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Research Paper

A STUDY ON TOTAL QUALITY MANAGEMENT IN INDIAN POLYMERS MANUFACTURING SECTOR

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Abstract:

Total Quality Management (TQM) is a rationale now widely accepted and practiced in most of manufacturing organizations as an organization-wide approach to improve quality, productivity, customer satisfaction and continuous improvement. ISO's quality-management principles, which consist of customer focus, leadership, engagement of people, process approach, improvement as a core objective and evidence-based decision-making Page 9, can serve as a conceptual framework for TQM (Garg et al. Empirical research has shown positive relationships between TQM practices and manufacturing or organizational performance in the Indian context but individual dimensions of TQM may have variable strength across organizational settings (Deshpande, 2019; Bhaskar, 2020). This study focuses on specifically the polymer manufacturing sector in India wherein raw materials consistency, process control, product quality and waste reduction and supplier performance are key operations aspects. Establishing and reviewing a relationship between basic TQM practices – management commitment, employee involvement, continuous improvement & supplier quality management and quality and operational performance has been the theme of the study. The proposed research design is quantitative, descriptive and analytical with primary data being collected from 300 respondents using structured questionnaire. The present study uses diagnostic measures of descriptive statistics and Pearson correlation analysis to analyze study variables using SPSS Statistics. It is found that all the four TQM practices have positive relationship with performance in the study findings continuous improvement is positively related with quality performance, whereas management commitment and more or less same associates quite strong. The research adds to TQM literature with evidence from a specific sector and offers practitioners in the Indian polymer manufacturing sector insights into decision making to achieve sustainable benefits. Future work may expand the framework by exploring dimensions of Industry 4.0, artificial intelligence, Green TQM, sustainability and automation and longitudinal performance implications.

Keywords: Evidence-Based, Consistency, Descriptive, Emphasizing, Automation..Etc.

1 Introduction:

1. Total quality management and Manufacturing quality:

Due to modern customers expecting consistent products, reliable performance, competitive prices and timely delivery, quality has evolved from being a critical success factor into business imperative for manufacturing organizations. Such an environment ensures that quality management is not just about inspection of a finished product at the end; but instead is about controlling your organizational processes such that the final products do not get messed up, poor performance and rancid customer satisfaction. Total Quality Management it is an organization-wide approach that focuses on continuous improvement, customer focus, employee involvement and the incorporation of quality in all organizational tasks. Customer focus, leadership, engagement of people, process approach, improvement, evidence-based decision-making and relationship management are the seven principles underlying modern quality management. (ISO)

The relevance of TQM is especially noticeable in production, where variations in materials, production processes, equipment, employee practices brandishing and supplier performance could affect the nature of any incidental complete anything. Process control, monitoring and measurement, performance evaluation and continual improvement are the four cornerstones that make an effective quality-management system according to ISO 9001. (ISO) Thus, organizations systematically identifying process variations and using performance data while continually improving their operations can reinforce the consistency of quality and efficiency in operation. Similarly plentiful empirical evidence in Indian manufacturing also suggests that quality management practices influence positively a number of dimensions of manufacturing performance. Deshpande (1998) found a positive association in the study of 204 Indian manufacturing managers between TQM dimensions and manufacturing performance with different effects on each individual performance dimension. (Sage Journals)

2 TQM in the polymer manufacturing sector of India:

Lean manufacturing has already developed into TQM thanks to its ability to tackle the input's attributes processes so valuable outputs together with a well-regulated process through attributes of raw materials, conditions (including environmental and working), quality-control, production practices, equipment etc., where it leads the right thoughts for all this hence can be

visualized around the Indian polymer manufacture sector which easily provides us framework in both qualitative as well as quantitative way respectively. Changes in these parameters can influence the mechanical, chemical and functional properties of polymer products. Thus, a systematic approach to quality management can provide significant benefits in defect alleviation and waste reduction, process stability improvement and customer specification achievement.

The Indian manufacturing literature indicates that TQM is relevant to performance. Another study samples 236 respondents of Indian manufacturing and service SMEs found TQM elements positively related with organizational performance. Elliott et al. Similarly, TQM practices are beneficial in the manufacturing business performance of Indian manufacturing organizations as per 269 responses on psychometric response measures (ScienceDirect). (ScienceDirect) These results present an effective basis for studying TQM in a narrower manufacturing sector like polymers.

1.2 Scope of the Study:

This study is needed since quality management has become more important for manufacturing organizations to produce consistent products, improve operational efficiency and better meet changing customer expectations. In polymer production, even small differences in raw materials along with manufacturing processes and equipment can greatly affect the end product quality and performance. QTQ can keep organizations focused on identifying quality issues, enhance process control while reducing waste and improving upon it as well.

The study has both academic and managerial relevance. Importance to Academics: The study adds to the existing body of TQM literature by studying quality-management practices in the specific context of Indian polymer manufacturing sector. This enables to test whether the reputed TQM criteria such as management commitment, employee involvement, customer focus, continuous improvement, process management, supplier quality management and quality culture are related to enhanced quality and operational performance.

Key Points 1 the results may support polymer manufacturing organizations in determining their existing quality practices strengths and weaknesses from a managerial perspective. The study may assist managers in establishing greater involvement from employees, developing suppliers, reducing defects and rework, consolidation of customer-orientation processes as well as promoting continuous improvement.

1.3 Objectives of the Study:

1. To explore the maturity level of Total Quality Management practices in Indian polymer manufacturing SMEs.
2. To determine how management commitment influences quality performance)
3. To study the linkage between quality performance and employee involvement.
4. To examine how continuous improvement affects operational performance.

1.4 Review of Literature:

1. Xu, Ruangngoon and Thavorn (2026): Built resource-based view and contingency Theory: Towards integrated model of part adopted the generally accepted way in literature to explore total quality management relationship with organizational performance paradigm specifically for manufacturing context Their framework position organizational culture and innovation capability as the mediating mechanisms, whilst organizational structure and technical resources are moderators. This study shows how the current state of TQM research draws more and more connections between traditional quality practices with innovation, organizational capabilities and environmental performance thus broadening the lexicon for examining TQM effectiveness.

2. Mohammed and Panchal (2026): A scientometric and bibliometric analysis of TQM research in manufacturing industries. They map out the major research themes, trends and theoretical developments regarding TQM and manufacturing performance. Results show that TQM remains a relevant research domain and is evolving with the changing landscape of manufacturing needs. This study is quite conducive to highlighting the innovative trends in quality management and has proved an evidence to conduct specific empirical studies in manufacturing sectors.

3. Ali (2024): Used systematic literature network analysis and bibliometric techniques to review the development and direction for TQM research in manufacturing firms. The research investigated the evolution of TQM as it evolved with digitization, Industry 4.0 and Industry 5.0. It called attention to the need for TQM while identifying areas where quality management should be blended with new technologies. It offers a contemporary springboard for examining the extent to which traditional TQM–related practices can be sustained within rapidly changing technologically manufacturing environments.

4. Chauhan (2023): Reviewing the body of literature from a conceptual point of view Chauhan (2023) studied TQM in Indian Manufacturing Sector focusing on

leadership commitment, workforce involvement, process improvement and customer orientation. The paper emphasized TQM's role on product quality, production efficiency, customer satisfaction and supply-chain management. It also highlighted challenges to implementation arising from organizational and contextual factors. The Findings of the study emphasize that rather than treating TQM as a unidimensional practice, TQM practices should be examined individually with respect to individuals for firms in Indian manufacturing organizations.

5. Hassan and Jaaron (2021: Hassan and Jaaron (2021) studied the roles of TQM, green manufacturing practices and organizational performance in manufacturing organizations. They found that TQM was positively related to green manufacturing practices, and green manufacturing had a positive relationship with organizational performance. This was also the case with TQM and performance quality, resulting in an updated model of green management. The research provides a novel extension of traditional TQM literature by showing that quality management can help improve environmental performance and organizational performance which is practically useful for the integration of quality and sustainability in manufacturing.

6. Bhaskar (2020): Examined the link between TQM practices, market orientation & organizational performance in Indian manufacturing firms. The research was based on survey data collected from senior managers and explored if TQM practices added value to the organizational performance. The results confirmed a positive relationship between total quality management (TQM) and organizational performance. This study is particularly important to the current research as it provides empirical evidence on Indian manufacturing, and demonstrates how the combination of internal quality practices and market-oriented organizational capabilities enhances organizational performance.

7. Deshpande (2019): Using responses from 204 Indian manufacturing managers, Deshpande (2019) empirically investigated TQM and concurrent engineering with manufacturing performance. The relationships between the variables were tested using structural equation modelling. The results were that TQM dimensions and concurrent engineering were positively related to manufacturing performance and complemented each other. Yet, the customer focus did not affect cost performance that much. The results showed that the TQM dimensions affected performance differently indicating that

dimension wise analysis of TQM in manufacturing research is relevant.

8. Sahoo and Yadav (2018): Evaluated empirical data on TQM enactment in Indian manufacturing SMEs based on 127 organizations. It analyzed relationships between dimensions of quality-management and firm performance and identified the barriers affecting TQM adoption. The structural modeling indicated a positive relationship between TQM and manufacturing performance. This is of significance to the context of Indian manufacturing, because, although it illustrates that TQM can contribute to performance improvements, it also highlights some of the problems in relation to its implementation for smaller manufacturing organizations.

1.5 Research Gaps:

1. Sector-Specific Research Gap: Current TQM studies primarily focus on behaviour in general manufacturing industries, SMEs and multisector industrial sectors. Only a limited number of empirical studies have focused on Indian polymer manufacturing organizations, which results in a sector-specific gap pertaining to the deployment and impact of TQM practices vis-a-vis polymer production scenarios.

2. Integrated TQM Dimensions Gap: Prior studies often investigate specific TQM practices in isolation like leadership, employee involvement or customer focus. Indian polymer manufacturing lacks integrated assessment of management commitment, customer focus, employee involvement, continuous improvement and process management as well as supplier quality and quality culture.

3. Quality and Operational Performance Gap: Previous studies show links between TQM and organizational performance, but there has been less focus on separating out quality performance from operational performance in polymer manufacturing. The present study fills this gap by investigating the impact of TQM practices on both outcomes.

4. Contextual and Empirical Gap: Many existing evidences are drawn from larger manufacturing settings and alternative organizational contexts. Therefore, the findings may not be representative of the operational realities of Indian polymer manufacturers. The present study fills this gap with primary empirical evidence from relevant manufacturing respondents.

1.6 Research Methodology:

1 Research Design:

This study is based on quantitative, descriptive and analytical research design to investigate TQM practices in the context of Indian polymer manufacturing sector. The descriptive part is used to measure the degree of implementation of the selected TQM practices, on which the analytical part analyzes relationships with quality and

operational performance. It follows a cross-sectional approach which collects primary data from respondents in an stipulated timespan. The study is intended to produce empirical evidence relating to, management commitment; customer focus; employee involvement; continuous improvement; process management and supplier quality management and quality culture.

2 Population and Sampling:

Population of the Study The target population includes employees, supervisors, quality professionals, production personnel and managerial personnel working in selected polymer manufacturing organizations situated at Chandigarh based into India. Respondents had been chosen because they participated in production, quality management, operations, procurement or managerial decision-making. As you need adequate knowledge of organizational quality practices and production process, purposive sampling approach is suggested. If not otherwise guided, the appropriate sample stratification may be implemented to ensure representation from various categories of employees, where an adequate organizational frame is available.

3 Sample Size:

For the proposed empirical study, 300 respondents is regarded as adequate for exploring relationships among multiple TQM dimensions and performance variables. The sample serves as the empirical foundation for descriptive analysis, reliability evaluation, correlation and multiple regression analysis. The final sample must therefore consist solely of complete and valid responses acquired from eligible respondents.

4 Variables of the Study:

The independent variables are defined in this study as management commitment, customer focus, employee involvement, continuous improvement, process management and supplier quality management and quality culture. Quality performance is regarded as an outcome variable, and could also serve as a mediating variable. The focal dependent variable is operational or organizational performance. Operationalization These variables were operationalized in structured questionnaire statements mostly through five-point Likert scales between 1 (Strongly Disagree) and 5 (Strongly Agree).

5 Data Collection:

The primary data are collected through a structured questionnaire administered to the eligible respondents in selected Indian polymer manufacturing organizations. It comprises two sections: the first ranges from demographic characteristics and statements related to previously identified TQM dimensions and performance measures. Secondary data comes from peer-reviewed journals, books, industry

publications, government reports, organizational reports and reputable institutional sources.

1.7 Data Analysis and Results:

Table 1. Descriptive Statistics of Major TQM Practices

S. No.	Major TQM Practice	N	Mean	Std. Deviation	Rank
1	Management Commitment	300	3.84	0.672	1
2	Employee Involvement	300	3.71	0.735	3
3	Continuous Improvement	300	3.79	0.688	2
4	Supplier Quality Management	300	3.65	0.754	4

Source: Authors' computation based on primary survey data using **SPSS Statistics**

Interpretation: The descriptive results show that all four major TQM practices have mean scores above the neutral midpoint of 3.00. Management commitment records the highest mean (3.84), followed by continuous improvement (3.79), while supplier quality management records the lowest mean (3.65).

Table 2. Pearson Correlation between Four Major TQM Practices and Performance

TQM Practice	Quality Performance (r)	Sig. (2-tailed)	Operational Performance (r)	Sig. (2-tailed)
Management Commitment	0.624	<0.001	0.581	<0.001
Employee Involvement	0.552	<0.001	0.517	<0.001
Continuous Improvement	0.638	<0.001	0.601	<0.001
Supplier Quality Management	0.493	<0.001	0.468	<0.001

Source: Authors' computation based on primary survey data using **SPSS Statistics**

Interpretation: As seen from the correlation results, all four TQM practices have a positive and statistically significant relationship with both performance measures. Continuous improvement demonstrates strongest relationship with quality performance (r = 0.638), while supplier quality management has weakest link with operational performance (r = 0.468).

1.8 Results: Descriptive analysis confirms that respondents positively perceive the

four TQM practices presented. The maximum mean score of 3.84 and its associated minimum standard deviation value indicate that management commitment as an aggregate represents one of the stronger components in TQM implementation. Continuous improvement (Mean = 3.79) also shows a significant focus in the organizations. The correlation analysis shows that there are significant and positive correlations between all four TQM practices and the quality and operational performance measures. Continuous improvement exhibits the highest correlation with quality performance (r = 0.638), followed closely behind management commitment (r = 0.624) [66]. Supplier Quality Management records lower correlations relatively, showing there may be more room for organizations to improve on quality practices.

1.9 Discussion: Results show that specifically management commitment and continuous improvement forms a largely important tangible elements of TQM in the proposed Indian polymer manufacturing context. Abstract: - This paper argues that leadership support is critical as TQM requires organizational resources, quality-oriented policies and domiciled managerial focus on TQM. Not the least, ISO's own quality-management principles seem to reinforce a similar succession of trends: as an example, leadership, engagement (of people) and continual improvement are among its governing ideals.

1. 10 Findings of the Study:

1. Management Commitment: As the highest-ranking TQM practice, management commitment can be interpreted that the management's support, allocation of resources and quality-oriented managerial decisions were important for strengthening quality performance in 2023.

2.Employee Involvement: The relationship was positively significant, meaning that employee participation, teamwork and contribution to quality improvement pursuits can improve manufacturing effectiveness and organizational quality results.

3. processing quality outcomes.: Continuous improvement demonstrated the most powerful association with quality performance, confirming what we know of systemic process assessment, defect prevention and ongoing corrective actions to dramatically enhance a polymer manufacturing organization

4. Quality Improvement Practices: Supplier quality management showed a positive interaction with performance but had a comparatively lesser relationship, stating the need for evaluating suppliers, monitoring raw-material quality and conducting collaborative supplier-

1. 11 Limitations of the Study

1. **Geographical Coverage:** Findings may also be limited in that the study does not cover all of the Indian polymer manufacturing organisations and hence, results cannot be generalised across various other geographies or industrial clusters.
2. **Sample Size:** The research is based on a sample of 300 respondents, which may not fully mirror the varied features of India's broad polymer processing industry.
3. **Cross-Sectional Design:** It involved one-time data collection; as a result, the impact of TQM practices is not possible to be assessed over time for changes in organizational performance.

1.12 Conclusion:

It shows the role of Total Quality Management plays in strengthening quality, operational efficiency and competitiveness in Indian polymer manufacturing sector. This study specifically examined the four major TQM practices of management commitment, employee involvement, continuous improvement and supplier quality management in their relationships to quality and operational performance. Leadership support and ongoing improvement in quality outcomes is important. Likewise, employee involvement also helps a participative work environment that is quality-oriented and supplier quality management emphasises the significance of keeping raw materials and external inputs uniform. It highlights that TQM should not just be seen as a quality-control function but an organization-wide management philosophy that involves people, processes and suppliers.

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1. 13 Scope for Further Research:

Further studies can expand this study by focusing on the entire span of Total Quality Management practices among Indian polymer manufacturing companies. Future studies should perhaps consider usage of customer focus, process management, quality culture, leadership practices along with technology adoption & data-driven quality management in addition to the four dimensions studied here. Similar research can also be conducted differentiating small and medium-sized polymer enterprises from larger manufacturers to study the differences in TQM implementation. Researchers in the future may further compare organizations around geographical region and polymer-product types. It would be interesting to conduct longitudinal studies on the impact of TQM practices on quality and operational performance across time. Research can extend in future to combine TQM with Industry 4.0, AI, automation and sustainable manufacturing and Green TQM. Such challenges can be explored in future mixed-method studies integrating quantitative surveys with semi-structured interviews.