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A study on total quality management consultant selection using TOPSIS method

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Abstract

Since its inception, quality management has undergone tremendous growth. The pharaohs of Egypt have sometimes used to date its genesis. However, it is frequently asserted that scientific administration, which was at its height in the late nineteenth and early twentieth centuries, is where contemporary quality assurance began. a wide range of enterprises, there is now much more interest in designing and implementing "total quality management (TQM) programmes" to improve performance and efficiency. Although top management backing for improvement initiatives is well acknowledged, there have been few tools to help management contribute to the creation of such programmes. The goals, resources, and preferences of the organization all influence consultant choice. Numerous variables that may be at odds with one another and adhere to ambiguous and imprecise data are having an impact on this issue. This study employs the "technique for order of preference by similarity to ideal solution (TOPSIS)" since choosing a comprehensive "quality management consultant" requires significant thought. According to how closely the favored choice resembles the ideal answer, this method employs an order of preference. Different criteria are given specific weights of importance according to the "equal weights method (EWM)". The rank of alternative consultants using the TOPSIS method for Consultant A is fourth, Consultant B is second, Consultant C is fifth, Consultant D is first and Consultant E is third. The result indicated that a consultant with high technical skills, average management skills and work experience in a related field is the best candidate among the selected consultants.

Keywords: TQM, Average project completion time, Work experience in a related field,Reputation, Implementation cost and MCDM..

Introduction

Because of the increased complexity in a limitless environment brought forth by globalization, management has changed in the twenty-first century. The development of information and communication technology has accelerated all human activities worldwide. The primary objective of the majority of organizations, whether public or commercial, is to increase competitiveness. A contemporary strategy for an organization's survival and expansion is management excellence. Many public organizations today have embraced this paradigm as their business strategy and have acknowledged the qualitative approach [1].TQM is simply one of many phrases used to describe the collection of actions required to direct businesses toward higher quality. The TQM descriptor is commonly used even though alternative terms like "quality improvement programme (QIP), companywide quality improvement (CWQI), and total quality control (TQC)" are also in use since they appear to cover a wide range of quality improvement activities. The definition of total quality management is "a management philosophy involved with individuals and work procedures that enhance customer satisfaction and enhance organizational performance" [2].Manufacturing and other industries are gathering impetus for "Continuous Improvement." Initiatives for "Continuous Improvement" seek to instill a culture of continuous improvement by including all parties. These advances are often small-scale, with cumulative effects that are more substantial than the sum of their parts. These gains are made possible by the methodical use of tools and methods designed to find and eliminate waste and variance in all operations [3].Contemporary "Continuous Improvement" methodologies, which got their start with "total quality management (TQM)", usually aim to involve the entire organization in the change initiatives. Many further "Continuous Improvement methodologies" have since emerged, expanding on the ideas of the earlier ones. These include "Lean Manufacturing, Six Sigma, and Lean Six Sigma," which are the most well-known [4].Among the most notable management advancements in the last twenty years is "Total Quality Management (TQM)". Initially in the 1980s, TQM emerged in Japan and quickly extended to Australia and Western nations. TQM subjects gained significant importance in the 1990s, and many firms sought to implement it and use it to grow and enhance their operations [5].

"Total quality management implementation" helps businesses grow their market share and, as a result, improves their ability to compete. The improvement of a group's quality of products and services is crucial for commercial success since clients desire higher quality, cheaper costs, and quick responses. " Total quality management", a control system and unified concept, boosts a company's ability to compete [6].TQM programme fails for several reasons, including a lack of top management dedication and comprehension of "Quality," a lack of insight into the organizational benefits of Strategy implementation, a lack of clarity in the guidelines, plan for implementation, and implementation procedures, a lack of knowledge of TQM and an incorrect understanding of the measuring system, a lack of explanation of the complexity of continuous advancement, and a failure to recognize the significance of TQM [7,8].Small and medium-sized manufacturing companies frequently struggle to implement effective TQM programmes because they lack sufficient financial, organizational, and external resources. By reducing knowledge gaps and other obstacles, mediating entities like consultants can be crucial to effective TQM service delivery in manufacturing organizations [9,10].The goals, resources, and interests of the organization all influence consultant choice. Numerous variables that may be at odds with one another and adhere to ambiguous and imprecise data are having an impact on this issue. " Multi-criteria decision-making (MCDM)" is unavoidable in this complex and contradictory situation for the choosing of the ideal TQM consultant for manufacturing enterprises where both theoretical and practical objectives can be taken into consideration. The intricacy of this procedure was further heightened by the inclusion of numerous individuals from various business functions [11,12].The business used the suggested procedure and established a consultant selection decision panel to choose the best TQM consultant. To pick a TQM consultant, these criteria were presented to the expert panel to elicit the most relevant and widely used criteria from their expertise and judgement. Six TQM consultants were chosen by the expert panel (referred to as "Con A to Con F") for further assessment. " Technical skills (TS), Management skills (MS), Average project completion time (PC), Work experience in a related field (WE), Reputation (RP), Implementation cost (IC), Professional knowledge (PK), Communication & interpersonal skills (CI), and Responsible & Trustworthy (RT)" are the criteria that will be taken into consideration during the selection procedure.

Materials and Methods

"TOPSIS" is an evaluation method that is widely used to analyses MCDM problems. It can be used for a variety of practical purposes, such as evaluating financial viability in a particular industry, comparing business results, and investing in cutting-edge manufacturing techniques. But there are also some limitations [13]. There are significant shortcomings to the "TOPSIS method" though. The potential for the phenomena known as "rank reversal" is one of the challenges that TOPSIS presents. When an option is added to or removed from the decision issue, this occurs, changing the "order of preference for the alternatives" [14]. Whenever a choice is added to or removed from the method, it occasionally leads to "Total rank reversal" when the preferences are completely reversed and the decision that was originally thought to be the best is now the worst. In many circumstances, such an occurrence might not be beneficial [15,16].In "MCDM" a variety of options must be examined and evaluated based on several variables. To assist the decision-maker in selecting from several possibilities is the aim of MCDM. Because of this, practical situations are frequently represented by several competing criteria, and no solution can likely satisfy all of the criteria simultaneously. According to the decision priorities, the solution is therefore a balanced choice. maker's The optimal result should therefore be the one that is "the Negative Ideal Solution (NIS) and most similar to the Positive Ideal Solution (PIS)" according to TOPSIS' guiding concept. The proximity metric is used to determine the final ranking [17,18].

Step 1: The decision matrix X, which displays "how various options perform concerning certain criteria", is created.

(1)

Step 2: Weights for the criteria are expressed as

$$w_j = [w_1 \cdots w \qquad (2)$$

Step 3: The matrix 's normalized values are computed as

(3)

"Weighted normalized matrix " is calculated by the following formula

(4)

Step 4: To begin, let's establish the "ideal best and ideal worst values": Here, we need to decide if the influence is "+" or "-. " If a column has a "+" impact, its greatest value is the "ideal best value for that column," and if it has a "-" influence, its poorest number is the "ideal worst value."

Step 5: Now we need to find "the difference between each response from the ideal best",

$$S_i^+ = \sqrt{\sum_{j=1}^{n}(N_{ij} - A_j^+)^2} \quad (5)$$

Step 6: Now we need to find "the difference between each response from the ideal worst",

$$S_i^- = \sqrt{\sum_{j=1}^{n}(N_{ij} - A_j^-} \quad (6)$$

Step 7: Now we need to find "theCloseness coefficient of i_{th} alternative"

$$CC_i = \frac{}{S_i^+} \quad (7)$$

The number of "The Closeness Coefficient" shows how much better the options are in relation. A "significantly worse alternative" is indicated by a smaller, CCi. and a "substantially better alternative" by a larger, CCi.The business used the suggested procedure and established a consultant selection decision panel to choose the best TQM consultant. To pick a TQM consultant, these criteria were presented to the expert panel to elicit the most relevant and widely used criteria from their expertise and judgement. Five TQM consultants were chosen by the expert panel (referred to as "Con A to Con E") for further assessment. " Technical skills (TS), Management skills (MS), Work experience in a related field (WE), Implementation cost (IC) and Average project completion time (PC)" are the criteria that will be taken into consideration during the selection procedure.

Analysis and Discussion

TABLE 1. TQM consultant selection details

	Technical skills	Management skills	Work experience in related field	Implementation cost	Average project completion time
Cons A	6.0	5.0	8.5	85.60	17.00
Cons B	3.0	3.0	4.0	76.00	17.00
Cons C	7.0	4.0	6.0	88.50	18.00
Cons D	6.0	4.0	3.5	67.50	20.00
Cons E	5.0	5.0	5.0	81.50	16.00

Table 1 shows the performance data of TQM consultant selection details. In this paper Cons A, Cons B, Cons C, Cons D and Cons E are used as an alternate consultant. " Technical skills (TS), Management skills (MS), Work experience in a related field (WE), Implementation cost (IC) and Average project completion time (PC)" are the criteria that will be taken into consideration during the selection procedure.

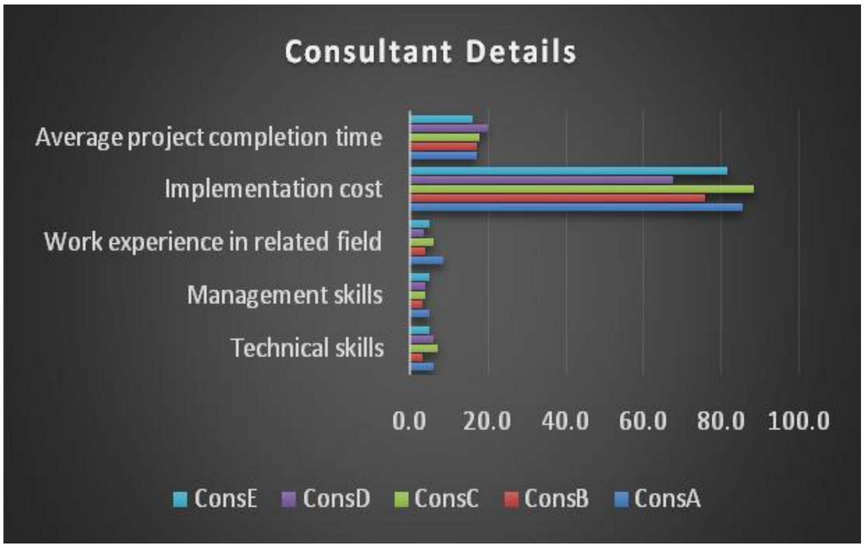

FIGURE 1. TQM consultant selection details

Figure 1 shows a graphical view of TQM consultant selection details. In this paper Cons A, Cons B, Cons C, Cons D and Cons E are used as an alternate consultant. " Technical skills (TS), Management skills (MS), Work experience in a related field (WE), Implementation cost (IC) and Average project completion time (PC)" are the criteria that will be taken into consideration during the selection procedure.

TABLE 2. Normalized Data

0.4819	0.4016	0.6827	6.8756	1.3655
0.2410	0.2410	0.3213	6.1045	1.3655
0.5623	0.3213	0.4819	7.1085	1.4458
0.4819	0.3213	0.2811	5.4217	1.6064
0.4016	0.4016	0.4016	6.5462	1.2852

The normalized matrix of the Ratings of the performance of the selection of the TQM consultant is displayed in Table 2 above. This matrix was produced using equation three.

TABLE 3. Weight

0.20	0.20	0.20	0.20	0.20
0.20	0.20	0.20	0.20	0.20
0.20	0.20	0.20	0.20	0.20
0.20	0.20	0.20	0.20	0.20
0.20	0.20	0.20	0.20	0.20

The preferred weight for the evaluation parameters is shown in Table 3. In this case, weights are equally distributed among " Technical skills (TS), Management skills (MS), Work experience in a related field (WE), Implementation cost (IC) and Average project completion time (PC)". The sum of weights distributed equals one.

TABLE 4. Weighted normalized decision matrix

0.0964	0.0803	0.1365	1.3751	0.2731
0.0482	0.0482	0.0643	1.2209	0.2731
0.1125	0.0643	0.0964	1.4217	0.2892
0.0964	0.0643	0.0562	1.0843	0.3213
0.0803	0.0803	0.0803	1.3092	0.2570

Table 4 shows the weighted normalized matrix of the decision matrix and it is calculated by table 2 and table 3 using equation 4.

TABLE 5. Positive Matrix

0.1125	0.0803	0.1365	1.0843	0.2570
0.1125	0.0803	0.1365	1.0843	0.2570
0.1125	0.0803	0.1365	1.0843	0.2570
0.1125	0.0803	0.1365	1.0843	0.2570
0.1125	0.0803	0.1365	1.0843	0.2570

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

0.0482	0.0482	0.0562	1.4217	0.3213
0.0482	0.0482	0.0562	1.4217	0.3213
0.0482	0.0482	0.0562	1.4217	0.3213
0.0482	0.0482	0.0562	1.4217	0.3213
0.0482	0.0482	0.0562	1.4217	0.3213

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**
Cons A	0.2917	0.1196
Cons B	0.1711	0.2067
Cons C	0.3416	0.0839
Cons D	0.1053	0.3412
Cons E	0.2340	0.1394

Table 7 shows the “Si plus and Si negative values”. The difference between each response from the “ideal best ( )” is found utilizing equation 5 and the difference between each response from the “ideal worst (” is found utilizing equation 6.

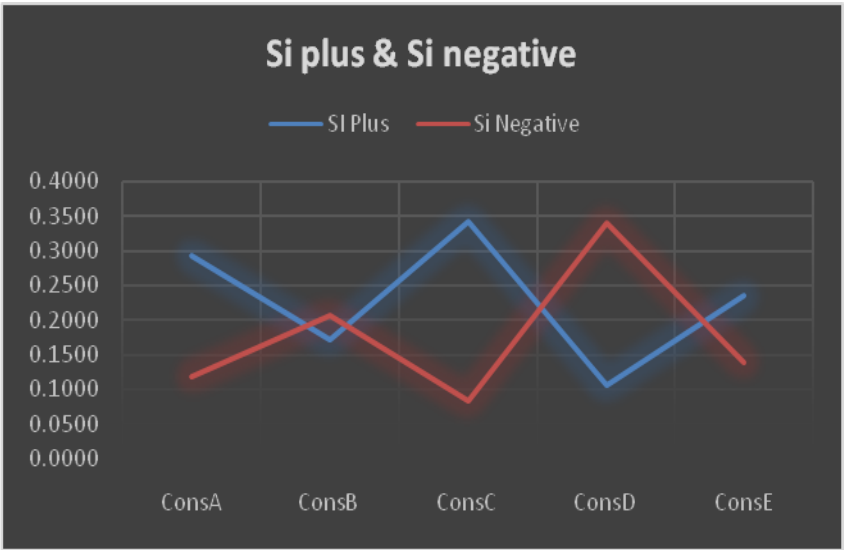

FIGURE 2. SI Plus and Si negative

Figure 2 illustrates the graphical representation of the Si plus and Si negative values. The difference between each response from the “ideal best ( )” is found utilizing equation 5 and the difference between each response from the “ideal worst (” is found utilizing equation 6.

TABLE 8. Closeness coefficient

	Ci
Cons A	0.2908
Cons B	0.5470
Cons C	0.1971
Cons D	0.7641
Cons E	0.3732

The proximity coefficient values of the alternatives are displayed in Table 8. Equation 7 is employed in the calculation. Here Closeness coefficient value forConsultant A is 0.2908, Consultant B is 0.5470, Consultant C is 0.1971, Consultant D is 0.7641 and Consultant E is 0.3732.

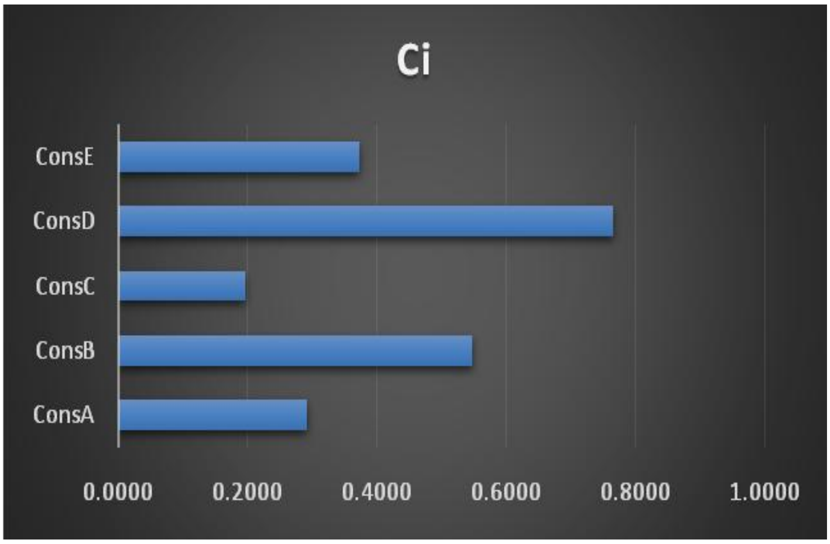

FIGURE 3. Closeness Coefficient (CCi)

Figure 3 illustrates the graphical representation of CCi. It is calculated by using equation 7. Here Closeness coefficient value forConsultant A is 0.2908, Consultant B is 0.5470, Consultant C is 0.1971, Consultant D is 0.7641 and Consultant E is 0.3732.

TABLE 9. Rank

	Rank
Consultant A	**4**
Consultant B	**2**
Consultant C	**5**
Consultant D	**1**
Consultant E	**3**

Table 9 shows the analysis of the selection of consultants for TQM. Here rank ofConsultant A is fourth, Consultant B is second, Consultant C is fifth, Consultant D is first and Consultant E is third.

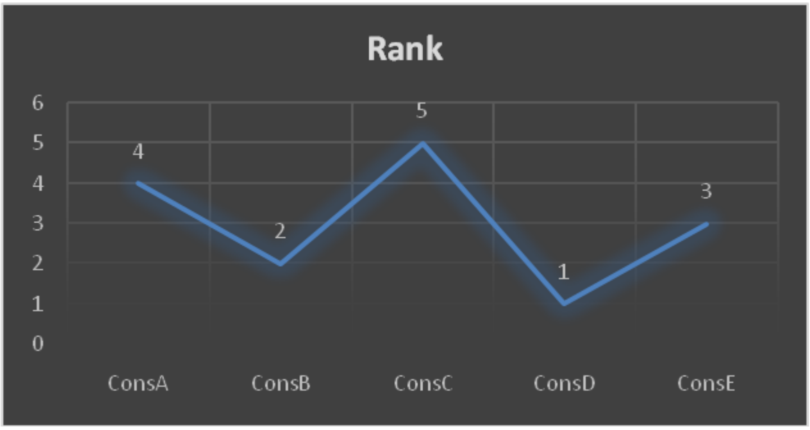

FIGURE 4. Rank

Figure 4 illustrates the ranking of Ui from Table 9. Here rank of alternatives using the TOPSIS method for Consultant A is fourth, Consultant B is second, Consultant C is fifth, Consultant D is first and Consultant E is third. The result indicated that consultant d with high technical skills, average management skills and work experience in a related field is the best candidate among the selected consultants.

Conclusion

Thanks to the quickening pace of globalization, manufacturing companies who can succeed in the challenging market environment will also succeed in the global competition of both local and foreign markets. " Total quality management (TQM)" has become a crucial management ethos for manufacturing businesses to stay competitive due to the evolving business environment and shifting client demands. Many manufacturing companies now use TQM to gain a competitive edge, boost productivity, increase organizational effectiveness, satisfy customers, enhance their whole business process, produce better products, and enhance their reputation. Assessment of the right consultants can be crucial to the effective implementation of a total quality management (TQM) programme and aid industrial businesses in gaining a competitive edge. The challenge of choosing an appropriate consultant, which relies on ambiguous and imprecise data, is generally impacted by several contradictory elements. This study employs the "technique for order of preference by similarity to ideal solution (TOPSIS)" since choosing a comprehensive "quality management consultant" requires significant thought. The result from the TOPSIS method indicated that a consultant with high technical skills, average management skills and work experience in a related field is the best candidate among the selected consultants.

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