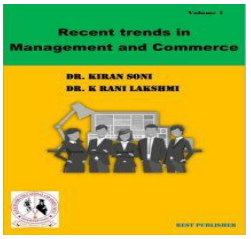
Recent trends in Management and Commerce
Vol: 2(4), 2021
REST Publisher
ISBN: 978-81-936097-6-7
Website: http://restpublisher.com/book-series/rmc/



Assessment of critical success factors used in effectuate total quality management using TOPSIS

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Abstract

Total Quality Management To satisfy customers, total quality management (TQM), a management philosophy, aims to continually improve the caliber of products and processes. Its adoption is still a major obstacle to the global competitiveness of industrial firms. Due to globalization, the environment in which Indian manufacturing enterprises operate is undergoing rapid change. They desperately require new strategies, tactics, and procedures if they are to become more competitive. The objective of the management concept known as total quality management (TQM) is to continuously enhance the quality of products and processes to satisfy customers. To improve their competitiveness, industrial companies around the world continue to give the implementation of this strategy top attention. Manufacturing businesses in India must operate in a dynamic environment as a result of globalization. To increase their competitiveness, they are in desperate need of new strategies, plans, and techniques. Due to the ability of international corporations to offer high-quality goods and services at lower prices, domestic enterprises have lost market share. Quality, flexibility, quick lead times and dependable delivery have replaced low-cost production as the new tactical goals for businesses looking to restore their competitive edge. Additionally, they have embraced cutting-edge production management techniques and technologies. The purpose of this article is to analyze and assess the TQM critical success factors (CSFs) for the Indian manufacturing sector based on their usefulness. TOPSIS was used to rate the CSFs. Result: The result of the analysis is Suppliers' quality management is seventh, Human resources management is third, Process management is first, Customer focus is second, the Role of the quality department is fourth, Product design is fifth, and Quality information system is sixth. Analysis of the findings shows that Process Management, Customer focus, Human resources management, and the Role of the quality department (first four ranks) are the most important among these critical success factors for the implementation of total quality management.

Keywords: Materials and Methods, Role of quality department, TOPSIS Method.

Introduction

In recent years, the practice of total quality management (TQM) has spread throughout the contemporary industry. Studies have revealed that there are significant differences in the topics covered in TQM papers. These publications cover a range of TQM topics, from conceptual issues to practical and empirical ones. There is general agreement that TQM implementation can increase an organization's overall effectiveness and performance. Regarding the core TQM concepts or the TQM as a whole, there is less consensus. TQM has not yet been viewed in unison; different people have given varied descriptions of it. [1]. Total quality management (TQM) has received a lot of attention recently. Despite obvious warnings that TQM is not a quick fix, that it requires an enabling company culture and top-down commitment to thrive, and that this is often the case, many businesses still employ it in the hopes of seeing short-term success. Support for TQM declines or ends altogether when there is no fast payoff. [2]. The widespread coverage of TQM in the academic, practitioner, and popular press over the years, along with the evident cautions offered in formal TQM training and implementation programs, seem to have had little effect. They see TQM as an addition to their company strategy rather than a complete replacement. Success rates are inevitably impacted by the level of commitment when quality is a distinct agenda rather than the agenda. [3]. Many institutions look to businesses for inspiration. The long-held competitive edge of American industry has decreased, much like that of our educational institutions. Many industries are looking to total quality management (TQM) for solutions to reclaim and bolster their advantage. TQM has mostly been used in the industrial industry. Due to this, its relevance to educational institutions is rather debatable. [4]. The building industry has struggled for a long time to keep acceptable levels of quality. Significant amounts of time, money, and resources—both human and material—are wasted annually as a result of insufficient or nonexistent quality management methods. Total Quality Management (TQM) principles were developed for the manufacturing industry and have increased productivity, decreased product prices, and improved product reliability. They were first used in Japan and more recently in the United States. These concepts can also help the construction industry. [5]. The TQM project, which attempts to improve performance, involves every organization in the industry. It pervades every aspect of a company and elevates quality to a strategic objective. Through an integrated effort from all employee levels, TQM aims to continuously improve performance and increase customer satisfaction. [6]. TQM lays a heavy emphasis on process improvement, customer and supplier contact, teamwork, training, and education in its quest to achieve customer satisfaction, cost-effectiveness, and defect-free production. TQM fosters the culture and environment required for invention and technological advancement. [7]. The adoption of TQM must pay special attention to CSFs since they have the potential to

significantly affect the firm, either for better or worse. They offer a management early warning system and a means of preventing surprises or lost opportunities. Successful competitive advantage and performance for the organization are guaranteed by satisfactory CSFs. Previous studies have demonstrated that TQM implementation efforts have failed because the system did not include the success criteria of the time[8]. A detailed grasp of CSFs and their sequential deployment is necessary for successful TQM implementation. To improve success rates, cut costs, and avoid failure, prioritizing CSFs is crucial for TQM adoption. CSFs are actions and procedures that management may control to accomplish the goals of the organization. [9,10].

Materials and Methods

Analytical models have been suggested in many studies as conflict resolution methods. Multicriteria decision-making is one of the most well-liked conflict management procedures, but there are many other options. It is possible to think of multicriteria decision-making (MCDM) as a dynamic, complex process involving managerial and engineering levels. [11]. TOPSIS was first put forth by Hwang and Yoon to assist in making the best decision based on a limited set of criteria. The well-known MCDA/MCDM approach TOPSIS has drawn a lot of interest from academics and industry professionals. [12]. Positive and negative ideal solutions are introduced as two "reference" points by the TOPSIS approach. Costs, advantages, and rise as compared to the unwanted ideal solution Reduce criteria, take into account the optimal outcome, and account for expenses for the benefit of increasing standards for the counterproductive perfect solution and shortening the path to the ideal solution. To improve the option, TOPSIS discovers that the distance should be increased. [13]. According to this technique, each characteristic is assumed to be monotonically increasing or decreasing. Using Euclidean distances, TOPSIS calculated the distances between the alternatives and their respective positive and negative ideal solutions. the comparison of the Euclidean distance findings according to the preferred order of the options. The order of the choices is determined by comparing Euclidean distances. [14,15]. In this alternative parameter considered are Suppliers quality management(R1), Human resources management(R2), Process management(R3), Customer focus(R4), Role of quality department(R5), Product design(R6), Quality information system(R7). Evaluation parameters are DM1, DM2, DM3, DM4, DM5.

Suppliers' quality management: The management of suppliers is crucial to the effectiveness of quality control in companies. A quality product needs good quality inbound materials to be produced. Therefore, it is necessary to maintain long-term, cooperative relationships with a small number of suppliers rather than many suppliers for these partnerships to be advantageous to both parties. With the suppliers, there should be no misunderstandings. Additionally, enterprises are encouraged to exchange data with suppliers about the performance of their suppliers' deliveries and the quality of incoming products. Additionally, vendors need to receive quality training [16,17].

Human resources management: Employee management in firms is given a lot of attention by TQM. The goal is to give workers the tools they need to meaningfully improve processes and their quality over time. An open culture, teamwork, and continual improvement are the main goals of TQM. To support these, the HRM and compensation systems must be in place. Additionally, the staff members need to be taught about their positions and be informed of their tasks and objectives [18].

Process management: The production procedures that affect product quality should receive a lot of attention. The processes must be documented by ISO 9000 standards. More rework and scrap will be produced as a result of a subpar manufacturing process. For efficient quality management, all areas of manufacturing operations must be reviewed regularly, and any deficient procedures must be corrected. There must be processes in place, and these must be continually improved, stop the creation of defective items. To increase the quality of the processes and the products, it is necessary to continually identify and improve the essential processes [19].

Customer focus: Customer pleasure is recognized as a key indicator of quality. Therefore, CF must receive a lot of attention during TQM implementation. This necessitates the creation of appropriate procedures for receiving and handling client complaints. The company must methodically record consumer requests and provide post-sale satisfaction [20].

Role of quality department

Planning for quality is another crucial CSF in TQM. It involves the creation of vision and mission statements, the use of quality control and other management tools, and the formation of quality policy. The firms anticipate increases in perceived product quality, decreased quality expenses, faulty and wastage rates, and improvements in product quality. Therefore, effective quality planning systems would raise product quality and consequently raise customer happiness[21].

Product design: PD is a crucial aspect of quality management; it directly affects how successful a product is. Customers' needs and expectations are satisfied by Sound PD. Engineers should have some shop floor and marketing experience to better PD design [22].

Quality information system: Since it serves as the foundation for many quality-related operations, there should be a system in place to gather information linked to quality, such as the price of quality data, scrap data, rework data, and its utilization. Information technologies make it possible to gather data quickly, communicate it openly, and use it to provide staff feedback. The goal of TQM is to make sure that the outputs of information systems are used to assess performance [23].

Result and Discussion

TABLE 1. Risk factors in TQM

	DM1	DM2	DM3	DM4	DM5
R1	0.6250	1.0240	0.7290	0.3240	0.7840

R2	1.7640	0.5760	1.2250	0.3240	0.7840
R3	1.7640	1.0240	1.9360	1.9360	2.1160
R4	1.0890	1.6000	1.2250	1.9360	1.3690
R5	1.0890	1.0240	0.7290	1.2250	0.7840
R6	0.6250	1.0240	0.7290	1.2250	0.7840
R7	0.6250	1.0240	0.7290	0.7290	0.7840

The analysis took into account alternative parameters such as Suppliers quality management(R1), Human resources management(R2), Process management(R3), Customer focus(R4), Role of quality department(R5), Product design(R6), Quality information system(R7). Evaluation parameters are DM1, DM2, DM3, DM4, DM5.

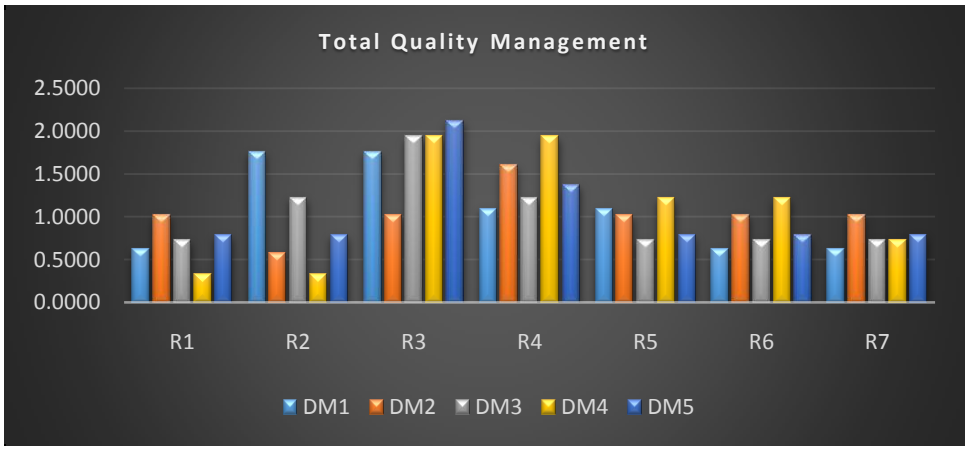

FIGURE 2. Risk factors in TQM

The analysis took into account alternative parameters such as Suppliers quality management(R1), Human resources management(R2), Process management(R3), Customer focus(R4), Role of quality department(R5), Product design(R6), Quality information system(R7). Evaluation parameters are DM1, DM2, DM3, DM4, DM5.

TABLE 2. Normalized Data

0.2000	0.3590	0.2447	0.0966	0.2554
0.5644	0.2020	0.4112	0.0966	0.2554
0.5644	0.3590	0.6499	0.5775	0.6893
0.3485	0.5610	0.4112	0.5775	0.4459
0.3485	0.3590	0.2447	0.3654	0.2554
0.2000	0.3590	0.2447	0.3654	0.2554
0.2000	0.3590	0.2447	0.2175	0.2554

Table 2 above shows the normalized matrix.

TABLE 3. Weight

0.2	0.2	0.2	0.2	0.2
0.2	0.2	0.2	0.2	0.2
0.2	0.2	0.2	0.2	0.2
0.2	0.2	0.2	0.2	0.2
0.2	0.2	0.2	0.2	0.2
0.2	0.2	0.2	0.2	0.2
0.2	0.2	0.2	0.2	0.2

Weights for the criteria are equally distributed as expressed in above table.

TABLE 4. Weighted normalized decision matrix

0.0400	0.0718	0.0489	0.0193	0.0511
0.1129	0.0404	0.0822	0.0193	0.0511
0.1129	0.0718	0.1300	0.1155	0.1379
0.0697	0.1122	0.0822	0.1155	0.0892

0.0697	0.0718	0.0489	0.0731	0.0511
0.0400	0.0718	0.0489	0.0731	0.0511
0.0400	0.0718	0.0489	0.0435	0.0511

The above normalized matrix is calculated by table 2 and table 3.

TABLE 5. Positive Matrix

0.1129	0.1122	0.1300	0.1155	0.1379
0.1129	0.1122	0.1300	0.1155	0.1379
0.1129	0.1122	0.1300	0.1155	0.1379
0.1129	0.1122	0.1300	0.1155	0.1379
0.1129	0.1122	0.1300	0.1155	0.1379
0.1129	0.1122	0.1300	0.1155	0.1379
0.1129	0.1122	0.1300	0.1155	0.1379

Table 5 shows the positive matrix calculated by using table 4. The ideal best for a column is the maximum value of that column in table 4.

TABLE 6. Negative matrix

0.0400	0.0404	0.0489	0.0193	0.0511
0.0400	0.0404	0.0489	0.0193	0.0511
0.0400	0.0404	0.0489	0.0193	0.0511
0.0400	0.0404	0.0489	0.0193	0.0511
0.0400	0.0404	0.0489	0.0193	0.0511
0.0400	0.0404	0.0489	0.0193	0.0511
0.0400	0.0404	0.0489	0.0193	0.0511

Table 6 shows the negative matrix calculated by using table 4. The Ideal best for a column is the minimum value in that column in table 4.

TABLE 7. SI Plus and Si negative

	SI Plus	**Si Negative**
R1	0.1740	0.0314
R2	0.1556	0.0801
R3	0.0404	0.1722
R4	0.0807	0.1336
R5	0.1393	0.0690
R6	0.1511	0.0623
R7	0.1619	0.0396

Table 7 shows the Si plus and Si negative values. difference of each response from the ideal best (S_i^+) is calculated using equation 5 and the difference between each response from the ideal worst (S_i^-) is calculated using equation 6.

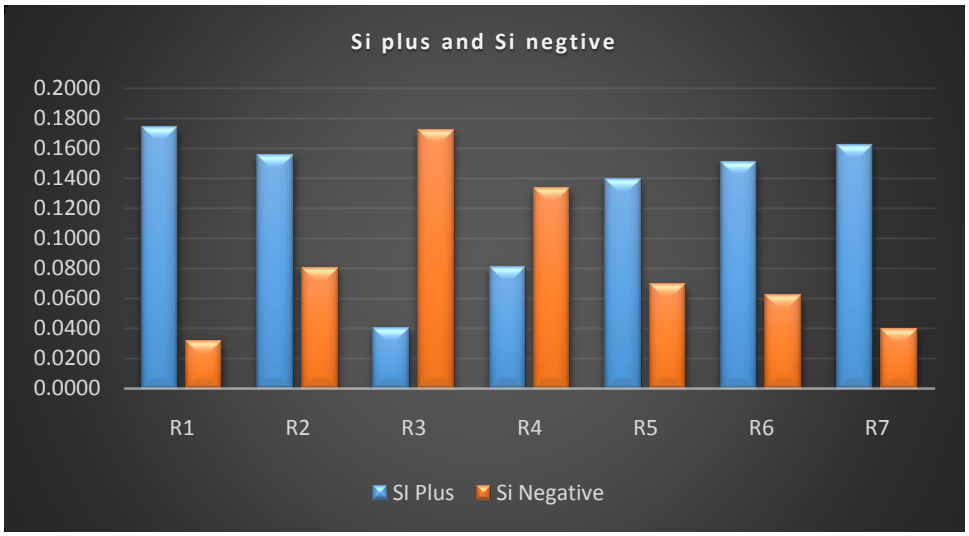

FIGURE 2. SI Plus and Si negative

Figure 2 illustrates the graphical representation of the Si plus and Si negative values. difference of each response from the ideal best (S_i^+) and the difference between each response from the ideal worst (S_i^-) is calculated TOPSIS.

TABLE8. Closeness coefficient

	Ci
R1	0.152907
R2	0.339933
R3	0.809985
R4	0.623414
R5	0.331249
R6	0.291766
R7	0.196612

The proximity coefficient values of the alternatives are displayed in Table 8. Here, the closeness coefficient of R1 is 0.152907, R2 is 0.339933, R3 is 0.809985, R4 is 0.623414, R5 is 0.331249, R6 is 0.291766 and R7 is 0.196612.

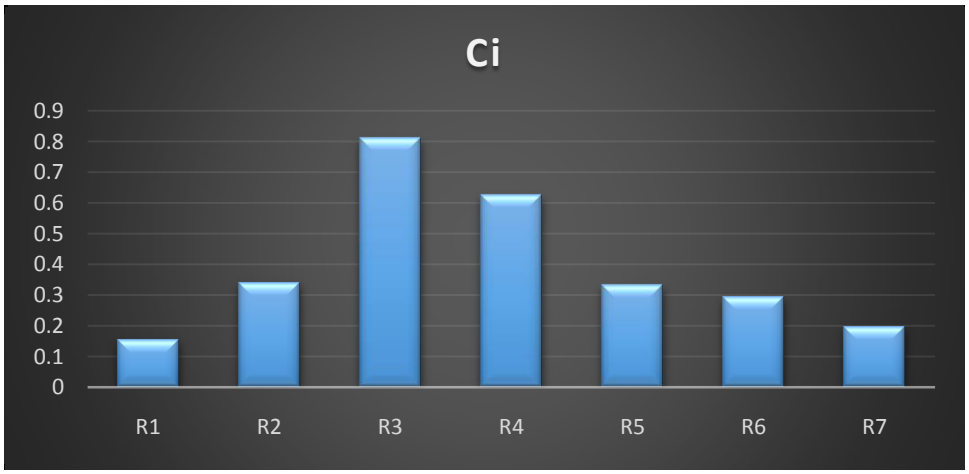

FIGURE 3. Closeness Coefficient (Ci)

Figure 3 illustrates the graphical representation of Ci. Here, the closeness coefficient of R1 is 0.152907, R2 is 0.339933, R3 is 0.809985, R4 is 0.623414, R5 is 0.331249, R6 is 0.291766 and R7 is 0.196612.

TABLE 9. Rank

	Rank
R1	7
R2	3
R3	1
R4	2
R5	4
R6	5
R7	6

Table 9 shows the rank of TQM risk factors. Here, the rank of R1 is seventh, R2 is third, R3 is first, R4 is second, R5 is fourth, R6 is fifth and R7 is sixth.

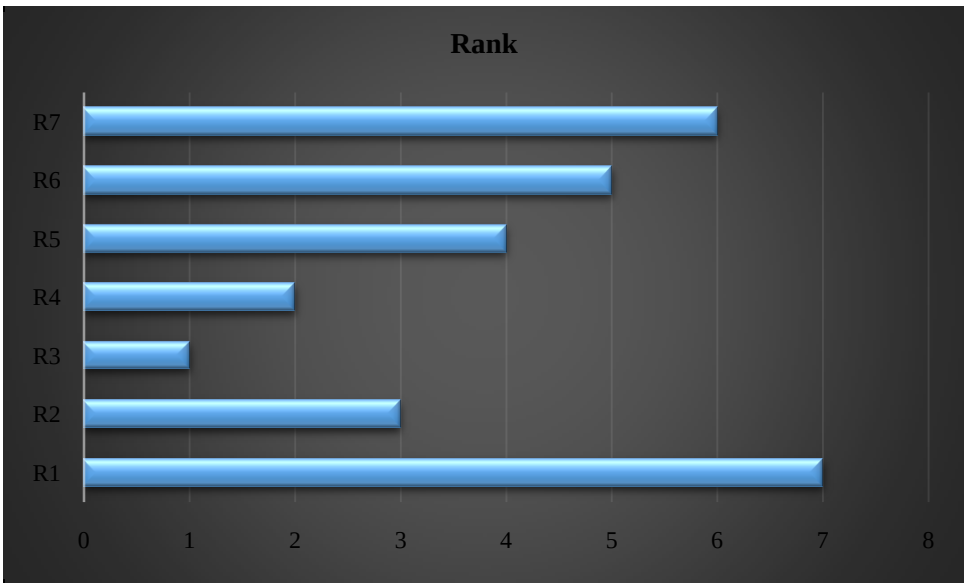

FIGURE 4. Rank

Figure 4 illustrates the graphical representation of the rank of TQM risk factors. Here, the rank ofR1 is seventh, R2 is third, R3 is first, R4 is second, R5 is fourth, R6 is fifth and R7 is sixth.Analysis of the findings shows that Process management, Customer focus, Human resources management, and Role of quality department (first four ranks) are the most important among thesecritical success factors for implementation of total quality management.

Conclusion

The evolution of modern management techniques has been significantly influenced by the advent of total quality management (TQM). One important strategic component for achieving corporate success is quality. Companies around the world, large and small, manufacturing and service, have adopted the principles of total quality management to improve their performance. However, in a society that is focused on knowledge, good quality alone is not enough. As a key element of entrepreneurship, the foundation for long-term competitive advantage has changed from quality to innovation. In the commercial sector, notably in manufacturing. The strategy suggests a shift in corporate culture and leadership that empowers every employee, makes everyone accountable for improving quality and provides them with particular tools for collaborative problem-solving. It emphasizes minimizing operating expenses and ensuring customer satisfaction. The authors contend that varying degrees of maturity and acceptance are the main distinctions between quality management, and total quality management (TQM), as it is used in industry and government. To prove their point, they looked at three indicators of the maturation and acceptance of any new technique. Based on TQM, many well-known companies that were in financial decline have undergone spectacular revitalizations and recovered their market share and profitability. Numerous thousands of lesser-known businesses have achieved something akin. Few manufacturing organizations have proven successful while ignoring the components of TQM. The performance benefits brought forth by these noble objectives, described above, are not evident but rather quite mixed after forty years of TQM methods. Some businesses have made significant advancements, more than enough to justify the intense interest in TQM. Here, the rank of R1 is seventh, R2 is third, R3 is first, R4 is second, R5 is fourth, R6 is fifth and R7 is sixth. Analysis of the findings shows that Process Management, Customer focus, Human resources management, and the Role of the quality department (first four ranks) are the most important among these critical success factors for the implementation of total quality management.

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