ltd., Coimbatore. Product quality plays a critical role in ensuring customer satisfaction and organizational performance. The research examines key factors such as process complexity, employee training and competency, technology integration, and defect rate. The study is based on primary data collected through structured questionnaires from employees and supported by secondary data sources. Statistical tools like percentage analysis, chi-square test, correlation, and t-test were used for analysis. The findings reveal that process complexity and technological changes significantly impact product quality, while employee training and awareness contribute positively. The study concludes that simplifying processes, improving training programs, and strengthening quality control measures can enhance overall product quality.

Keywords: Product Quality, Manufacturing Process, Process Complexity, Training.

Introduction

Product quality is a key factor in the success of any manufacturing organization, as it directly affects customer satisfaction, brand reputation, and profitability. In today's competitive environment, companies must ensure that their products consistently meet required standards throughout the entire manufacturing process. Manufacturing involves several stages, including raw material selection, production, inspection, and packaging. Maintaining quality at each stage is challenging due to factors such as process complexity, human errors, machine issues, and environmental conditions. Even small deviations can lead to defects, increased costs, and reduced customer trust. Process complexity is one of the major challenges in maintaining product quality. As manufacturing systems become more advanced and involve multiple steps, it becomes difficult to ensure consistency and accuracy. Employees may face difficulties in handling complex procedures, leading to delays and errors. Employee training and

competency also play an important role in quality management. Well-trained employees can effectively manage tasks and reduce mistakes, while lack of training may result in poor quality outcomes. Similarly, technology integration improves production efficiency and accuracy but may create challenges such as system failures and the need for continuous updates. Another important factor is defect control. Organizations must monitor and reduce defects through effective quality control measures to ensure that only high-quality products reach customers. This study focuses on analysing the challenges in maintaining product quality in the manufacturing process at Jayem Automotives Pvt Ltd., Coimbatore. It aims to provide insights into improving quality standards by addressing issues related to process complexity, employee training, technology, and defect rate.

Objectives of the Study

- To analyse the challenges in maintaining product quality in manufacturing
- To evaluate the impact of process complexity on product quality
- To assess employee training and competency levels
- To understand the role of technology in maintaining quality
- To examine defect rate and quality control measures
- To provide suggestions for improving product quality

Literature Review

Maintaining product quality is a key concern in modern manufacturing, as it directly impacts efficiency, competitiveness, and customer satisfaction. Existing studies highlight that technological advancements and process complexity play a major role in influencing product quality.

Kumar, Bhamu, and Sangwan (2021) identified challenges in implementing Industry 4.0, such as lack of skilled workforce and infrastructure, which can affect quality outcomes. **Similarly, Sousa and Nazarenko (2022)** emphasized the concept of Zero Defect Manufacturing, suggesting that continuous monitoring and data-driven approaches can help reduce defects and improve quality.

Research by **Powell and Myklebust (2022)** indicates that traditional quality management methods like Lean and Six Sigma need to be integrated with modern digital technologies to achieve better results**.**

Liu and Liu (2020) highlighted the importance of employee training, stating that skilled workers are essential for handling complex manufacturing processes and maintaining consistent quality. Furthermore, studies on technology integration show that while advanced systems improve accuracy and efficiency, they also introduce challenges such as system complexity and the need for continuous updates**.**

Sundaram and Zeid (2023) found that artificial intelligence can enhance quality inspection by reducing human errors and improving detection accuracy. Overall, the literature suggests that product quality is influenced by factors such as process complexity, employee competency, technology integration, and

defect control. Effective management of these factors is essential for maintaining consistent product quality in manufacturing industries.

Research Methodology

This study adopts a **descriptive research design** to analyse the challenges in maintaining product quality.

- **Data Collection:**
  - Primary data: Questionnaire from employees
  - Secondary data: Journals, company reports
- **Sampling Method:** Convenience Sampling
- **Sample Size:** 120 respondents
- **Tools Used:**
  - Percentage Analysis
  - Chi-Square Test
  - Correlation Analysis
  - T-Test

These tools helped in identifying relationships between variables and evaluating the impact of different factors on product quality.

Table 1.1
Respondents Process Complexity and Product Quality

S.NO	PARTICULARS	RESPONDENTS	PERCENT
1	Strongly Agree	45	37.5%
2	Agree	27	22.5%
3	Neutral	20	16.7%
4	Disagree	17	14.2%
5	Strongly Disagree	11	9.2%
	Total	**120**	**100.0**

Source: Computing from Primary Data

The table 1.1 reveled that the most respondents 37.5 percent are agreed that process complexity affects product quality, indicating it is a major challenge in maintaining consistency and accuracy. Simplifying manufacturing processes can improve quality consistency.

Table 1.2

Respondents Employee Training Impact

S.NO	PARTICULARS	RESPONDENTS	PERCENT
1	Strongly Agree	23	19.2%
2	Agree	45	37.5%
3	Neutral	16	13.3%
4	Disagree	20	16.7%
5	Strongly Disagree	16	13.3%
	Total	**120**	**100.0**

Source: Computing from Primary Data

The table 1.2 reveled that the majority of respondents 37.5 percent are believed that employee training improves product quality, showing its importance in reducing errors and improving performance. Continuous training improves employee performance and product quality.

Table 1.3

Respondents Technology Impact on Quality

S.NO	PARTICULARS	RESPONDENTS	PERCENT
1	Strongly Agree	39	32.5%
2	Agree	25	20.8%
3	Neutral	26	21.7%
4	Disagree	13	10.8%
5	Strongly Disagree	17	14.2%
	Total	**120**	**100.0**

Source: Computing from Primary Data

The table 1.3 reveled that the most of respondents 32.5 percent are agreed that technology positively influences product quality, though some remain neutral or highlight challenges in its implementation. Proper implementation and maintenance of technology are essential

Table 1.4

Respondents Technology Impact on Quality

S.NO	PARTICULARS	RESPONDENTS	PERCENT
1	Strongly Agree	47	39.2%
2	Agree	27	22.5%
3	Neutral	12	10%
4	Disagree	19	15.8%
5	Strongly Disagree	15	12.5%
	Total	**120**	**100.0**

Source: Computing from Primary Data

The table 1.4 reveled that the majority of respondents 39.2 percent are strongly agreed that employee competency significantly impacts product quality. Employee skills and competency levels play a crucial role in maintaining product quality. Improving employee knowledge and expertise can lead to better production outcomes and fewer errors.

Table 1.5
Respondents Technology Impact on Quality

S.NO	PARTICULARS	RESPONDENTS	PERCENT
1	Strongly Agree	50	41.7%
2	Agree	30	25%
3	Neutral	18	15%
4	Disagree	12	10%
5	Strongly Disagree	10	8.3%
	Total	**120**	**100.0**

Source: Computing from Primary Data

The table 1.5 reveled that the Most respondents 41.7 Percent are strongly agreed that quality control measures effectively reduce defects, Effective defect control systems help in identifying and reducing errors in the manufacturing process. Strong quality control practices ensure consistent product quality and minimize production losses.

Table 1.6 Chi Square test

Chi-Square Tests			
	Value	df	Asymptotic Sig. (2-sided)
Pearson Chi-Square	107.926[a]	45	.000
Likelihood Ratio	110.793	45	.000
Linear-by-Linear Association	2.051	1	.152
N of Valid Cases	120		
a. 60 cells (93.8%) have expected count less than 5. The minimum expected count is .13.			

Source: Computing from Primary Data

The Chi-Square test shows a significant association between the variables ($x2 = 107.926$, $p < 0.05$), so the null hypothesis is rejected. The Likelihood Ratio also supports this result, while the Linear-by-Linear Association is not significant. However, since most cells have expected counts less than 5, the results should be interpreted with caution.

Table 1.7 Correlations

Correlations			
		EXPERIENCE OF THE RESPONDENTS	EMPLOYEE TRAINING AND COMPETENCY
EXPERIENCE OF THE RESPONDENTS	Pearson Correlation	1	.276**
	Sig. (2-tailed)		.002
	N	120	120
EMPLOYEE TRAINING AND COMPETENCY	Pearson Correlation	.276**	1
	Sig. (2-tailed)	.002	
	N	120	120
**. Correlation is significant at the 0.01 level (2-tailed).			

Source: Computing from Primary Data

The correlation analysis shows a positive relationship between experience of the respondents and employee training and competency ($r = 0.276$). The significance value ($p = 0.002$) is less than 0.01, indicating that the relationship is statistically significant.

However, the correlation is weak, suggesting that while experience has some influence on training and competency, it is not very strong.

CONCLUSION

The study on challenges in maintaining product quality in the manufacturing process highlights the importance of managing multiple factors that influence quality outcomes. From the analysis, it is evident that process complexity, employee competency, technology integration, and defect control play a significant role in determining the consistency and reliability of products. The findings indicate

that complex manufacturing processes create difficulties in maintaining uniform quality, as they increase the chances of errors and delays. Simplifying workflows and improving process clarity can help reduce these issues. Employee training and competency were found to have a positive impact on product quality, as skilled workers are better able to handle tasks efficiently and respond to quality-related problems. Continuous training programs and skill development initiatives are therefore essential. Technology integration has improved production accuracy and efficiency; however, it also introduces challenges such as system failures and frequent updates.

Proper management, maintenance, and employee adaptation to new technologies are necessary to ensure that these advancements contribute positively to quality improvement. Additionally, effective defect control measures were found to reduce errors and improve overall product quality. Regular monitoring, inspection, and quick corrective actions help in minimizing defects and maintaining standards. In conclusion, maintaining product quality requires a balanced approach that combines simplified processes, skilled workforce, effective use of technology, and strong quality control systems. By addressing these challenges, organizations can improve product quality, reduce production costs, and enhance customer satisfaction. This study provides valuable insights that can help manufacturing industries adopt better practices for achieving consistent and high-quality output.

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