Utilizing an ANP framework for prioritizing effective criteria on performance management in cooperative organization

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\textbf{A B S T R A C T}

Performance management plays an essential role on increasing efficiency of business units. It helps find important barriers against a business unit helping us setup better strategies for handling troubles. In this paper, we present an empirical study to find important factors influencing performance management in cooperative organizations. The proposed study uses analytical hierarchy process to rank important factors in three groups of team level, individual and organization levels. The survey is based on receiving feedbacks from decision makers and making a pairwise comparison on measuring the relative importance of each criterion influencing performance management. The results of our survey indicate that setting appropriate standards for performance management is the most important item followed by relationship between organization structure and performance management, performance management based on future events. The other three factors including continuous improvement and updating systems, encouraging employee for change culture and relationship between future outlook and performance management are other important factors.

\section{1. Introduction}

Performance management and measurement are important techniques in improving organizational skills. They play necessary role on increasing efficiency of business units (Neely, 2004). Performance management helps us find important barriers against a business unit helping us setup better strategies for handling troubles (Porter, 1985-2003). There are literally many efforts to find efficient methods to detect barriers in organizations. Hemati and Karkehabadi (2012), for instance, proposed a method based on integer nonlinear multiple objective programming to investigate the conditions of uncertainty in a private university in Iran using balanced scorecard method. In their implementation,
In this research, they used fuzzy set covering problem and non-linear multiple objective integer programming to choose the best combination of strategies for specified period of time with the least deviation in experts' feedbacks.

2. Theoretical Framework

Khodaei Valahzaghard et al. (2012) performed another investigation to study the effects of human resource supporting strategies on job satisfaction. In their study, the effects of related services to support employee to reach job satisfaction and employee activities in one of Iranian banks called Mellat bank was investigated using 276 random samples. The results showed that employees were relatively satisfied from the benefit package of the bank and they were relatively happy on working for such organization.

Analytical hierarchy process (AHP) is one of the popular approaches for ranking problem with various criteria. There are several assumptions when AHP is used to make some decisions, such as, the independency between higher and lower level elements, the independency of the elements within a level, and the hierarchy structure of the decision problem (Saaty, 1994, Saaty & Zoffer, 2011). Nevertheless, an obvious shortcoming of AHP is the primary assumption of independency among various criteria. Analytic network process (ANP), on the other hand, considers interdependencies among the decision attributes and permits a more systematic analysis. In addition, the interactions of decision attributes within the same level and the feedbacks between two various levels play important role on decision making and it must be taken into consideration during the decision making process.

Therefore, the AHP method does not properly work when we consider such decision problems (Saaty 1996). The analytical network process (ANP), as an extensive and complementary technique of the AHP, was developed by Saaty (1996; 1999; 2001; 2003; 2004; 2005; 2006; 2008). On the contrary to AHP, ANP provides a more comprehensive approach in decision-making without making other assumptions on the independency of the higher-level elements from lower-level elements and also of the elements within a level. In spite of all these issues, the applications of ANP are not very common in a decision-making problem but there has been an increase in the use of ANP in multi-criteria decision-making problems (Jharkhariaa & Shankar, 2007).

The ANP method can be used to make decision problems, which would not be built hierarchically and does not incorporate the inner-independent and outer-independent assumptions. ANP method has been applied to diverse areas. It also gives inclusion of all the relevant criteria including tangible or intangible, etc. The ANP is the most useful model for the analysis of societal, governmental and corporate decisions that is available today to the decision makers. According to Chung et al. (2005), ANP has the following steps,

**Step 1: Model construction and problem structuring:** The problem needs to be stated clearly and decomposed into rational system like network. The structure can be obtained by the opinion of decision makers through brainstorming or other appropriate techniques.

**Step 2: Pairwise comparisons matrices and priority vectors:** In ANP, like AHP, decision elements at each component make a pairwise comparison with respect to their relative importance towards their control criteria, and the components are also compared pairwise with respect to their contribution to the objectives.

**Step 3: Super matrix formation:** To calculate global priorities in a system with interdependent effects, the local priority vectors are entered in the suitable columns of a matrix and a super matrix is actually a partitioned matrix, where each matrix segment denotes a relationship between two nodes (components or clusters) in a system (Sarkis 2003; Haghighat Monfared et al., 2012).

Fig. 1 shows effective factors studied for the implementation of ANP method for this survey.
A triangular number shown in Fig. 1 is represented as \((l,m,u)\) where \(l\), \(m\) and \(u\) represent the lowest, the most possible and the highest possible values, respectively where \(l \leq m \leq u\). Each fuzzy number can be represented by a membership function as follows,

\[
\mu(x/M) = \begin{cases} 
0, & x < l, \\
(x - l)/(m - l), & l \leq x \leq m, \\
(u - x)/(u - m), & m \leq x \leq u, \\
0, & x > u
\end{cases}
\]  

(17)

![Fig. 1. A triangular number](image)

**Fig. 1.** Infrastructure for ANP implementation
3. Discussion

This paper adopts the following linguistic terms to represent a triangular fuzzy number. Table 1 shows decision making numbers in linguistic form and their equivalences.

Table 1
Linguistic scale used to measure intensity of importance

<table>
<thead>
<tr>
<th>Linguistic scale</th>
<th>Triangular fuzzy scale</th>
<th>Triangular fuzzy reciprocal scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly important</td>
<td>(9,9,9)</td>
<td>(1/9,1/9,1/9)</td>
</tr>
<tr>
<td>Intermediate value</td>
<td>(7,8,9)</td>
<td>(1/7,1/8,1/7)</td>
</tr>
<tr>
<td>Moderately important</td>
<td>(6,7,8)</td>
<td>(1/6,1/7,1/6)</td>
</tr>
<tr>
<td>Intermediate value</td>
<td>(5,6,7)</td>
<td>(1/5,1/6,1/5)</td>
</tr>
<tr>
<td>Weakly important</td>
<td>(4,5,6)</td>
<td>(1/4,1/5,1/4)</td>
</tr>
<tr>
<td>Intermediate value</td>
<td>(3,4,5)</td>
<td>(1/3,1/4,1/3)</td>
</tr>
<tr>
<td>Equally important</td>
<td>(2,3,4)</td>
<td>(1/2,1/3,1/2)</td>
</tr>
<tr>
<td>Just equal</td>
<td>(1,1,1)</td>
<td>(1,1,1)</td>
</tr>
</tbody>
</table>

Table 2
Final ranking of performance measurement characteristics in team level

<table>
<thead>
<tr>
<th>Character</th>
<th>a_l</th>
<th>a_m</th>
<th>a_u</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assigning appropriate person for evaluation</td>
<td>0.35</td>
<td>0.59</td>
<td>0.94</td>
<td>2</td>
</tr>
<tr>
<td>Setting appropriate standards for evaluation</td>
<td>0.48</td>
<td>0.72</td>
<td>0.97</td>
<td>1</td>
</tr>
<tr>
<td>Building future based approach</td>
<td>0.16</td>
<td>0.29</td>
<td>0.49</td>
<td>4</td>
</tr>
<tr>
<td>Target setting for performance management system</td>
<td>0.24</td>
<td>0.38</td>
<td>0.67</td>
<td>3</td>
</tr>
</tbody>
</table>

As we can observe from the results of Table 2, setting appropriate standards for performance evaluation is the most important factor for the success of performance measurement in team level followed by assigning appropriate person for performance evaluation. Target setting for performance measurement system is the third important factor and finally building future based approach is the last important option in implementation of fuzzy ANP system.

Table 3
Final ranking of performance management characteristics in individual level

<table>
<thead>
<tr>
<th>Character</th>
<th>a_l</th>
<th>a_m</th>
<th>a_u</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feedback on results of performance evaluation</td>
<td>0.31</td>
<td>0.53</td>
<td>0.82</td>
<td>3</td>
</tr>
<tr>
<td>Good definition of work responsibility</td>
<td>0.63</td>
<td>0.87</td>
<td>0.96</td>
<td>1</td>
</tr>
<tr>
<td>Enriching positive aspects and removing negative factors</td>
<td>0.13</td>
<td>0.21</td>
<td>0.37</td>
<td>6</td>
</tr>
<tr>
<td>Payment system and benefit package</td>
<td>0.24</td>
<td>0.41</td>
<td>0.61</td>
<td>4</td>
</tr>
<tr>
<td>Building a mutual trust</td>
<td>0.22</td>
<td>0.37</td>
<td>0.59</td>
<td>5</td>
</tr>
<tr>
<td>Setting appropriate standards for performance evaluation</td>
<td>0.49</td>
<td>0.75</td>
<td>0.89</td>
<td>2</td>
</tr>
</tbody>
</table>

According to the results of Table 3, in terms of performance management in individual level, good definition of work responsibility is the most important item followed by setting appropriate standards for performance evaluation. Having constructive feedback on performance evaluation is another important factor in individual level while payment system and benefit package also pay important role on performance management. Finally, building a mutual trust among individuals as well as
enriching positive aspects of performance evaluation and removing any undesirable factors are the last important factors influencing performance management.

<table>
<thead>
<tr>
<th>Character</th>
<th>$a_1$</th>
<th>$a_m$</th>
<th>$a_n$</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relationship between organization structure and performance management</td>
<td>0.52</td>
<td>0.72</td>
<td>0.88</td>
<td>2</td>
</tr>
<tr>
<td>Relationship between future outlook and performance management</td>
<td>0.07</td>
<td>0.21</td>
<td>0.33</td>
<td>6</td>
</tr>
<tr>
<td>Setting appropriate standards for performance management</td>
<td>0.73</td>
<td>0.85</td>
<td>0.92</td>
<td>1</td>
</tr>
<tr>
<td>Encouraging employee for change culture</td>
<td>0.17</td>
<td>0.29</td>
<td>0.44</td>
<td>5</td>
</tr>
<tr>
<td>Continuous improvement and updating systems</td>
<td>0.24</td>
<td>0.39</td>
<td>0.57</td>
<td>4</td>
</tr>
<tr>
<td>Performance management based on future events</td>
<td>0.36</td>
<td>0.54</td>
<td>0.76</td>
<td>3</td>
</tr>
</tbody>
</table>

As we can observe from the results of Table 4, setting appropriate standards for performance management is the most important item followed by relationship between organization structure and performance management, performance management based on future events. The other three factors including continuous improvement and updating systems, encouraging employee for change culture and relationship between future outlook and performance management are other important factors.

4. Conclusion

In this paper, we have presented an empirical study to find important factors influencing performance management in cooperative organizations. The proposed study used analytical hierarchy process to rank important factors in three groups of team level, individual and organization levels. We have used the feedback received from experts to make a pairwise comparison on measuring the relative importance of each criterion influencing performance management. The results of our survey indicate that setting appropriate standards for performance management is the most important item followed by relationship between organization structure and performance management, performance management based on future events. The other three factors including continuous improvement and updating systems, encouraging employee for change culture and relationship between future outlook and performance management are other important factors.

References


