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UTILIZING FUZZY EXPERT SYSTEM IN ORGANIZATIONS' PERFORMANCE ASSESSMENT

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ABSTRACT

This article provides a fuzzy expert system for evaluating organization performance. Organization evaluation is used for identifying and improving organization's competitive situation with the aim of alignment with market competitive atmosphere. Excellence models are self-assessment tools, one of which is EFQM. In this paper, expert performance evaluation is based upon EFQM. Application of fuzzy expert system in organizations' performance assessment causes a powerful control system for continuous assessment and enhancement of organizations' performance. This system evaluates all activities and metrics of organization and, based on this, points of strength and improvable points are proposed for performance enhancement.

KEY WORDS
Performance Assessment, EFQM (European Foundation for Quality Management), Expert System, Fuzzy Logic.

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INTRODUCTION

Every organization, regardless of its activities, size, structure, maturity, and its achievements in pursuing goals, needs to assess and evaluate its success in reaching business goals and guidelines. There exist several different models for performance assessment amongst which EFQM is more popular in Iran. EFQM was founded in 1998 in Europe and now it is an executive tool to help firms in measuring how much they are in organizational excellence balanced growth path. This tool helps organizations to compare their current and ideal situations and find the differences and, based on them and their reasons identify the solutions of optimizing the current situations and execute them.

The general goal of self-assessment is to find and analyze the strength points and improvable areas. For this aim, EFQM with cause-and-effect relationships between enablers and results is utilized. But the important point is that because of the qualitative nature of the assessment the selection of the framework is not enough to solve all the problems. Some of the problems are:

- The assessment results are variable regarding the views of persons to a degree, so the scores of different assessments would be different somehow.
- Due to the variety of criteria and sub-criteria of model and the complexity of relationships between them, it is difficult and inconvenient to invent the rules.

Thus, fuzzy expert systems are used in the form of EFQM model in order to resolve the above problems.

In designing the fuzzy expert system in EFQM excellence model, the goal is assessment based on the data given to the system about the situation of the organization. The results are scored criteria and listed strength points and improvable areas. The advantage of this method, besides facilitating the assessment process, is independence of the assessment results of the opinions of different persons, which could be a reliable and general option for assessing all organizations. Furthermore, based on fuzzy logic, the evaluators would be more convenient in determining the scores of approach, and results and the diversity of different evaluators' scores would be red uced.

A review on the literature of applying EFQM model in organizations reveals that it could be divided into two groups: the first group includes papers only executing and implementing EFQM model [1-11], the results of which was application and analysis of EFQM model and movement in the excellence path. Papers in the second group endeavor to combine E FQM model with other tools and models such as Data Envelopment Analysis [12], Intellectual Capital Management [13], DEMATEL technique [14], AHP technique [15,16], and System Dynamics [17-19] with the aim of improving the efficiency of EFQM model.

Moreover, with a review on the applications of Expert Systems a lot of utilization areas are found, such as car failure diagnosis [20, 21], compiler performance improvement [22], human disease diagnosis [23], detection of roller bearing defects [24], hybrid short-term load forecasting system execution [25], data quality fuzzy expert system [26], multi-sensor data fusion for land vehicle attitude estimation [27], analysis of the survey results in evaluation of university teachers [28], and modeling pipe deterioration using soil properties [29].

But, it seems that the application of expert systems in excellence models such as EFQM is unattended. Accordingly, in this research the application of fuzzy expert system for enhancement of organization

assessment using EFQM excellence model is studied. In this paper, first performance evaluation using fuzzy method is reviewed. Then, design of fuzzy expert system in EFQM excellence model is described and finally the results of applying this system are presented. Following are brief introductions to the key concepts used in the paper.

EFQM Excellence Model

EFQM model has 9 criteria. 5 criteria are enablers and the other 4 are results. Enablers cover what an organization does and results criteria refer to what an organization earns. Results are outcomes of executing enablers, and enablers are improved regarding feedbacks gained from results.

Enablers include leadership, policy and strategy, employees, partnerships and resources, and processes, and results consist of customer results, employees' results, people results, and key performance results. All the enabler criteria, except policy and strategy, involve 5 sub-criteria. Policy and strategy criterion includes 4 sub-criteria. Each results criterion is constituted of 2 sub-criteria. Accordingly, 28 sub-criteria are defined for enablers and 8 for results.

Expert System

Expert systems are systems used for processing and providing results or presenting knowledge. Expert systems are the most significant part of artificial intelligence. Generally, expert systems help in solving problems by using inductive knowledge and methods. The most important section in studying expert systems is knowledge engineering. In knowledge engineering the process of extraction and acquisition of knowledge from an expert person for considering it from a knowledge-based point of view is attended. Expert systems have different applications in diverse scientific areas nowadays and there is a bright vision of their more utilization in the future.

Fuzzy Logic

Fuzzy logic is a type of multi-value logics and is based upon fuzzy sets theory. Fuzzy sets are generated by generalization and expansion of sets in a natural way. In the real world, human recognizes a lot of concepts in a vague and imprecise way and uses them as. are a sort of variables accepting words and phrases of human or machine language as their values instead of numbers. As numerical variables are used in the mathematics calculations, in fuzzy logic are involved are expressed regarding the lingual values in set of phrases.

FUZZY PERFORMANCE ASSESSMENT

Regarding the fact that in the normal method each sub-criterion is given a score between 0 and 100 percent (with 5 percent step width) and the range is wide (20 different possible scores), the response of all assessors about a particular sub-criterion would not possibly be the same. Thus, the range 0 to 100 could be divided into smaller ranges. This would provide smaller number of options (5 selectable fuzzy choices) for assessors, which would lead to less confusion during the scoring process, more similar responses, and so more realistic scores.

In the proposed method, the scores are assumed to be triangular fuzzy numbers and assessors would choose amongst the following choices in scoring each sub-criterion:

1- 0% (very low): no evidence or reason (a small part of the areas)
2- 25% (low): limited evidences (almost one fourth of the areas)
3- 50% (normal): visible evidences (almost half the of areas)
4- 75% (much): precise and many evidences (almost three fourth of the areas)
5- 100% (very much): complete and wide evidences (almost all of the areas)

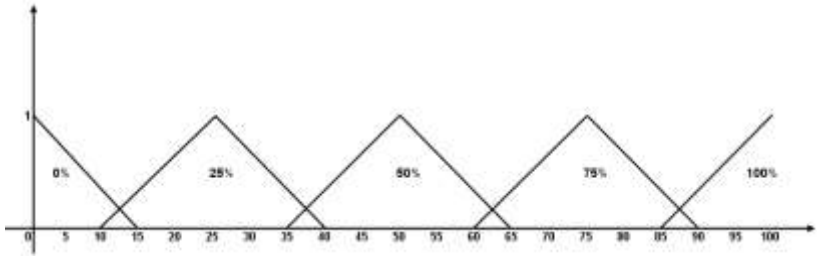

Figure 1. Triangular Fuzzy Numbers of 5 Choices

Table 1. Triangular Fuzzy Numbers

Choice	Qualitative Number	Triangular Fuzzy Number(m,α,β)
1	(very little) no evidence or reason	(0,0,15)
2	(little) limited evidences	(25,15,15)
3	(normal) visible evidences	(50,15,15)
4	(much) precise and many evidences	(75,15,15)
5	(very much) complete and wide evidences	(100,15,0)

Finally for computing organization's total score, using fuzzy logic concepts and the formula of transferring fuzzy numbers to crisp numbers ('s formula: $\chi = m + \frac{\alpha-\beta}{4}$), the organization's total score which has been calculated in the fuzzy format is transformed into number.
In enablers' scoring tables, the score of each feature of approach, elements is assigned as a fuzzy number. Then using summation of two fuzzy numbers and scalar multiplication the direction of average, sub-criteria scores, criteria scores, and total score are computed. Finally as stated before the fuzzy number are transformed into equal numbers. The same steps are taken for results scoring tables.
It is worthy to know that in this method the scoring accuracy deteriorates, but it should be noted that in reality decision making is qualitative, such that all assessors mention that their scores are not definite and is a range of scores. So, this method is more natural and rational than the current method and is closer to reality.

DESIGNING FUZZY EXPERT SYSTEM IN EFQM EXCELLENCE MODEL

In designing this system the strength points, improvable areas, and scores of each activity and indicator is derived by the system regarding the information provided to the system by the user and rules defined in the system.

Information Provided by the User

The data needed to be entered by the user and the information gathered by the system through questioning is divided into two chief groups of results and enablers.

Results

The user is required to enter data such as indicator title, values of indicators during 4 years, aims during 2 years, comparison with dominant organizations for 4 years, and reason (e.g. the reason of reaching or not reaching the goals, the reason of having good or bad trend). The questions asked by the system from the user are mentioned in table 4 below.

Table 2. Questions Related to Results Section

Question		Answer	Description
A- Whether the indicator trend would be increasing or decreasing?		Increasing ☐ Decreasing ☐	If the trend is increasing 1 is assigned, otherwise -1 is assigned
Are the indicator goals defined well?	B- Are the goals alligned with strategy?	Yes ☐ No ☐	If the answer is 'Yes' 1 is assigned, otherwise 0 is assigned
	C- Regarding the organization's situation is it possible to reach the identified goals? Are the values of goals defined rationally according the easiness of achieving them?	Yes ☐ No ☐	If the answer is 'Yes' 1 is assigned, otherwise 0 is assigned
D- Based upon the descriptions provided in cause section, are there cause and effect relationships between the indicator and the approach, the settlement, or the evaluation and revision?		Yes ☐ No ☐	If the answer is 'Yes' 1 is assigned, otherwise 0 is assigned
E- How many areas has been covered by the indicator?		almost all areas ☐ almost three forth of areas ☐ almost half of areas ☐ almost one forth of areas ☐ just a small part of areas ☐	for the choices all areas, three forth of areas, half of areas, one forth of areas, and small part of areas, amounts 1, 0.75, 0.5, 0.25, and 0 are assigned respectively

Enablers

The user is required to enter data such as activity title and number of indicator related to this activity (for searching indicator and reasons related to it).
Questions asked by the system are as declared in table 5 below.

Table 3. Questions Related to Enablers Section

Question	Answer	Descriptions
F- Which approach element affects information of the results feedback column?	approach ☐ settlement ☐ evaluation and revision ☐	for approach, setllement, and evaluation and revision, numbers 1, 2, and 3 are assigned respectively
G- Is the process defined and formulated well?	very little ☐ little ☐ medium ☐ much ☐ very much ☐	for the choices very much, much, medium, little, and very little, amounts 1, 0.75, 0.5, 0.25, and 0 are assigned respectively
H- Is focused on the stakeholders' requirements?	very little ☐ little ☐ medium ☐ much ☐ very much ☐	for the choices very much, much, medium, little, and very little, amounts 1, 0.75, 0.5, 0.25, and 0 are assigned respectively
I- Does support strategy and policy?	very little ☐ little ☐ medium ☐ much ☐ very much ☐	for the choices very much, much, medium, little, and very little, amounts 1, 0.75, 0.5, 0.25, and 0 are assigned respectively
J- Is related to other approaches?	very little ☐ little ☐ medium ☐ much ☐ very much ☐	for the choices very much, much, medium, little, and very little, amounts 1, 0.75, 0.5, 0.25, and 0 are assigned respectively
K- Is the approach implemented?	very little ☐ little ☐ medium ☐ much ☐ very much ☐	for the choices very much, much, medium, little, and very little, amounts 1, 0.75, 0.5, 0.25, and 0 are assigned respectively
L- How many areas has been covered by the indicator?	almost all areas ☐ almost three forth of areas ☐ almost half of areas ☐ almost one forth of areas ☐ just a small part of areas ☐	for the choices all areas, three forth of areas, half of areas, one forth of areas, and small part of areas, amounts 1, 0.75, 0.5, 0.25, and 0 are assigned respectively
M- Is the effectiveness and transmission of the approach measure regularly?	very little ☐ little ☐ medium ☐ much ☐ very much ☐	for the choices very much, much, medium, little, and very little, amounts 1, 0.75, 0.5, 0.25, and 0 are assigned respectively
N- Is the learning activities used for identifying and sharing the best activities and improvement situations?	very little ☐ little ☐ medium ☐ much ☐ very much ☐	for the choices very much, much, medium, little, and very little, amounts 1, 0.75, 0.5, 0.25, and 0 are assigned respectively

System's Rule Set
Results Section
The first rule (Trends):
IF $A*(Data_{t-2}- Data_{t-3})>0$ **AND** $A*(Data_{t-1}- Data_{t-2})>0$ **AND** $A*(Data_{t} - Data_{t-1})>0$ **THEN** trend=1 **ELSE** trend=0
In other words, if the amounts of indicator have a good trend during 4 years (the value of the indicator is better than the previous year), then the amount of trend would be 1, otherwise it would be 0 (1 means appropriate trend and 0 means inappropriate trend).

The second rule (Goals):
IF $A*(Data_{t} - goal_{t})>=0$ **AND** B=1 **AND** C=1 **THEN** goal=1 **ELSE** goal=0
In other words, if the indicator has been able to reach the goals and the goals are aligned with organizational strategy and regarding the organization's situation it is possible to reach the identified goals and the values of goals are defined rationally according the easiness of achieving them, then the amount of goals are 1, otherwise they are 0.

The third rule (Comparison):
IF $comparison_{t}$<>Null **AND** $comparison_{t-1}$<>Null **AND** $comparison_{t-2}$<>Null **AND** $comparison_{t-3}$<>Null **THEN** comparison=1 **ELSE** comparison=0
In other words, if the comparison is done for all values of indicator during 4 years, then the value of comparison equals 1, otherwise it equals 0.

Enablers Section
The fourth rule (Approach Rationality):
IF A=1 **AND** trend=1 **AND** A*(Data$_t$ - goal$_t$)>=0 **AND** B=1 **AND** C=1 **THEN** rational=1 **ELSE** rational=0
In other words, if the information of the results feedback column is affected by the approach element, the trend of indicator values are appropriate during 4 years, the indicator has been able to reach the goal, the goals are aligned with the organizational strategy, regarding the organization's situation it is possible to reach the identified goals, and the values of goals are defined rationally according the easiness of achieving them, then the amount of approach rationality is 1, otherwise it is 0.

The fifth rule (Systematic Implementation of the Approach):
IF A=2 **AND** trend=1 **AND** A*(Data$_t$ - goal$_t$)>=0 **AND** B=1 **AND** C=1 **THEN** systematic=1 **ELSE** systematic=0
In other words, if the information of the results feedback column is affected by the settlement element, the trend of indicator values are appropriate during 4 years, the indicator has been able to reach the goal, the goals are aligned with the organizational strategy, regarding the organization's situation it is possible to reach the identified goals, and the values of goals are defined rationally according the easiness of achieving them, then the amount of systematic approach implementation is 1, otherwise it is 0.

The sixth rule (Analyzing and Using Results):
IF A=3 **AND** trend=1 **AND** A*(Data$_t$ - goal$_t$)>=0 **AND** B=1 **AND** C=1 **THEN** analysis=1 **ELSE** analysis=0
In other words, if the information of the results feedback column is affected by the element, the trend of indicator values are appropriate during 4 years, the indicator has been able to reach the goal, the goals are aligned with the organizational strategy, regarding the organization's situation it is possible to reach the identified goals, and the values of goals are defined rationally according the easiness of achieving them, then the amount of analyzing and using results is 1, otherwise it is 0.

Extracting Points of Strength and Weakness

Results Section
IF trend=1 **THEN** indicator has a good trend **ELSE** indicators have not good trends
In other words, if the response of the first rule (i.e. Trends) is 1, then it could be told that there is information related to each year and indicator has a good trend, otherwise the indicator does not possess a good trend.
IF goal=1 **THEN ELSE** the goals are not achieved
In other words, if the response of the second rule (i.e. Goals) is 1, then it could be told that the goals are determined and achieved, otherwise they are not achieved.
IF comparison=1 **THEN ELSE** the comparison are not for all years
In other words, if the response of the third rule (i.e. Comparison) is 1, then it could be told that the comparisons are conducted for all years, otherwise they are not conducted for all years.
IF D=1 **THEN**
In other words, if the answer to question "Based upon the descriptions of the cause section, is there any cause and effect relationship between approach or implementation or evaluation and revision and the values of this indicator?", which is asked from user by the system, is 'yes', then based upon the descriptions provided in cause section, there are cause and effect relationships between the approach and the indicator, otherwise there is no such relationship between them.
IF E=1 **THEN** this indicator covers all areas **ELSE** this indicator doesn't cover all areas
In other words, if the response to question "How many areas has been covered by the indicator?", which is asked from user by the system, is 'almost all areas', then it could be said that this indicator covers all areas, otherwise the indicator does not cover all areas.

Enablers Section
Suitability of approach:
IF average(G, H, rational)<0.25 **THEN** there is not any evidence that approach is suitable **ELSE IF** 0.25<average(G, H, rational)<0.5 **THEN** there are a few evidences that approach is suitable **ELSE IF** 0.5<average(G, H, rational)<0.75 **THEN** it's partly evidence that approach is suitable **ELSE IF** 0.75<average(G, H, rational)<1 **THEN** there are explicit evidences that approach is suitable **ELSE IF** average(G, H, rational)=1 **THEN** it's comprehensive evidence that approach is suitable
In other words, if the average of the answers to the questions "Is the process defined and formulated well?" and "Is it focused on the demands of stakeholders?" and the rule of "Rationality", which is asked from user by the system, is less than 0.25, then it could be said that there is no evidence for suitability of the approach. Else, if the average is between 0.25 and 0.5, then the existence of a few evidences for suitability of approach could be concluded. Else, if the average of responses is between 0.5 and 0.75, then it could be claimed that it is partly evidenced that the approach is suitable. Else, if the average is between 0.75 and 1, then the existence of explicit evidences for approach suitability is concluded. Else, if the average equals 1, then there are comprehensive evidences that the approach is suitable.

Integrity of approach:
IF average(I,J)<0.25 **THEN** there is not any evidence that approach is Integrated **ELSE IF** 0.25<average(I,J)<0.5 **THEN** there are a few evidences that approach is Integrated **ELSE IF** 0.5<average(I,J)<0.75 **THEN** it is partly evidenced that approach is Integrated **ELSE IF** 0.75<average(I,J)<1 **THEN** there are explicit evidences that approach is Integrated **ELSE IF** average(I,J)=1 **THEN** there are comprehensive evidences that approach is Integrated

In other words, if the average of the answers to the two questions "Is the approach supporting strategy and policy?" and "Is it related to other approaches?" , which are asked from user by the system, is less than 0.25, then it could be said that there is no evidence for integrity of the approach. Else, if the average is between 0.25 and 0.5, then the existence of a few evidences for integrity of approach could be concluded. Else, if the average of responses is between 0.5 and 0.75, then it could be claimed that it is partly evidenced that the approach is integrated. Else, if the average is between 0.75 and 1, then the existence of explicit evidences for approach integrity is concluded. Else, if the average equals 1, then there are comprehensive evidences that the approach is integrated.

Implementation of approach:
IF K<0.25 **THEN** there is not any evidence that approach is implemented **ELSE IF** 0.25<K<0.5 **THEN** there are a few evidence that approach is implemented **ELSE IF** 0.5<K<0.75 **THEN** it's partly evidenced that approach is implemented **ELSE IF** 0.75<K<1 **THEN** there are explicit evidences that approach is implemented **ELSE IF** K=1 **THEN** there are comprehensive evidences that approach is implemented
In other words, if the average of the answers to the question "Is the approach implemented?", which is asked from user by the system, is less than 0.25, then it could be said that there is no evidence for implementation of the approach. Else, if the response is between 0.25 and 0.5, then the existence of a few evidences for implementation of approach could be concluded. Else, if the response is between 0.5 and 0.75, then it could be claimed that it is partly evidenced that the approach is implemented. Else, if the response is between 0.75 and 1, then the existence of explicit evidences for approach implementation is concluded. Else, if the response equals 1, then there are comprehensive evidences that the approach is implemented.

Systematic implementation of the approach:
In other words, if the response to the rule "Systematic Implementation of the Approach" is less than 0.25, then it could be said that there is no evidence for systematic implementation of the approach. Else, if the response is between 0.25 and 0.5, then the existence of a few evidences for systematic implementation of approach could be concluded. Else, if the response is between 0.5 and 0.75, then it could be claimed that it is partly evidenced that the approach is implemented systematically. Else, if the response is between 0.75 and 1, then the existence of explicit evidences for systematic approach implementation is concluded. Else, if the response equals 1, then there are comprehensive evidences that the approach is implemented systematically.

Measuring the effectiveness of the approach:
IF M<0.25 **THEN** there is not any evidence that approach is measured **ELSE IF** 0.25<M<0.5 **THEN** there are a few evidence that approach is measured **ELSE IF** 0.5<M<0.75 **THEN** it's partly evidenced that approach is measured **ELSE IF** 0.75<M<1 **THEN** there are explicit evidences that approach is measured **ELSE IF** M=1 **THEN** there are comprehensive evidences that approach is measured
In other words, if the response to the question "Is the effectiveness and of the approach measure regularly?" which is asked from user by the system, is less than 0.25, then it could be said that there is no evidence for measurement of the effectiveness of the approach and its implementation. Else, if the response is between 0.25 and 0.5, then the existence of a few evidences for measurement of the effectiveness of the approach and its implementation could be concluded. Else, if the response is between 0.5 and 0.75, then it could be claimed that it is partly evidenced that the approach effectiveness is measured and implemented. Else, if the response is between 0.75 and 1, then the existence of explicit evidences for measurement of the effectiveness of the approach and its implementation is concluded. Else, if the response equals 1, then there are comprehensive evidences that the approach is measured and implemented.

Learning activities:
IF N<0.25 **THEN** there is not any evidence that approach is **ELSE IF** 0.25<N<0.5 **THEN** there are a few evidence that approach is **ELSE IF** 0.5<N<0.75 **THEN** it's partly evidenced that approach is **ELSE IF** 0.75<N<1 **THEN** there are explicit evidences that approach is **ELSE IF** N=1 **THEN** there are comprehensive evidences that approach is
In other words, if the response to the question "Is the learning activities used for identifying and sharing the best activities and improvement situations?", which is asked from user by the system, is less than 0.25, then it could be said that there is no evidence for learning activities. Else, if the response is between 0.25 and 0.5, then the existence of a few evidences for learning activities could be concluded. Else, if the response is between 0.5 and 0.75, then it could be claimed that it is partly evidenced that the approach is . Else, if the response is between 0.75 and 1, then the existence of explicit evidences for learning activities is concluded. Else, if the response equals 1, then there are comprehensive evidences that the approach is.

Improvement activities:
IF analysis<0.25 **THEN** there is not any evidence that approach is improvable **ELSE IF** 0.25<analysis<0.5 **THEN** there are a few evidence that approach is improvable **ELSE IF** 0.5<analysis<0.75 **THEN** it's partly evidenced that approach is improvable **ELSE IF** 0.75<analysis<1 **THEN** there are explicit evidences that approach is improvable **ELSE IF** analysis=1 **THEN** there are comprehensive evidences that approach is improvable
In other words, if the response to the rule "Analyzing and Using the Results" is less than 0.25, then it could be said that there is no evidence for analysis and exploitation of results. Else, if the response is between 0.25 and 0.5, then the existence of a few evidences for analysis and exploitation of measurement results

for improvement could be concluded. Else, if the response is between 0.5 and 0.75, then it could be claimed that it is partly evidenced that the measurement results are analyzed and used for improvement. Else, if the response is between 0.75 and 1, then the existence of explicit evidences for analysis and exploitation of measurement results for improvement is concluded. Else, if the response equals 1, then there are comprehensive evidences that the measurement results are analyzed and used for improvement.

Score of each Activity and Sub-criterion

Results Section

For computing the score of each indicator, regarding the scoring method in EFQM model, the following formula is used:

Indicator score = 0.5 × AVERAGE (rounded score, goals, comparison, reason) + 0.5 × score

For computing the score of each sub-criterion, the scores of the indicator of that sub-criterion are averaged and then for calculating the score of each criterion, the scores of all of its sub-criteria are averaged.

Enablers Section

For computing the score of each activity, regarding the scoring method in EFQM model, the following formula is used:

Approach score = AVERAGE (approach integrity score, approach suitability score)

Score = AVERAGE (approach implementation score, approach structured implementation score)

Score = AVERAGE (results analysis, learning activities score, approach effectiveness and measurement)

For computing the score of each sub-criterion, the scores of the indicator of that sub-criterion are averaged and then for calculating the score of each criterion, the scores of all of its sub-criteria are averaged.

Organization's Total Score

Finally for computing the total score of organization, based on the weights determined in EFQM model (version 2010), the following formula is used:

Organization score = 1 × (people score + employees score + processes + partnerships and resources + employees + policy and strategy + leadership indicator score) + 1.5 × (key performance results + customer results indicator score)

APPLICATION OF THE DESIGNED EXPERT MODEL IN LOCAL POWER COMPANY

The expert model designed in this paper is applied to the local power company of Yazd (i.e. a city in the middle of Iran), and the results is compared with the current methods, which indicated no significant difference between the outcomes. Consequently, it could be concluded that the proposed method could be a substitute for the current methods.

CONCLUSIONS

The aim of designing fuzzy expert system for organizational performance assessment is automation of assessment process regarding the information provided to the system about the situation of organization. The result is scoring the criteria and finding the strength and weakness points of the organization. The advantage of this method, besides facilitating the assessment, is independence of the assessment results of the personal opinions of the expert, which could introduce this method as a reliable and comprehensive method for assessing all organizations. Furthermore, using fuzzy logic, determining the scores of approach, settlement, evaluation and revision, and results is expedited and unlike the current methods, in which it is possible to have different scores by different persons for one particular criterion, in this method, the scores are defined in a standard format and the accuracy and speed of assessment are improved.

Regarding that the application of expert systems in performance assessment is not attended yet, utilization of this method could be a new step into this road. The design of expert system could not be of benefit, unless it is customized and examined in different organizations, which could be the subject of future further researches.

CONFLICT OF INTEREST

Authors declare no conflict of interest.

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