

Prioritizing PMO Functions in Organizations: A Group Fuzzy Decision Making Approach

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Abstract

Background: The objective of this paper is to review the literature about the functions of Project Management Office (PMO), and propose a new approach to prioritize these functions in an organization. **Methods:** The theoretical framework of functions was extracted from the literature review, and the appropriate prioritizing method, which is based on Delphi and group fuzzy analytical hierarchy process, was adopted by interviewing with academic experts. The case study approach was especially used for testing the theoretical framework and method in real world situations. Applying this approach in current research bring about in-depth understanding of PMO functions within an organization. **Findings:** The proposed approach provides a new outlook for implementing project management office functions considering organizational needs. The theoretical framework includes 19 functions categorized in 5 groups: Strategic alignment and governance, organization and process, learning and organizational growth, project support, monitoring, control and assessment. Regarding this framework, the PMO functions were determined and prioritized in the case study organization. The findings indicate that the strategic level functions that entirely meet the organizational needs attained the highest priority. The results are helpful in adding more value to the existing literature and research background in terms of building a theoretical basis for further in-depth research into PMO functions. **Application:** Regarding the lack of research and empirical evidence in this subject, the findings provide practitioners with practical guidelines for implementing the project management office functions in the light of the organizational requirements.

Keywords: Analytical Hierarchy Process, Fuzzy Theory, Multi-criteria Decision Making, Organization, Project Management Office

1. Introduction

Managing Projects toward goals and completing them within contractual time and budget are considered as the most important objectives of project-based organizations¹. Some challenges which have arisen from ineffective project management processes and procedure barriers to these objectives. Implementing the project management office has become a common solution for these problems. However, in many organizations, PMOs focus on unnecessary functional are as that do not address organizational needs. A majority of efforts

to establish a project management office have failed due to inappropriate prioritization of organizational needs in executing PMO functions². As well as organizational needs, other factors have to be taken into account such as organizational readiness, challenges associated with implementation of PMO functions and many other criteria. Low-risk functions can be executed with minimum of organizational resistance. Medium-risk functions may face with organizational resistance to some extent, and high-risk ones can face high organizational resistance because of change in the governance and organizational power³. In this regard, determining the

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priority of PMO functions should be considered in organization to facilitate the implementation process. However, there are no theoretical researches in this field and researchers have mainly focused on defining functions and characteristics. Researchers such as Wysocki, Dinsmore and Englund investigated PMO functions in project-based organizations⁴. Also, many researchers put emphasis on other aspects of PMO in organizations. For instance, Hobbs offered project management office functions according to a comprehensive survey in more than 500 European organizations⁵. Furthermore, Desouza, Hill, and Crawford proposed functions of the project management office in their point of view⁶⁻⁸. An article about evaluating three main roles of project management office in organizations⁹, and the other about the project management office roles in knowledge sharing¹⁰, provide a theoretical basis for further practical studies. Regarding the researches conducted so far, this research gap can be understood that none of their searches have offered a practical approach to prioritize the project management office functions, whereas it is of crucial importance for PMOs to focus on organizational needs. The aim of current study is to offer an approach toward identifying and prioritizing project management office functions in project-based organizations. The proposed approach is examined through a case study research in an Iranian project-based organization, and is primarily based on expert judgment and literature review. Also, the approach was confirmed by obtaining the opinions of a number of academic experts.

The result of literature review shows that the project management office functions are numerous and range from project portfolio management to project management mentoring. Regarding the fact that many functions are stated for PMO, selecting an appropriate combination of these functions that fit the organizational needs is of crucial importance⁶. In order to provide a theoretical basis for research, different point of view about project management office functions were reviewed and categorized in 5 functional areas as follow^{4,5,8,11-15}:

- **Strategic alignment and governance:** Project portfolio management, participating in strategic management, project governance, business performance management.
- **Organization and process:** Project management organization and structure, provide project management standards and methodologies.

- **Learning and organizational growth:** Human resource development, project knowledge management.
- **Project support:** Resource management, project management mentoring, project stakeholder management, project planning, team development, facilities and equipment support, project management tools.
- **Monitoring, control and assessment:** Project control and monitoring, project management maturity assessment, project auditing, project recovery.

2. Materials and Methods

2.1 Research Question

The research question is as follow: How PMO functions can be determined and prioritized in a project-based organization?

The aim of the research is to propose a practical approach to determined and prioritize PMO functions.

2.2 Sampling and Data Gathering

This study is practical and is conducted through a field research. The data gathering tools include questionnaire (In order to determine the prioritization criteria), and structured brainstorming with experts (In order to determine and prioritize functions based on criteria). The theoretical scope of research is limited to the PMO literature, and the sample is selected from the project management experts in the case study organization (experts who have at least 7 years of work experience in project management). Purposive sampling method is adopted, and the sample volume was calculated 40 persons based on Kookaran formula. In this formula, D which is equal to 0.1 represents the sampling precision, p and q represent the probability of the existence of common characteristic in the sample (the organizational project management knowledge) that are equal to 0.5 in this paper. S is the size of the sample, N is the target population size, Z is the standard normal statistic and confidence level is 95%¹⁶. All in all, the sample includes 5 persons in senior level, 15 in middle level and 20 within project level.

$$S = \frac{NZ^2PQ}{ND^2 + PQZ^2} \quad (1)$$

The demo graphic analysis of interviewees shows that a majority of respondents are project manager (Figure1).

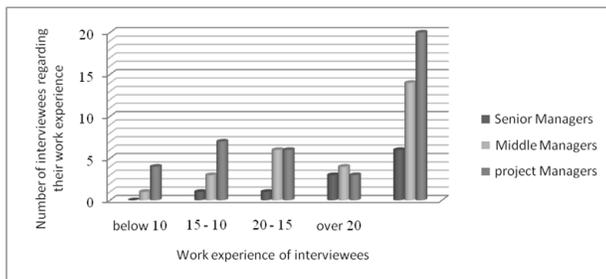


Figure 1. Distribution of job experience of interviewees.

2.3 Research Steps

The research steps are as below:

- Literature Review:** The articles and books related to the subject of PMO were reviewed to build a theoretical basis.
- Proposing an Approach:** This approach was proposed to determine and prioritize PMO functions based on reviewing the literature of decision making methods.
- Validating the Approach:** This approach was confirmed by 10 academic experts.
- Examining the Proposed Approach:** The approach was examined in a case study organization.
- Generalization:** The results were reviewed to draw a general conclusion as a practical guideline for project-based organizations.

2.4 The Proposed Approach

In the second step of the research, an approach was proposed and then confirmed by academic experts. At first, PMO stakeholders in the organization have to be identified. Then, the PMO functions should be determined based on theoretical framework and comments of the stakeholders. Also, prioritization criteria have to be identified based on expert judgments. In the next step, PMO functions are prioritized using group fuzzy AHP method. Finally, initiatives needed for executing PMO functions in the organization should be proposed based on priorities (Figure2).

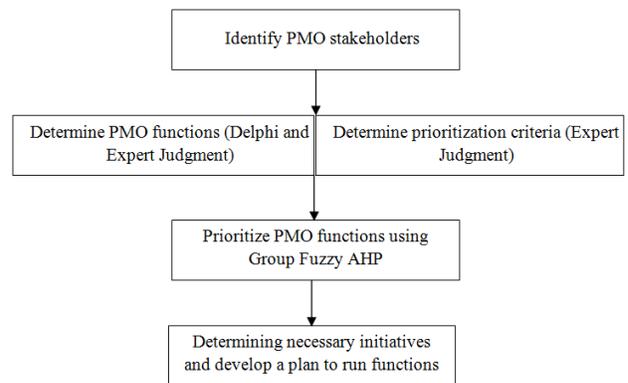


Figure 2. The steps of proposed approach.

2.5 Validity and Reliability

The validity of questionnaire (prioritization criteria) obtained using “Lawsheformula”:

$$CVR = \frac{N_e - n/2}{n/2} \geq 0.6 \quad (2)$$

According to this method, all of the criteria and sub criteria were admitted. The results obtained from the questionnaires were analyzed based on “Lickert scale” (5 options), and the “Cronbach’s alpha” was calculated by software “SPSS16” for checking the reliability. The overall calculated alpha mean for the questionnaire is 0.86 (more than 0.7). There fore, the reliability of questionnaires were acceptable.

2.6 The Fuzzy Analytical Hierarchy Process

The AHP techniques form a framework for decisions that use a one-way hierarchical relation with respect to the decision layers. This approach provides a structured framework for setting priorities on each level of the hierarchy using pair-wise comparisons. In 1965, Zadeh introduced the Fuzzy Set Theory to deal with the uncertainty. A major contribution of this set is the capability of representing uncertain data. It also allows mathematical operators and programming to be performed to the fuzzy domain. This set is characterized by a membership function, which assigns to each object a grade of membership ranging between 0 and 1¹⁷. A Triangular Fuzzy Number (TFN) is shown below (Figure3).

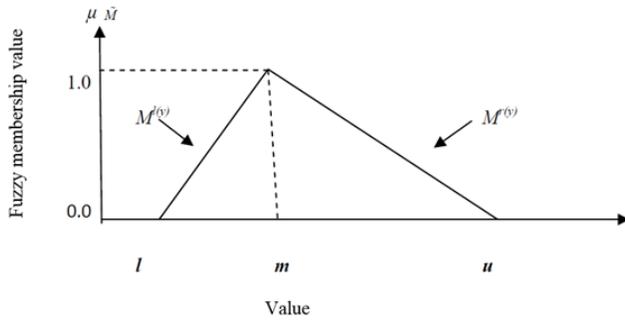


Figure 3. Triangular fuzzy number.

Each triangular fuzzy number has linear representations on its left and right side, such that its membership function can be defined as¹⁷:

$$\mu(x/\tilde{M}) = \begin{cases} 0, & x < l, \\ (x-l)/(m-l), & l \leq x \leq m, \\ (u-x)/(u-m) & m \leq x \leq u, \\ 0, & x > u \end{cases} \quad (3)$$

A fuzzy number can always be given by its corresponding left and right representation of each degree of membership as in the following¹⁷:

$$\tilde{M} = (M^{l(y)}, M^{r(y)}) = (l + (m-l)y, u + (m-u)y), \quad y \in [0,1] \quad (4)$$

The steps of fuzzy AHP method followed in this research are mentioned, as shown below:

Step 1: An Expert Group for Decision-Making is selected.

Table 1. Fuzzy conversion scale

| Importance intensity | Triangular fuzzy scale $G_i = (li, mi, ui)$ | Importance intensity | Triangular fuzzy scale $G_i = (li, mi, ui)$ |
|----------------------|---|----------------------|---|
| 1 | (1, 1, 1) | 1/1 | (1/1, 1/1, 1/1) |
| 2 | (1, 2, 4) | 1/2 | (1/4, 1/2, 1/1) |
| 3 | (1, 3, 5) | 1/3 | (1/5, 1/3, 1/1) |
| 5 | (3, 5, 7) | 1/5 | (1/7, 1/5, 1/3) |
| 7 | (5, 7, 9) | 1/7 | (1/9, 1/7, 1/5) |
| 9 | (7, 9, 11) | 1/9 | (1/11, 1/9, 1/7) |

Step 2: Triangular Fuzzy Numbers are calculated. The Triangular Fuzzy Numbers are set up. Each expert makes a pair-wise comparison of the decision criteria and gives relative scores. Instead of a crisp value, which is used in AHP, the fuzzy AHP is a range of values to incorporate

the decision-makers' uncertainty. In this method, the fuzzy conversion scale is as illustrated in Table 1. This scale has been employed in Parkash's fuzzy prioritization approach¹⁸ (Table 1).

Step 3: Calculation of G_i . The triangular fuzzy numbers are set up using the AHP method based on the fuzzy numbers:

$$\tilde{G}_1 = (l_i, m_i, u_i) \quad (5)$$

$$l_i = (l_{i1} \otimes l_{i2} \otimes \dots \otimes l_{ik})^{\frac{1}{k}}, \quad i = 1, 2, \dots, k \quad (6)$$

$$m_i = (m_{i1} \otimes m_{i2} \otimes \dots \otimes m_{ik})^{\frac{1}{k}}, \quad i = 1, 2, \dots, k \quad (7)$$

$$u_i = (u_{i1} \otimes u_{i2} \otimes \dots \otimes u_{ik})^{\frac{1}{k}}, \quad i = 1, 2, \dots, k \quad (8)$$

Step 4: Calculation of G_T . Toward this purpose, the geometric fuzzy mean of the total row is established using¹⁷:

$$\tilde{G}_T = \left(\sum_{i=1}^k l_i, \sum_{i=1}^k m_i, \sum_{i=1}^k u_i \right) \quad (9)$$

Step 5: Determination of fuzzy priorities for each candidate. In this step, the global weights for each candidate is determined and the candidates fuzzy priorities are calculated using linguistic variables, which are defined for the triangular fuzzy numbers, as shown below¹⁷:

- Very good (3, 5, 5)
- Good (1, 3, 5)
- Moderate (1, 1, 1)
- Poor (1/5, 1/3, 1)
- Very poor (1/5, 1/5, 1/3)

Step 6: Calculation of w . The fuzzy geometric mean of the fuzzy priority value is calculated with normalization priorities for factors using:

$$\tilde{W} = \tilde{G}_i / \tilde{G}_T = (l_i, m_i, u_i) / \left(\sum_{i=1}^k l_i, \sum_{i=1}^k m_i, \sum_{i=1}^k u_i \right) = \left(l_i / \sum_{i=1}^k l_i, m_i / \sum_{i=1}^k m_i, u_i / \sum_{i=1}^k u_i \right) \quad (10)$$

Step 7: Calculation of $w_{\alpha l}$. Factors belonging to α -cut values are determined for the calculated α . The fuzzy priorities will be applied for lower and upper limits for each α value:

$$w_{\alpha l} = (w_{\alpha l}, w_{\alpha u}) \quad i = 1, 2, \dots, k \quad l = 1, 2, \dots, l \quad (11)$$

Step 8: Calculation of W_{ip} , W_{in} . Combine the entire upper values and the lower values separately, and then divide them by the total sum of α value:

$$W_{il} = \frac{\sum_{l=1}^L \alpha(w_{il})_l}{\sum_{l=1}^L \alpha_l} \quad i = 1, 2, \dots, k \quad l = 1, 2, \dots, L \quad (12)$$

$$W_{iu} = \frac{\sum_{l=1}^L \alpha(w_{iu})_l}{\sum_{l=1}^L \alpha_l} \quad i = 1, 2, \dots, k \quad l = 1, 2, \dots, L \quad (13)$$

Step 9: Calculation of w_{id} . The following formula is used in order to defuzzify by combining the upper limit value and the lower limit values using the optimism index (λ).

$$w_{id} = \lambda W_{iu} + (1 - \lambda)W_{il} \quad \lambda \in [0, 1] \quad i = 1, 2, \dots, k \quad (14)$$

Step 10: Calculation of W_{in} . Finally, the defuzzification values priorities are normalized using:

$$W_{in} = \frac{w_{id}}{\sum_{i=1}^k w_{id}}; \quad i = 1, 2, \dots, k \quad (15)$$

2.7 Results

Experiences of project-based organizations show that they have faced with many challenges in executing PMO functions. One of the most important challenges is the organizational resistance against PMO initiatives. Another is related to organizational readiness to accept

the project management office functions. In this regard, the best solution for this problem is to prioritize PMO functions. This approach helps organizations to focus on the most important affairs.

After explaining research methodology and literature review, PMO functions in the case study organization are determined and prioritized. In order to determine PMO functions, the common functional boundaries of this unit with other organizational entities should be considered. In this regard, stakeholders of the case study PMO were identified. Then, Delphi method was used in the group meetings with executives, the PMO manager and experts to determine functions based on theoretical functions and with respect to common boundaries of PMO in the organization. Referring to theoretical functions, 11 functions out of 20 was determined for the case study organization (Table 2).

After determining the PMO functions, they should be evaluated in terms of the necessity and alignment with organizational needs. In other words, the priority of these functions should be specified based on criteria such as organizational readiness. Prioritization of PMO functions helps the organization to execute functions which are mostly needed and mainly acceptable. Consequently,

Table 2. PMO Functions in the case study organization

| Group | Code | Function | Case study |
|------------------------------------|------|--|------------|
| Strategic Alignment and governance | S1 | Project portfolio management | ✓ |
| | S2 | Participating in strategic management | ✓ |
| | S3 | Project governance | - |
| | S4 | Business performance management | - |
| Organization and Process | O1 | Project management organization and structure | ✓ |
| | O2 | Provide project management standards and methodologies | ✓ |
| Learning and organizational growth | L1 | Human resource development | ✓ |
| | L2 | Project knowledge management | ✓ |
| Project Support | P1 | Resource management | ✓ |
| | P2 | Project management mentoring | ✓ |
| | P3 | Project stakeholder management | ✓ |
| | P4 | Project planning | - |
| | P5 | Team development | - |
| | P6 | Facilities and equipment support | - |
| | P7 | Project management tools | - |
| Monitoring, control and Assessment | M1 | Project control and monitoring | ✓ |
| | M2 | Project management maturity assessment | ✓ |
| | M3 | Project auditing | - |
| | M4 | Project recovery | - |

better organizational climate will be provided to execute other functions properly. Toward this purpose, the group fuzzy analytical hierarchy process method¹ was used. The steps of AHP include:

1. Defining the goals, options and criteria of the problem. 2. Determining the weights of criteria regarding to the goal. 3. Determining weights of the alternatives regarding to the criteria.

4. Determining the priorities of the alternatives¹⁹. At first, the prioritization criteria for implementing PMO function should be identified. These criteria are not mentioned in the literature. Therefore, academic experts were interviewed. In conclusion, 8 criteria were identified and categorized in 3 categories (Table 3).

The validity of prioritization criteria were checked through obtaining comments of organizational experts with questionnaire and considering an arithmetic average and the cut point of 3 for accepting them. The results show the acceptance of all criteria. After finalizing the elements of the problem, the AHP problem can be shown (Figure 4).

1 GFAHP

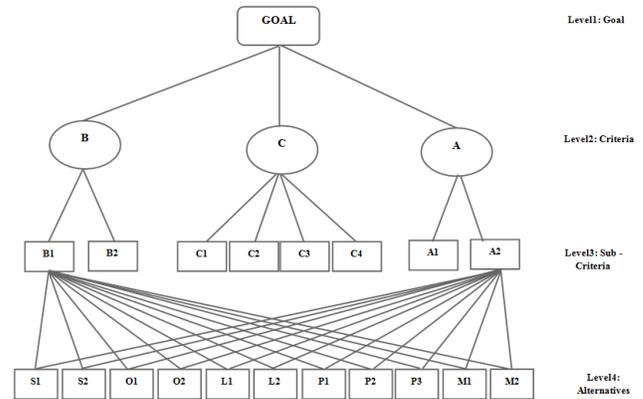


Figure 4. AHP levels.

The organizational expert should be interviewed to determine priority of criteria and functions. In this regard, group meetings were held and 30 experts made their opinion to determine the pair-wise comparison matrix based on the mentioned spectrum (the theoretical steps are noted in section 2.6).

Table 3. Criteria and sub-criteria for prioritizing PMO Function

| Criteria | Code | Sub-criteria |
|-------------------------------|------|---|
| Alignment (A) | A1 | Alignment with organizational vision, mission and objectives |
| | A2 | Alignment with requirements and needs of project management environment |
| Background (B) | B1 | Existence of human resource capabilities needed to fulfill a function |
| | B2 | Existence of tools and processes needed to fulfill a function |
| Companionship and Support (C) | C1 | Senior management support towards executing a function |
| | C2 | Middle management support towards executing a function |
| | C3 | Companionship of Project teams to fulfill a function |
| | C4 | Consensus between managers in different organizational level |

Table 4. Criteria and Sub-criteria (Fuzzy weight factors)

| Criteria | Sub-criteria | Fuzzy weight factors |
|---------------------------|-----------------------|----------------------|
| Alignment | A1 (0.25, 0.64, 1.42) | (0.051, 0.41, 1.32) |
| | A2 (0.11, 0.27, 0.72) | (0.02, 0.16, 0.69) |
| Background | B1 (0.15, 0.59, 1.23) | (0.03, 0.15, 0.911) |
| | B2 (0.12, 0.27, 1.23) | (0.02, 0.07, 0.93) |
| Companionship and Support | C1 (0.71, 1.16, 2.1) | (0.06, 0.17, 0.93) |
| | C2 (1, 2.05, 3.16) | (0.08, 0.29, 1.53) |
| | C3 (0.51, 0.65, 1) | (0.04, 0.08, 0.44) |
| | C4 (0.48, 0.52, 1.2) | (0.04, 0.07, 0.45) |

The allowable inconsistency ratio for these matrixes is 0.1¹⁹. This ratio is below 0.1 for all of the calculated

matrixes. Therefore, judgments are consistent and reliable. As a result of calculating pair-wise comparison matrix for criteria and sub-criteria, the fuzzy weights were obtained (Table 4).

The prioritized alternatives which is shown in Table 5. Overall weights actually are calculated by multiplying normalized row vectors by weighted criteria vector. As it is shown, project portfolio management function with value of 0.17 has the highest priority.

Then, the importance of alternatives should be determined based on the mentioned formulas. The result for the function “S1” is illustrated (Table 5).

The final Priorities of Project Management Office functions in the case study organization show that the project portfolio management has the priority 1 (Table 6).

Table 5. Importance of function "S1" based on Sub-criteria

| Fuzzy weight factor of Sub-criteria | Importance (Triangular fuzzy scale) | Fuzzy Weight |
|-------------------------------------|-------------------------------------|--------------------|
| (0.051, 0.41, 1.32) | (1, 1, 1) | (0,04; 0,38; 1,32) |
| (0.02, 0.16, 0.69) | (1, 3, 5) | (0,02; 0,48; 3,43) |
| (0.03, 0.15, 0.911) | (1, 3, 5) | (0,03; 0,52; 4,56) |
| (0.02, 0.07, 0.93) | (1, 3, 5) | (0,02; 0,21; 4,56) |
| (0.06, 0.17, 0.93) | (3, 4, 5) | (0,16; 0,85; 4,64) |
| (0.08, 0.29, 1.53) | (1, 1, 1) | (0,07; 0,29; 1,54) |
| (0.04, 0.08, 0.44) | (1/5, 1/5, 1/3) | (0,01; 0,02; 0,17) |
| (0.04, 0.07, 0.45) | (1/5, 1/5, 1/3) | (0,08; 0,01; 0,16) |

Table 6. Final priorities of functions

| Code | Function | Normalized Weight | Priority |
|------|--|-------------------|----------|
| S1 | project portfolio management | 0.17 | 1 |
| L1 | Human resource development | 0.162 | 2 |
| O2 | Provide project management standards | 0.133 | 3 |
| M1 | Project management maturity assessment | 0.106 | 4 |
| M2 | Project control and monitoring | 0.098 | 5 |
| L2 | Project knowledge management | 0.082 | 6 |
| P3 | Project stakeholder management | 0.062 | 7 |
| O1 | Project management organization | 0.051 | 8 |
| S2 | Participating in strategic management | 0.042 | 9 |
| P1 | Resource management | 0.032 | 10 |
| P2 | Project management mentoring | 0.028 | 11 |

After determining the priority of PMO functions, a series of interviews were conducted with experts to determine the measures which have to be taken toward implementing functions.

4. Discussion

The Research gap, which was identified as a result of the literature review, has been addressed in this paper by introducing a practical approach which can be used for project-based organizations to determine and prioritize PMO functions. Furthermore, practical guides are proposed. The results of examining the proposed approach in the case study organization reveals the fact that prioritizing the functions can be beneficial for the project-based organizations in terms of the reasons mentioned below:

- Addressing crucial organizational needs.
- Avoiding challenges and mitigate risks in executing PMO functions.
- Increasing the efficacy of PMO in the organization.

- Gaining the support of executives.
- Managing PMO resources and capabilities in line with organizational strategies.
- Reaching the organizational consensus on implementing high-risk PMO functions.

Reviewing the results of case study research some practical guidelines can be offered for project-based organizations:

- Referring to theoretical PMO functions to determine PMO functions.
- Communicating with PMO stakeholders before determining PMO functions.
- Determining common boundaries of PMO in the organization before determining PMO functions.
- Using Delphi in group meetings with experts, executives and stakeholders to determine PMO functions.
- Using group decision making methods to prioritize PMO functions.
- Considering the necessary initiatives before executing PMO functions.

5. Conclusion

Regarding to recent increase in the number of project-based organizations and competition over limited resources in the business environment, the complexities of project management have significantly increased, and it in turn brings along problems such as delays in delivering project deliverables, increase in project costs and scope creeps that lead to irreversible consequences for these organizations. Hence, these organizations have taken appropriate measures such as establishment and development of Project Management Offices to minimize such problems. As a matter of fact, it is of crucial significance to define correct functions of this organizational entity based on real needs. The results of researches conducted in this field of study show many shortcomings in this area, and reveals the necessity of offering a practical approach for determining and prioritizing PMO functions. Therefore, an approach is introduced in this article to accomplish this goal. This approach is based on group fuzzy AHP method and was examined in a case study organization. It should be mentioned that 40 executives and experts participated in this research. The steps of the proposed approach includes:

1. PMO stakeholders in the organization have to be identified.
2. PMO functions should be determined based on theoretical framework and comments of the stakeholders.
3. Prioritization criteria have to be identified based on expert judgments.
4. PMO functions have to be prioritized.
5. Initiatives for executing PMO functions in the organization should be proposed based on expert judgment.

The weighted criteria to prioritize functions includes organizational effectiveness (0.52), needed infrastructure for executing functions (0.15), and organizational support and companionship (0.34). According to GFAHP method, the function of project portfolio management gained the highest priority and the Project management mentoring gained the lowest priority. In addition, a number of interviews were carried out to determine the measures which have to be taken into account before executing PMO functions. This step helps organizations to address crucial organizational needs, avoid challenges and mitigate risks in executing PMO functions.

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