Identifying the Most Influencing Success Factors of TQM Implementation in Manufacturing Industries using Analytical Hierarchy Process

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Abstract

TQM implementation serves the purpose of achieving business excellence which eventually leads to customer satisfaction, increased profits and higher production for the organization. The purpose of this paper is to investigate the most important success factors of TQM and study its comparative importance for enhanced execution in manufacturing industries. In this study a broad literature review was done to identify and prepare the list of success factors for sustaining TQM implementation. Analytic hierarchy process is used to assign the relative importance and ranking the identified success factors of TQM in perspective manufacturing industries. The finding of study demonstrates that ‘Top management commitment’ ranked number one and this factor is fundamental for implementing TQM initiatives successfully. The success factors ‘education and training’ and ‘rewards & recognition’ ranked at second and third positions which need special attention while performing TQM activities in a more effective manner. The results also propose a general hierarchy model for judging the relative importance of success factors that would influence implementation of TQM.

Keywords
Total Quality Management, Top Management Commitment, Success Factors, Manufacturing, TQM implementation

1. Introduction

In the current circumstances of fiercely competitive environment, different business management tools such as Total Quality Management (TQM), Total Productive Maintenance (TPM), Six-Sigma, Just in Time (JIT), etc. are used by many organizations to improve their operational capabilities. In TQM, the organizations used to deploy some statistical and management tools for enhancing organizational capabilities through continuous improvement approach (Ismyrilis and Moschidis, 2015; Ismyrilis, 2017; Silombela et al., 2018). Total Quality management is indeed a joint effort of management, staff members, workforce, suppliers and dealers in order to meet and exceed customer satisfaction level (Prajogo and Sohal, 2003; Singh and Smith, 2004; Thai Hoang, Igel and Laosirihongthong, 2006). Another definition, Total quality management is a continuous endeavor by employees to continuously enhance (Yang, 2006; Prakas and Murali, 2016) the quality of their products and services through customers’ feedback. Total Quality management is indeed a joint effort of management, staff members, workforce, suppliers and dealers in order to meet and exceed customer satisfaction level. In today’s competitive environment, customer satisfaction is a most important concern for all type of organizations (Choi and Eboch, 1998; Reed et al., 2000; Ugboro and Obeng, 2000). TQM attempts to incorporate all the organizational activities like marketing, quality, finance, design, engineering, production and customer service to focus on meeting customer demands and organizational objectives (Soltani and Wilkinson, 2018; Sahoo, 2019). TQM not only improve the business performance of the companies but also boost the morale and skill of the employees.

A number of good researchers have emphasized many success factors like leadership commitment, employee participation, financial resources, suppliers, communication, customer focus, process approach etc. that are essential to effective deployment of TQM implementation in any organization (Kaynak 2003; Rao et al. 2004 and Baird et al. 2011). TQM is not just a management philosophy but a culture of an organization dedicated towards continuous
improvement and customer satisfaction (Mohammad 2005, Talib et al. 2011). On the other hand implementation of TQM success factors is not easy task and its results are not easy to get (Mohammad 2005, Talib et al. 2011). Thus it is very important for any organization that implementation of these TQM success factors in well structured manner, to achieve employee fulfillment, customer satisfaction, better financial results and business performance (Ashok and Santhakumar 2002; Verma and Rathod 2014). To get maximum benefits and preferred results, priority of these TQM success factors is essential. In order to find out the importance of TQM success factors, the present study exercises an analytic hierarchy process (AHP) approach. The main objective of present study is to identifying the most essential success factor during the TQM implementation in a leading tractor manufacturing company of India.

The subsequently sections deal with the literature review followed by identification of TQM success factors. An introduction to AHP is discussed and the comparative significance of the success factors is evaluated by using the AHP approach in the succeeding section. Lastly, results on findings are presented followed by conclusion.

2. Literature review

A broad literature review of the preceding studies on TQM have studied about the concept of TQM and the important success factors for successful implementation of TQM in any organization. Success factors are a set of significant elements that help the organization in achieving its objectives for better business performance. The focus of present study literature review was on the investigation of those critical success factors of TQM implementation that result in improved productivity, market position, sales volume and customer satisfaction particularly in manufacturing industries. In order to investigate the success factors of TQM implementation, various literature has been studied from different areas like from quality Guru’s (Crosby, 1979; Deming, 1982; Ishikawa, 1985; Juran, 1988; Feigenbaum, 1991), quality awards (Malcolm Baldrige National Quality Award, The Deming Award, European Quality Award, Rajiv Gandhi National Quality Award) and from practical research (Kohli and Singh 2015; Sahoo and Yadav 2017; Knol et al. 2018). These studies give a good number of success factors important for implementation of TQM. The success factors identified from the TQM literature are presented in Table 1.

Table 1. TQM Success factors with their references/sources

<table>
<thead>
<tr>
<th>S.No.</th>
<th>SUCCESS FACTORS</th>
<th>SOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Top Management Commitment</td>
<td>Deming, 1982; Oakland (1993); Flynn et al. (1994); Ahir et al. (1996); Schmitz &amp; Platts, 2004; Li et al. (2005); Ho Voon et al. (2014); Talib et al. (2013); Singh and Sushil (2013); Psomas and Jaca (2016)</td>
</tr>
<tr>
<td>2.</td>
<td>Continuous Improvement</td>
<td>Ho Voon et al. (2014); Talib et al. (2013); Singh and Sushil (2013)</td>
</tr>
<tr>
<td>3.</td>
<td>Supplier Quality</td>
<td>Oakland (1993); Ahir et al. (1996); Samson and Terziovska, (1999); Kayank, 2003; Talib et al. (2013)</td>
</tr>
<tr>
<td>4.</td>
<td>Customer Focus</td>
<td>Deming, 1982; Oakland (1993); Flynn et al. (1994); Ahir et al. (1996); Samson and Terziovska, (1999); Li et al. (2005); Ho Voon et al. (2014); Talib et al. (2013); Singh and Sushil (2013); Psomas and Jaca (2016)</td>
</tr>
<tr>
<td>5.</td>
<td>Rewards and Recognition</td>
<td>Ahir et al. (1996); Talib et al. (2013)</td>
</tr>
<tr>
<td>6.</td>
<td>Education and Training</td>
<td>Deming, 1982; Ahir et al. (1996); Ho Voon et al. (2014); Talib et al. (2013); Singh and Sushil (2013); Psomas and Jaca (2016)</td>
</tr>
<tr>
<td>7.</td>
<td>Total Employee Participation</td>
<td>Deming, 1982; Ahir et al. (1996); Samson and Terziovska, (1999); Kayank, 2003; Ho Voon et al. (2014); Talib et al. (2013); Psomas and Jaca (2016)</td>
</tr>
<tr>
<td>8.</td>
<td>Review &amp; Monitoring</td>
<td>Oakland (1993); Ahir et al. (1996); Samson and Terziovska, (1999); Kayank, 2003; Li et al. (2005); Talib et al. (2013);</td>
</tr>
<tr>
<td>9.</td>
<td>Quality Management</td>
<td>Deming, 1982; Ho Voon et al. (2014); Talib et al. (2013)</td>
</tr>
<tr>
<td>10.</td>
<td>SPC Usage</td>
<td>Ishikawa, 1985; Oakland (1993); Ahir et al. (1996); Ho Voon et al. (2014); Haridy et al. 2017; Baker et al. 2018</td>
</tr>
<tr>
<td>11.</td>
<td>Quality Citizenship</td>
<td>Oakland (1993); Ahir et al. (1996)</td>
</tr>
<tr>
<td>13.</td>
<td>Benchmarking</td>
<td>Ahir et al. (1996); Talib et al. (2013); Singh and Sushil (2013)</td>
</tr>
<tr>
<td>14.</td>
<td>Communication</td>
<td>Oakland (1993); Ahir et al. (1996); Kayank, 2003; Ho Voon et al. (2014); Talib et al. (2013); Psomas and Jaca (2016)</td>
</tr>
</tbody>
</table>
2.1 Identification of TQM Success factors

The most prominent success factors for implementing TQM in manufacturing industries are identified using literature review and discussion with professionals and academicians. The identification and establishing the interrelationship among the critical success factors through AHP is discussed in this paper. First the TQM implementation success factors (as shown in Table 1) were identified using the literature review and then the eight most prominent success factors were sorted out after discussion with the TQM professionals and academicians. The success factors play a very crucial role in order to achieve business goals and organizational effectiveness (Tseng & McLean, 2008). The following are the eight identified success factors as:

1. *Top Management Commitment*: Management commitment is vital not only for talking the business objectives and strategies, but also for providing direction and motivation to the employees of the organization (Dale, 1999; Nist, 2000; Kanji, 2002).

2. *Rewards and Recognition*: Rewards and Recognition can be formal or informal (Crosby, 1998). They provide energy for retaining passion for implementing quality initiatives. Moreover every organization to have rewards and recognition joined with the performance success and employees skills (Harrington 1998).

3. *Education and Training*: Education and training gives knowledge and skills to employees in order to meet their work and individual objective. A booming education and training curriculum would generate more positive employee attitude in terms of loyalty and helping nature in their individual growth and job participation (Mellat et al. 2011). Further, Stahl (1995) stresses education and training as the important factor that helps in organizing employees in the direction of managing the TQM philosophy in the process of manufacturing.

4. *Total Employee Participation*: According to Logothetis (1992) with the total employee participation, organizations can boost employee’s capability to solve the problems and exploit opportunities. Arumugam et al. (2008) stressed as total employee involvement is a major success factor to develop a partnership between employees and managers.

5. *Review & Monitoring*: To increase the quality and service, information from customers, competitors and suppliers should be gather in well-organized way. Sila and Embrahimpoor, (2002) examined that quality review & monitoring is positively associated with organizational performance.

6. *Strategic Planning and Management*: Strategic planning and management combines the improvement and exploitation of plans, which develop the relationship with stakeholders (Tseng & McLean, 2008). To achieve good financial and organizational results long term policy is supposed to be undoubtedly identified and efficiently passed throughout the organization (Peters, 1998; Brah et al. 2002).

7. *Quality Management*: A good quality culture crafts a feeling on the customer regarding the company (Bitner, 1992; Curry & Kadasah, 2002). Quality management is essential for as long as employee empowerment that shows employees to focus on quality and examine their individual errors (Ahire, Golhar, & Waller, 1996).

8. *Communication*: A proper communication can facilitate the whole organizational employee to manage the priorities. The stream of information between employees and machines for purposes such as monitoring, safety, maintenance, and analytics is essential to maximizing the organizational efficiency (Talib et al. 2013).

3. AHP Methodology
According to Saaty (1980) Analytic hierarchy process (AHP) is one of the qualitative techniques. AHP is a universal judgmental approach for resolving complexes and problems (Saaty 1988). AHP is intended to decompose a multifarious problem into various intermediate steps of hierarchy structure (Crowe, Noble, & Machimada, 1998; Saaty, 1980). In order to explore the most influencing success factors of TQM implementation in manufacturing industries this study uses the AHP methodology. With the assist of professionals and academician judgments the priorities between all the success factors is formulated. With professional’s proficiency pair wise evaluation results are applied to pairs of homogenous criteria (Saaty, 1980). AHP can lodge both objective and sub objective results of the professionals concerned in order to determine priority among the different factors. The process flow chart concerning different steps to conduct the AHP study is shown in Figure 1.

Figure 1. Process Flow to perform AHP methodology

4. Case study (To investigate the impact of TQM success factors)
The AHP technique is widely applied in many areas with diverse applications. Application of AHP technique to examine priority and ranking in different areas is well documented in literature as shown in Table 2.

<table>
<thead>
<tr>
<th>Author (Year)</th>
<th>Application (Area)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fong and Choi (2000)</td>
<td>Contractor selection</td>
</tr>
<tr>
<td>Lewis, Pun, and Lalla (2005)</td>
<td>Determination of TQM benefits in SMEs</td>
</tr>
<tr>
<td>Chen et al. (2009); Salomon et al. 2019</td>
<td>Aviation safety</td>
</tr>
<tr>
<td>Mohajeri and Amin (2010)</td>
<td>Railway station site selection</td>
</tr>
<tr>
<td>Chen and Fan (2009)</td>
<td>Corporate social responsibility</td>
</tr>
<tr>
<td>Pourghasemi et al. 2012; Rahaman et al. 2015</td>
<td>Geographical Information</td>
</tr>
<tr>
<td>Önder et al. 2013</td>
<td>Banking Sector</td>
</tr>
<tr>
<td>Soltés and Gavurová (2014)</td>
<td>Health care systems</td>
</tr>
<tr>
<td>Saito et al. 2015</td>
<td>Animal disease response activities</td>
</tr>
<tr>
<td>Goyal and Kaushal 2016</td>
<td>Optimized mobile network selection</td>
</tr>
<tr>
<td>Alvarez Pérez et al. 2017</td>
<td>Financial Sector</td>
</tr>
<tr>
<td>Cahyapratama and Sarno 2018</td>
<td>Singer selection process</td>
</tr>
<tr>
<td>Srivastava et al. 2019; Lai (2019)</td>
<td>Indian railway; Military logistic depot</td>
</tr>
</tbody>
</table>

In order to explore the levels of TQM success factor implementation in manufacturing organizations, this study uses the AHP methodology. The different steps concerned in AHP methodology are as follows.

Step-1: Objective of the study
The purpose of present study is to investigate the most influencing success factor of TQM implementation for manufacturing industries in order to get maximum advantage during TQM implementation journey.

Step-2: Development of AHP hierarchical framework
After the objective had been recognized, appropriate and important success factors were identified as discussed in section 3. The identified eight major success factors which affect decision making in TQM implementation are given abbreviations as mentioned below:

1. Top Management Commitment (TMC)
2. Rewards and Recognition (R&R)
3. Education and Training (E&T)
4. Total Employee Participation (TEP)
5. Review and Monitoring (R&M)
6. Strategic Planning and Management (SP&M)
7. Quality Management (QM)
8. Communication (C)

Step-3 Compilation of observed information
This section covers the compilation of observed information through the combined judgment of professionals particularly selected from manufacturing organizations and academician. In this present study, a set of 15 professionals provided their opinion for assessment to these success factors. All the professionals have significant knowledge in organization quality improvement activities.

Step-4: Perform pair wise comparison of attributes
After compilation empirical information, the next step is to evaluate relative importance of success factors and offer a score for alternatives depending upon qualitative factors. Pair wise comparisons of each success factor are made to establish relations within the structure. This is a principal step in developing an AHP model to evaluate relative importance of factors and offer a score for alternatives depending upon qualitative factors. The AHP targets on two factors at a time and their relationship with each other. Invited professionals were asked for assigning relative points with respect to the objective of the study. The comparative importance of every factor is determined by a
measurement scale to supply numerical judgments corresponding to verbal judgments. The degree of preference is
given to the pair-wise comparisons of decisive factor on 9 point scale (Saaty, 1988), where 1 reflects equal
weightage and 9 reflects extreme or absolute importance as shown in Table 3.

Table 3. Pair wise comparison scale

<table>
<thead>
<tr>
<th>Degree of preference</th>
<th>Effect of factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Equal importance</td>
</tr>
<tr>
<td>3</td>
<td>Moderate importance of one over another</td>
</tr>
<tr>
<td>5</td>
<td>Essential or strong importance</td>
</tr>
<tr>
<td>7</td>
<td>Very strong importance</td>
</tr>
<tr>
<td>9</td>
<td>Extreme/absolute importance</td>
</tr>
<tr>
<td>2, 4, 6, 8</td>
<td>Intermediate values between two adjacent judgments</td>
</tr>
</tbody>
</table>

Step-4: Development of pair-wise comparison matrix

A set of pair-wise comparison matrices for each of the success factor at intermediate level is built up. The factors at
higher level are said to be governing factors which affects the factors at lower level. The factors at the lower level
are compared with each other, based upon their effect on the governing factors. This provides an opportunity to
develop a pair-wise comparison for developing a structure of n × n reciprocal judgment matrix.

The pair-wise comparison matrix highlights the factors which are dominating other factors. These judgments are
then expressed as integers. If i\textsuperscript{th} factor is very important or demonstrably more important than j\textsuperscript{th} factor, then based
on the above Table 3 degree of preference a number is assigned and entered in i\textsuperscript{th} row, j\textsuperscript{th} column and reciprocally is
entered in j\textsuperscript{th} row, i\textsuperscript{th} column. If the evaluators have given a common preference scale to the factors being compared,
then number ‘1’ is entered to both positions. The n (n – 1)/2 judgments are helping to develop the matrix, where n is
total number of success factors. Table 4, shows the pair-wise comparison matrix.

Table 4. Pair-wise comparison matrix

<table>
<thead>
<tr>
<th></th>
<th>TMC</th>
<th>R&amp;R</th>
<th>E&amp;T</th>
<th>TEP</th>
<th>R&amp;M</th>
<th>SP&amp;M</th>
<th>QM</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMC</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>R&amp;R</td>
<td>1/2</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>E&amp;T</td>
<td>1/2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>TEP</td>
<td>1/2</td>
<td>1/2</td>
<td>1/3</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>R&amp;M</td>
<td>1/5</td>
<td>1/4</td>
<td>1/2</td>
<td>1/2</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>SP&amp;M</td>
<td>1/2</td>
<td>3</td>
<td>1/2</td>
<td>1/2</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>QM</td>
<td>1/2</td>
<td>1/3</td>
<td>1/5</td>
<td>1/4</td>
<td>1/2</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>1/7</td>
<td>1/5</td>
<td>1/4</td>
<td>1/5</td>
<td>1/4</td>
<td>1/2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>SUM</td>
<td>3.592</td>
<td>8.2833</td>
<td>5.7833</td>
<td>9.450</td>
<td>15.750</td>
<td>9.083</td>
<td>22.000</td>
<td>29.000</td>
</tr>
</tbody>
</table>

Step-5: Normalization of matrix

After making all the pair wise comparisons for each of the success factor, normalize the column of numbers by
dividing each entry in column ‘i’ of the Table 4 by the sum of all entries in same column. This creates (Table 5) the
normalized comparison matrix. In normalized comparison matrix the sum of the entries in each column is ‘1’ (Saaty,
2000; Chuang, 2001). The normalized value \( r_{ij} \) is calculated as:

\[
r_{ij} = \frac{a_{ij}}{\sum_{i=1}^{n} a_{ij}}
\]

Then sum each row of the normalized values and take the average. This provides priority weights for each success
factor. Priority means the comparative significance of impact of a norm in relation to other norm that is placed
above it in the hierarchy. The approximate priority weight (W1, W2,…….Wj) for each factor is obtained as shown in
Table 5.
Where, \( n \) is number of success factors; \( a \) is the cell value assigned in pair wise matrix.

Table 5. Criteria pair wise comparison matrix (Normalized)

<table>
<thead>
<tr>
<th></th>
<th>TMC</th>
<th>R&amp;R</th>
<th>E&amp;T</th>
<th>TEP</th>
<th>R&amp;M</th>
<th>SP&amp;M</th>
<th>QM</th>
<th>C</th>
<th>Sum</th>
<th>Priority weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMC</td>
<td>0.278</td>
<td>0.241</td>
<td>0.346</td>
<td>0.212</td>
<td>0.317</td>
<td>0.220</td>
<td>0.091</td>
<td>0.241</td>
<td>1.947</td>
<td>0.243</td>
</tr>
<tr>
<td>R&amp;R</td>
<td>0.139</td>
<td>0.121</td>
<td>0.173</td>
<td>0.212</td>
<td>0.254</td>
<td>0.037</td>
<td>0.136</td>
<td>0.172</td>
<td>1.244</td>
<td>0.155</td>
</tr>
<tr>
<td>E&amp;T</td>
<td>0.139</td>
<td>0.121</td>
<td>0.173</td>
<td>0.317</td>
<td>0.127</td>
<td>0.220</td>
<td>0.227</td>
<td>0.138</td>
<td>1.463</td>
<td>0.183</td>
</tr>
<tr>
<td>TEP</td>
<td>0.139</td>
<td>0.060</td>
<td>0.058</td>
<td>0.106</td>
<td>0.127</td>
<td>0.220</td>
<td>0.182</td>
<td>0.172</td>
<td>1.064</td>
<td>0.134</td>
</tr>
<tr>
<td>R&amp;M</td>
<td>0.056</td>
<td>0.030</td>
<td>0.086</td>
<td>0.053</td>
<td>0.063</td>
<td>0.110</td>
<td>0.091</td>
<td>0.138</td>
<td>0.628</td>
<td>0.078</td>
</tr>
<tr>
<td>SP&amp;M</td>
<td>0.139</td>
<td>0.362</td>
<td>0.086</td>
<td>0.053</td>
<td>0.063</td>
<td>0.110</td>
<td>0.182</td>
<td>0.069</td>
<td>1.065</td>
<td>0.133</td>
</tr>
<tr>
<td>QM</td>
<td>0.070</td>
<td>0.040</td>
<td>0.035</td>
<td>0.026</td>
<td>0.032</td>
<td>0.028</td>
<td>0.045</td>
<td>0.034</td>
<td>0.310</td>
<td>0.039</td>
</tr>
<tr>
<td>C</td>
<td>0.040</td>
<td>0.024</td>
<td>0.043</td>
<td>0.021</td>
<td>0.016</td>
<td>0.055</td>
<td>0.045</td>
<td>0.034</td>
<td>0.279</td>
<td>0.035</td>
</tr>
<tr>
<td>Total</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td></td>
</tr>
</tbody>
</table>

From the above table one can guess that the priority is given to top management commitment i.e ‘0.243’ go after by education and training ‘0.183’ and so on.

Step-6: Consistency checking in pair wise matrix

In this step consistency of obtained pair of norms is checked. One possibility is that professionals may be inconsistent in their evaluation. The weightages of different success factors are determined by calculating the eigen vector weights for making the evaluation. An index of consistency is further calculated for providing information on numerical and transitive consistency. The results can therefore be used to search for additional information and re-examine data used in constructing the scale in order to improve consistency. The relative weights (\( \delta \)), is calculated by using the formula:

\[
A \times W_j = \delta, \text{ where } j = 1, 2, \ldots n
\]

Where ‘\( A \)’ represents the pair-wise comparison decision matrix, here in this study it is 8 x 8 matrix and \( W_j \) represents priority weight.
Table 6, shows the value of \( \lambda \) for the eight criteria and maximum value of \( \lambda_{max} \) is 8.901. With the help of maximum value of \( \lambda \) the consistency index (CI), which measures the inconsistencies of pair-wise comparisons is calculated as:

\[
CI = \frac{\lambda_{max} - n}{(n-1)} = 0.128
\]

Table 6. Eigen vector values

<table>
<thead>
<tr>
<th>Success Factors</th>
<th>( \delta )</th>
<th>Priority weights</th>
<th>Eigen vector ( \lambda )</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMC</td>
<td>2.166</td>
<td>0.243</td>
<td>8.901</td>
</tr>
<tr>
<td>R&amp;R</td>
<td>1.375</td>
<td>0.155</td>
<td>8.844</td>
</tr>
<tr>
<td>E&amp;T</td>
<td>1.616</td>
<td>0.183</td>
<td>8.837</td>
</tr>
<tr>
<td>TEP</td>
<td>1.146</td>
<td>0.133</td>
<td>8.614</td>
</tr>
<tr>
<td>R&amp;M</td>
<td>0.674</td>
<td>0.078</td>
<td>8.593</td>
</tr>
<tr>
<td>SP&amp;M</td>
<td>1.183</td>
<td>0.133</td>
<td>8.882</td>
</tr>
<tr>
<td>QM</td>
<td>0.329</td>
<td>0.039</td>
<td>8.480</td>
</tr>
<tr>
<td>C</td>
<td>0.298</td>
<td>0.035</td>
<td>8.541</td>
</tr>
</tbody>
</table>

After calculating the consistency index, it is compared with the appropriate consistency index and this index was called random consistency index (RCI). The average consistencies for different order random matrices are shown in Table 7, (Saaty and Kearns, 1985).

Table 7. Random Consistency Index Table

<table>
<thead>
<tr>
<th>( n )</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCI</td>
<td>0</td>
<td>0</td>
<td>0.58</td>
<td>0.9</td>
<td>1.12</td>
<td>1.24</td>
<td>1.32</td>
<td>1.41</td>
<td>1.45</td>
<td>1.49</td>
</tr>
</tbody>
</table>

The last ratio that has to be calculated is Consistency Ratio (CR). Generally, if CR is less than 10%, the evaluations are consistent (Dyer & Forman, 1992) and acceptable. But if CR is greater than 10%, the quality of evaluations should be revised to have CR less than or equal to 10%. The formulation of CR is:

\[
CR = \frac{CI}{RCI}
\]

For example, in present study, the consistency ratio is ‘0.0907’; as a result the evaluations are consistent and acceptable. On the basis of calculated priority weights as discussed in Table 5, the ranking of the TQM success factors were done and is shown in Figure 2.
5. Conclusion

The objective of this study is to investigate the most influencing success factor of TQM implementation for manufacturing industries in order to get maximum advantage during TQM implementation journey. The results of AHP methodology demonstrates that ‘Top management commitment’ ranked number one and this factor is fundamental for implementing TQM initiatives successfully. The factors ‘education & training’ and ‘rewards & recognition’ ranked at second and third positions which need special attention while performing TQM activities in more effective manner. The other factors ‘strategic planning’ and ‘Total employee participation’ ranked at fourth and fifth places are truly important which need to motivate and promote employees to participate in TQM promotional activities. Last but not the least, factors ‘Monitoring and reviewing implementation of TQM initiatives’, quality management and communication are also important to give continuous growth for the successful implementation of TQM in any type of manufacturing organization. AHP hierarchy model formulated through this study will be very valuable to decision maker in manufacturing organization while implementing TQM.

In this research paper the most influencing success factors have been identified by using AHP. There is a good scope to further establish the relationship between these factors using some other mathematical model methods.

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