A Critical Review of TQM and Zero-Defect Concept in Manufacturing Industries: A Qualitative Study

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Abstract

Total Quality Management (TQM) and the Zero-Defect Concept have emerged as prominent strategies in the manufacturing sector, aiming to enhance product quality and customer satisfaction. This critical evaluation seeks to assess the value and implications of TQM and the Zero-Defect Concept through a quantitative analysis. The study explores various aspects of TQM implementation, including process improvement, staff involvement, supplier management, and customer focus, along with the Zero-Defect Concept. The findings indicate that adopting TQM significantly improves overall organizational performance. The application of zero-defect practices demonstrates a strong correlation with TQM dimensions like process improvement and staff involvement, leading to enhanced product quality. However, the study also identifies challenges and limitations associated with the implementation of TQM and the Zero-Defect Concept. These include resistance to change, insufficient staff engagement, suboptimal integration of suppliers, and difficulties in sustaining continuous improvement efforts. Addressing these issues is crucial for organizations to fully benefit from TQM and zero-defect practices, ensuring their successful implementation and yielding desired outcomes.

Keywords: Total Quality Management (TQM), Zero-Defect Concept, Manufacturing Industries

Quantitative Study, Organizational Performance

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Introductions

In the current business environment, it has become crucial for companies to meet customer demands for high-quality products (Chahar, Hatwal, & Sen, 2019). Social media's widespread usage has made customers more inclined to express complaints and share negative experiences, potentially resulting in customer attrition. As a result, manufacturing enterprises must place utmost importance on product quality and minimize the occurrence of defective items (Patel S., 2016). Several factors contribute to achieving high product quality and enhancing competitiveness within a company (Gewohn, Usländer, & Beyerer, 2019). The quality of raw materials used plays a pivotal role as the final product's ability to meet requirements heavily relies on the superior quality of its components. Additionally, having skilled professionals available to

support the workforce is vital. Furthermore, companies must possess comprehensive knowledge and understanding of how their products fit into the market and cater to consumer needs. By approaching these aspects systematically and creatively, companies gain a competitive edge by successfully meeting consumer needs and quality expectations. The concept of quality management originated in the United States during World War II, with influential figures emphasizing its significance and changing people's perceptions of it (Patel S., 2016). In the 1970s, Japanese businesses gained significant ground in the industrial market by aligning their sectors with customer needs and expectations. This shift in focus resulted in the decline and bankruptcy of some American industries due to changing market expectations. The key to this success lies in prioritizing the needs and expectations of consumers.

According to Patel (2016), the early 20th century witnessed the introduction of improvements in the quality management process. Despite the sector's complex history, effectively managing quality optimization remains a challenge. The quality of a product is greatly influenced by the suppliers a company collaborates with and their understanding of quality (Noshada & Awasthib, 2015). Furthermore, maintaining high-quality and durable technical tools is essential for producing flawless products. Advances in machinability and the utilization of sophisticated technological instruments are favourable factors that enhance product quality (Fakert, Gromov, Muller, Polzer, & Wolf, 2008). Additionally, when considering quality in manual manufacturing, the human factor and its impact on various activities must be considered (Ostadi & Masouleh, 2019). While it is impossible to eliminate errors and flaws in the assembly process involving humans (Guastello, 2013), it is feasible to reduce the occurrence of faults and defective products through various preventive measures. Clear instructions and proper utilization of appropriate equipment can contribute to achieving this objective. There are several established methods available for evaluating, enhancing, and ensuring the quality of a company, depending on the desired outcomes. These methods include failure mode and effect analysis (Xiuxu & Yuming, 2010), fishbone diagrams, and zero-defect manufacturing (Eger et al., 2018). Their primary purpose is to achieve desired outcomes such as waste reduction, fewer defective items, and minimized customer complaints. Customer complaints can lead to additional work, expenses, and dissatisfied customers, which businesses strive to avoid. Zero defects and zero-defect manufacturing (ZDM) play crucial roles in preventing and predicting scrapped components and system failures. Figure 1 shows the various benefits of TQM and Zero-Defect Concept to the Organisation:

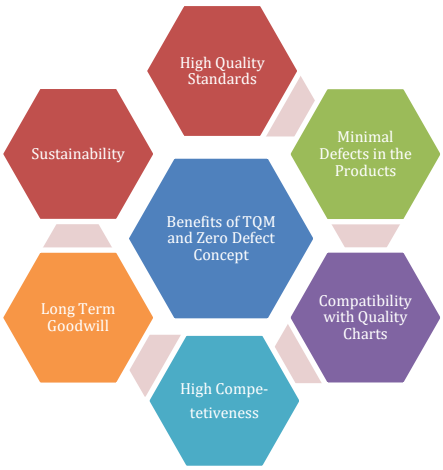

Figure 1 Various Benefits of TQM and Zero-Defect Concept to the Organisation

Literature Review

Zero defect manufacturing (ZDM) is an effective approach specifically designed to ensure the production of flawless and defect-free products on assembly lines (Eger et al., 2018). The primary goal of ZDM is to minimize errors and defects throughout the manufacturing process, leading to cost-effective, environmentally friendly, and competitive production (Psarommatis & Kiritsis, 2018). Implementing ZDM offers several advantages, including reduced scrap production, faster lead times and deliveries, improved problem-solving capabilities, enhanced planning efficiency, and increased confidence in product availability and quality. Bai & Zhang (2018) also emphasize the cost reduction associated with minimizing faulty products in business operations. By identifying and rectifying defects and utilizing defect detection data, it becomes possible to predict and prevent future failures. While achieving zero errors in manual production may present challenges, the concept of ZDM aims for perfection by elevating the quality of products and processes. The literature on ZDM covers a wide range of topics, providing various solutions and insights related to process improvements in ZDM (Lindström et al., 2019). Implementing the ZDM strategy aligns with the objectives of an ideal Industry 4.0 plan, making it a valuable contribution to the seamless flow of integrated knowledge (Lindström et al., 2019).

One key aspect of ZDM highlights the significance of an integrated model that encompasses product quality, resource performance, a product-plant perspective, and lifecycle analysis. Taking a lifecycle approach to ZDM involves incorporating a comprehensive knowledge-feedback loop and utilizing real-time data. In their research, Ostadi & Masouleh (2019) employ failure mode and effect analysis (FMEA) to examine errors causing defects in a manual production plant. They identify correlations between these errors and human, technological, and process-related factors. Ostadi & Masouleh (2019) emphasize the advantage of considering human factors in the pursuit of Zero-Defect Production (ZDP), as elements like stress and motivation significantly impact the

achievement of high-quality outcomes. Similarly, the importance of recognizing and understanding the role of human beings in the production process is to uphold quality standards.

Total Quality Management (TQM), as defined by Bergman & Klefsjö (2007), is an ongoing effort to meet and exceed customer requirements while minimizing costs. Active participation and continuous improvement from all individuals involved are crucial elements of TQM. Meeting customer demands is an ongoing process that significantly influences a company's profitability (Chaudhary, Zafar, & Salman, 2014). TQM encompasses various management techniques that focus on identifying customer needs, being responsive to changing market dynamics, and improving process efficiency. Advocates of TQM argue that its implementation leads to improved financial performance for the company (York & Miree, 2004). The successful implementation and continuous practice of Total Quality Management (TQM) rely on the commitment of all employees, their active engagement in ongoing improvement, and their willingness to reduce costs and waste. The quality of products plays a pivotal role in a business's success and profitability. Satisfied customers are more likely to repurchase products and recommend them to others when they receive high-quality goods. With the increasing importance of sustainable manufacturing, efficient resource utilization becomes essential in meeting customer needs (Colledani et al., 2014).

Conclusion

Through quantitative analysis and critical evaluation, valuable insights have been gained regarding the effectiveness, implications, and challenges associated with Total Quality Management (TQM) and the Zero-Defect Concept in manufacturing industries. The research findings indicate that the implementation of TQM significantly enhances overall organizational performance while adopting the zero-defect philosophy leads to improved product quality. The study emphasizes the importance of TQM practices such as process improvement, employee participation, supplier management, and customer focus in successfully implementing the zero-defect concept. Organizations that prioritize these TQM characteristics are more likely to achieve superior product quality and customer satisfaction. However, the report also identifies several difficulties and constraints in the practical implementation of TQM and the Zero-Defect Concept. These challenges include resistance to change, limited employee involvement, inadequate supplier integration, and obstacles to sustaining continuous improvement. Overcoming these issues is crucial for organizations to fully leverage the potential benefits of TQM and zero-defect practices. Future research opportunities exist to explore the impact of emerging innovations like artificial intelligence and the Internet of Things on the application of TQM and zero-defect procedures. Additionally, investigating the role of leadership in promoting TQM and zero-defect initiatives and examining the effects of these strategies in different business sectors can further expand knowledge in this field.

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