An approach for evaluation and ranking EFQM criteria in high tech organization: (Case study: An airline in Iran)

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Abstract

In recent years, ignorance of some factors based on organizational excellence, in an organization, causes many different issues. One of the common tools for scheduling dealing with these issues is the use of a repetitive evaluation system. Such a system which ranks performance evaluation factors in every period by organization performance and concentrates to each criterion by its importance. Therefore, it is of great importance to first recognize and rank effective organizational excellence factors and second concentrate precisely to each factor. For this reason, comprehensively recognizing the effective factors and using an approach based on degree of importance are urgently needed in order to cares each factor by its weigh. As a consequence, in this article, an approach based on FAHP for ranking effective factors has been presented. The result of implementing the recommended approach in an airline in Iran (Islamic Republic of) proves its application and effectiveness.

Introduction

Excellence Model which is now in most parts of the world, whether developed or developing industrial countries such as several national awards for efficiency, quality, Excellency, business excellence is awarded to the industries, that can be cited as an important and effective tool for growth and excellence industries. This model providing self-assessment and Compare internal and external competitors, also excellence models based on defined criteria are guiding the organization in a management framework and encourage them to achieve short-term and long-term programed objectives (Wonggrassamee, 2003).

Today, many organizations are looking for excellence, but most of them have failed to achieve this goal. In most cases, the cause of the failure is that the managers do not understand excellence correctly. Since 1982 that Peters and Waterman's book In Search of Excellence published, efforts were made to the definition of excellence (Park, 2007-Su Mi Dahlgaard).

Excellence is consists of excellence in strategy, operations and performance results of the organization that related to the stakeholders (Adebabjo & Maan, 2008). Peters and Waterman in their book (in search of excellence) explain excellent organizations: Excellent companies has innovations, the ability to change and leadership that makes excellent actions and values (Hermel, 2003).

Today, organizations must have to coordinate with customer needs and focus on the results of the safety, environmental and social performance note for their success. Considering these factors can be mentioned as business excellence (Boys, 2005)

Hermel & Ramis-pujol describe steps of excellence from beginning of pre-excellence to the fifth stage of the integrated innovative development (Vouzas, 2007).

Phrase of pre-excellence show the Period of before the publication of In Search of excellence by Peters and Waterman. The concept of excellence has been strongly influenced by the book. This concept before Published Book by Peters and Waterman had a different implication Therefore, a review of the historical theories of organizational development and their relationship with the concept of excellence is valuable. .
Scientific Management, also called Taylorism, is a theory of management that analyzes and synthesizes workflows. Its main objective is improving economic efficiency, especially labor productivity. It was one of the earliest attempts to apply science to the engineering of processes and to management (Hermel, 2003).

Human relations movement in management theory is the analysis of people's issues that arise due to interpersonal and organizational relationships. In the business world, human relations are a critical part of organizational success; an organization may have a wonderful business plan, but without employees to carry out that plan, it is worthless. It's often said that a happy employee is a more productive employee. Nothing proves this more than the history of the human relations movement in management.

Social systems theory considers the organization as an open system. In this theory factors that lead to organizational excellence are richen tasks and Participate process owners. Excellence is a dynamic approach that require planning. This dynamic vision is used in social economic theory but its main focus is on reducing the inappropriate actions of the organization's operations (Hermel, 2003).

System structure theory considers the structure of the organization as a whole and therefore proposes to the world approach of business excellence. This approach is based on the analogy of the natural sciences and hopes to build a bridge between the theory of management and these sciences (Hermel, 2003).

The neoclassical theory was an attempt at incorporating the behavioral sciences into management thought in order to solve the problems caused by classical theory practices. The premise of this inclusion was based on the idea that the role of management is to use employees to get things done in organizations. Rather than focus on production, structures, or technology, the neoclassical theory was concerned with the employee. Neoclassical theorists concentrated on answering questions related to the best way to motivate, structure, and support employees within the organization (Hermel, 2003).

**Problem definition and proposed approach**

Quality and efficiency are two important concepts of management which are used to evaluate organizations. Quality is the best indicator for focus on customer requirement. Quality is combines elements of marketing, research and development, production and after-sales service, thus improving the quality can be one of the main approaches that considers to improve the organization's ability in processes, products and services. Therefore organization's survival and growth will be related to the focus on quality in all organizational levels. It can be said that quality is the starting point for organizational excellence. Recognizing the important and influence criteria, then prioritize them according to their importance can have a significant influence on organizational excellence. Therefore, in this study, an approach based on analytical hierarchy process to determine the rating and ranking of organizational indicators presented in high-technology industries. Because of the extracted criteria and sub-criteria act hierarchically and the interdependence between criteria is minimum, the analytic hierarchy process is used.

For the consider uncertainty in the proposed approach, fuzzy theory were used. Thus the proposed approach in the framework of steps given below:

**Step 1:** In this step, selecting and mining suitable criteria and sub-criteria based on organizational excellence. This work is done by using the library study, but this source cannot encompass evaluation factors integrity, therefore based on the experience of experts, some of the criteria determined by the experts of the organization. The goal in this step, provides the complete set of excellence criteria and sub-criteria to evaluate high-tech industries.

**Step 2:** in this step, weighting criteria and sub-criteria that provided in step 1. Because of the hierarchical relationship between criteria and sub-criteria and according to experts there is interdependence between the factors is minimal, the method used for weighting is Analytic Hierarchical Process. Also for consider ambiguity and uncertainty in the model, we use the fuzzy theory. So the method using for weighting is fuzzy AHP.
We use pairwise comparison matrix to determine the Local Weigh of factors through the questionnaires which comparing pairwise comparison between factors. Then experts are asked to use language terms of table (1) which has presented by chairman et al (2006) to recognize the importance in pairwise comparison. The importance of linguistic scales showed schematically in figure (1).

Table 1: Triangular fuzzy conversion scale

<table>
<thead>
<tr>
<th>Linguistic difficulty</th>
<th>scales for difficulty</th>
<th>Linguistic scales for importance</th>
<th>Triangular fuzzy scale</th>
<th>Triangular reciprocal scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Just equal</td>
<td>Just equal</td>
<td>(1, 1, 1)</td>
<td>(1, 1, 1)</td>
<td></td>
</tr>
<tr>
<td>Equally difficult(ED)</td>
<td>Equally importance(EI)</td>
<td>(1/2, 1, 3/2)</td>
<td>(2/3, 1, 2)</td>
<td></td>
</tr>
<tr>
<td>Weakly difficult(WMD)</td>
<td>Weakly importance(WMI)</td>
<td>(1, 3/2, 2)</td>
<td>(1/2, 2/3, 1)</td>
<td></td>
</tr>
<tr>
<td>Strongly difficult(SMD)</td>
<td>Strongly importance(SMI)</td>
<td>(3/2, 2, 5/2)</td>
<td>(2/5, 1/2, 2/3)</td>
<td></td>
</tr>
<tr>
<td>Very strongly difficult(VSMD)</td>
<td>Very strongly importance(VSMI)</td>
<td>(2, 5/2, 3)</td>
<td>(1/3, 2/5, 1/2)</td>
<td></td>
</tr>
<tr>
<td>Absolutely more difficult(AMD)</td>
<td>Absolutely more importance(AMI)</td>
<td>(5/2, 3, 7/2)</td>
<td>(2/7, 1/3, 2/5)</td>
<td></td>
</tr>
</tbody>
</table>

We use Bezbura and Beskese’s method (2007) to implement DE fuzzy and obtain the weight of each factors when questionnaires full filed and the pairwise comparison Matrix extracted. The mentioned method is going forward:

If $M_{ij}$ shows the triangular fuzzy numbers placed in row i and column j in pairwise comparison Matrix, then:

$$
\sum_{j=1}^{m} M_{ij} = \left( \sum_{j=1}^{m} a_j, \sum_{j=1}^{m} b_j, \sum_{j=1}^{m} c_j \right), i = 1, 2, 3, ..., n
$$

a, b and c show respectfully low, medium and high limit of triangular fuzzy numbers. $S_i$: fuzzy synthetic extent and defines as follow:

$$
S_i = \sum_{j=1}^{m} M_{ij} \otimes \left[ \sum_{j=1}^{n} \sum_{i=1}^{m} M_{ij} \right]^{-1}
$$

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And for obtaining  

\[ \left[ \sum_{i=1}^{n} \sum_{j=1}^{m} M_{ij} \right]^{-1} \]

act as follow:

\[ \left[ \sum_{i=1}^{n} \sum_{j=1}^{m} M_{ij} \right] = \left( \sum_{i=1}^{n} \sum_{j=1}^{m} a_{ij}, \sum_{i=1}^{n} \sum_{j=1}^{m} b_{ij}, \sum_{i=1}^{n} \sum_{j=1}^{m} c_{ij} \right) \]

\[ \left[ \sum_{i=1}^{n} \sum_{j=1}^{m} M_{ij} \right]^{-1} = \left( \frac{1}{\sum_{i=1}^{n} \sum_{j=1}^{m} c_{ij}}, \frac{1}{\sum_{i=1}^{n} \sum_{j=1}^{m} b_{ij}}, \frac{1}{\sum_{i=1}^{n} \sum_{j=1}^{m} a_{ij}} \right) \]

Then we have to detect possible degree. For instance, possible degree \((M_2 \geq M_1)\) is:

\[ V(M_2 \geq M_1) = \text{Sup}[\min(\mu_{M_1}(x), \mu_{M_2}(y))], y \geq x \]

The possible degree:

\[ V(M_2 \geq M_1) = \text{hgt}(M_1 \cap M_2) = \mu_{M_2}(d) = \begin{cases} 
1 & \text{if } b_2 \geq b_1 \\
0 & \text{if } a_1 \geq c_2 \\
\frac{a_1 - c_2}{(b_2 - c_2) - (b_1 - a_1)} & \text{Otherwise} 
\end{cases} \]

And \(d\) is the maximum height between \(\mu_{M_1}\) and \(\mu_{M_2}\) which is illustrated in figure (2).

![Figure 2: The intersection between M1 and M2](image-url)

In the next step, we determine possible degree for convex fuzzy numbers:

\[ V(M \geq M_1, M_2, \ldots, M_k) = V[(M \geq M_1) \& (M \geq M_2) \& \ldots \& (M \geq M_k)] = \min(M \geq M_i) \quad i = 1, 2, \ldots, k \]
So if

\[ d'(A_i) = \min V (S_i \geq S_k) \]

Then the obtained weigh defines as:

\[ W' = (d'(A_1),d'(A_2),...,d'(A_n))^T \]

Then, the obtained weigh should be normalized:

\[ W = (d(A_1),d(A_2),...,d(A_n))^T \]

Now, we can determine the Local Weigh for each criteria and sub-criteria.

In order to determine the final Local Weigh of sub-criteria, we have to multiple the local weigh of criteria in sub-criteria’s. After that, sub-criteria will be ranked by the final Local Weigh.

**Case Study**

In recent years, an organization have to reach its goals and success as goes along as response to customers’ demands while also needs to consider environmental, social and security issues. Today, quality has not being summarized into the quality of products or services. It goes even further than delivery, management and it also provides all aspects of customers’ activities and all the ways in which a company meet customers, communities and beneficiaries’ demandes.

Extension of awareness in accepting quality in all aspects and willingness to remain in competitive markets, urges many organizations all over the world to cooperate with to implement the quality plans through a guidance. Recognizing key criteria in improve quality and organizational excellence and focusing on its importance are one way of improving quality and organizational excellence.

One of the industries that quality and effectiveness play important roles in is air transportation industry which is a contributing factor in sustainable development. In this paper, we have implemented the proposed approach in Mahan Air in order to check it for the efficiency and effectiveness. Mahan Air was established as the first Iranian private Airline in 1992.

The results are given below:

Step1: by using the models presented in literature review and experts’ opinions, we commence extracting and selecting criteria and sub-criteria which are effective in evaluating performances. UBEM, p4,bassioni, kanji, Business Excellence Diamond Model are used (table 4-1).

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Sub-Criteria</th>
<th>Abbreviations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer</td>
<td>Access to organization</td>
<td>C1</td>
</tr>
<tr>
<td></td>
<td>Flexibility in responding to needs</td>
<td>C2</td>
</tr>
<tr>
<td></td>
<td>Handling customer complaints</td>
<td>C3</td>
</tr>
<tr>
<td></td>
<td>Loyality of customers</td>
<td>C4</td>
</tr>
<tr>
<td>Performance</td>
<td>Organizational performance</td>
<td>P1</td>
</tr>
<tr>
<td></td>
<td>Manpower performance</td>
<td>P2</td>
</tr>
<tr>
<td></td>
<td>Performance of external stakeholders</td>
<td>P3</td>
</tr>
<tr>
<td></td>
<td>Performance of internal stakeholders</td>
<td>P4</td>
</tr>
<tr>
<td>Human resource</td>
<td>Human Resource Programs to support the organization's strategy</td>
<td>HR1</td>
</tr>
<tr>
<td></td>
<td>concentration on staff training to improve knowledge and skills</td>
<td>HR2</td>
</tr>
<tr>
<td></td>
<td>Align with organizational goals and employee participation</td>
<td>HR3</td>
</tr>
</tbody>
</table>

Table (4-1): Criteria and sub-criteria used in Business excellence
Step 2: In this step, we weight criteria and sub-criteria derived from the previous step. We, therefore, gave a questionnaire like figure (3) to the experts who uses linguistic terms (table (4-1)) to pairwise compare them.

Dear Export, Please determine the importance of each factor in row than each one in column, by using linguistic terms in table (1).

<table>
<thead>
<tr>
<th>Criteria</th>
<th>C</th>
<th>P</th>
<th>HR</th>
<th>Pr</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pr</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure (3): A sample of the questionnaire for pairwise comparison of criteria

The questionnaires were distributed among exports. After pairwise comparison of triangular fuzzy numbers, they were superseded by table (1) and the weight of the criteria and sub-criteria were calculated from Bozbura and Beskese method (2007). An example of calculations using the customer's paired comparisons for sub-criteria (Table 2) are given below:

\[
\sum_{j=1}^{4} M_{k_1}^j = (3.5, 5, 6.5)
\]

\[
\sum_{j=1}^{4} M_{k_2}^j = (3.167, 4.5, 6.5)
\]

\[
\sum_{j=1}^{4} M_{k_3}^j = (2.667, 3.667, 5.5)
\]

\[
\sum_{j=1}^{4} M_{k_4}^j = (2.667, 3.33, 5)
\]

Then we obtain the combined limits:

\[ S_1 = (0.149, 0.303, 0.542) \]

\[ S_2 = (0.135, 0.273, 0.542) \]
$S_3 = (0.113, 0.222, 0.458)$

$S_4 = (0.113, 0.202, 0.417)$

And also the possible degree:

$V(S_1 \geq S_2) = 1$

$V(S_2 \geq S_1) = 0.929$

$V(S_3 \geq S_2) = 0.792$

$V(S_4 \geq S_3) = 0.726$

For every pairwise comparison, the minimum level possible is defined as follows:

$MinV(s_i \geq s_j) = 1$

$MinV(s_2 \geq s_1) = 0.929$

$MinV(s_3 \geq s_1) = 0.792$

$MinV(s_4 \geq s_1) = 0.726$

Therefore, non-normalized weight vector will be as follows:

$W' = (1, 0.929, 0.792, 0.726)^T$

Then, the obtained weights has to be normalized:

$W = (0.2901, 0.2695, 0.2298, 0.2106)^T$

Owing to very time-consuming calculations for determining weights-the more extended Pairwise comparison matrix, the more added time, we write MATLAB R2012a, a programming language,’s code for the Fuzzy AHP. Thus To determine weights, pairwise comparison matrices is considered as input to the MATLAB and weight of criteria and sub-criteria are perceived as output which Saved much time doing calculations. The results of these outputs indicated in Table (3) in below.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>$W_{\text{criteria}}$</th>
<th>Sub-Criteria</th>
<th>$W_{\text{Sub-Criteria}}$</th>
<th>$W_{\text{Criteria}} \times W_{\text{Sub-Criteria}}$</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer</td>
<td>0.294</td>
<td>C1</td>
<td>0.304</td>
<td>0.089376</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C2</td>
<td>0.255</td>
<td>0.07497</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C3</td>
<td>0.242</td>
<td>0.071148</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C4</td>
<td>0.199</td>
<td>0.058506</td>
<td>2</td>
</tr>
<tr>
<td>Performance</td>
<td>0.173</td>
<td>P1</td>
<td>0.167</td>
<td>0.028891</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P2</td>
<td>0.281</td>
<td>0.048613</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P3</td>
<td>0.329</td>
<td>0.056917</td>
<td>15</td>
</tr>
</tbody>
</table>
### Conclusion

Due to reach a continual performance evaluation, Key indicators ought to extract to the Organization with compilation and then all of them should be properly classified and ranked. Moreover, recognition and priority of the key indicators in evaluation system is of great importance. Therefore, in this paper, an approach based on AHP presented for ranking effective factors on evaluation of business excellence. The main purpose of the approach is analysis, recognition and rank of the key factors through business excellence indicators in high-tech industries.

After execution phase in Mahan Air (An airline of Islamic Republic of Iran), its consequences and applications had verified by exports in Organization.

### References