

IDENTIFICATION OF SIGNIFICANT CRITERIA FOR SELECTION OF CONSTRUCTION PROJECT MANAGERS IN IRAN

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ABSTRACT: Project managers play a key role in cost, time, and quality of a project. Selection of an appropriate project manager, therefore, is considered as one of the most important decisions in any construction project. It should be noted that most important decision makings are carried out by the project manager throughout the project. Traditionally, project manager selection in construction companies in Iran is through organizing an interview with candidates and selecting the most appropriate choice in accordance with the capabilities, potentials and individual specifications coupled with the requirements of the project. In the same direction, organizing interview on selection of appropriate candidate is usually carried out by senior managers of companies. Determination of the most important criteria for selection of project managers and also identification of significance coefficient of each criterion can highly help senior managers of companies to make sound selection decisions. In this paper, a numerical model has been considered for determination of significance of each criterion, details of which are submitted for selection of project manager in Iranian petrochemical, oil and gas sector companies. For this reason, all criteria- considered by senior managers of the companies under study- are first determined. Then, information obtained through 38 interviews, conducted by senior managers of the mentioned companies while selecting project manager, is analyzed. Significant coefficient of each criterion is calculated through the accumulated data using fuzzy curves method.

Keywords: Fuzzy curves method, Project manager, Criterion, Construction, Interview

1. INTRUODOCTION

Due to various technical and financial concerns, construction projects have been complicated in recent years. Manager of such projects usually face various challenges in the lifespan of project in a way that their responsibilities usually start before inception of the project. Moreover, their duties are continued even after completion of construction phase of a project. Sayles and Chandler listed five critical success factors for a project: project managers' competence, scheduling of activities, control systems and responsibilities, monitoring of project, and continual involvement in the project [1]. Therefore, appropriate selection of a project manager is considered as one of the most important factors behind success of a project. In the meantime, many construction companies term selection of appropriate manager for their projects as one of the most threatening and risky decision makings in this regard. It is obvious that having enough information and technical know-how on the criteria that should be taken into consideration in selection of project manager is regarded as the first step in selection of an appropriate project manager.

2. CRITERIA FOR SELECTION OF CONSTRUCTION PROJECT MANAGER

Various parameters might be taken into consideration while selection of a competent manager. Nevertheless, different researchers have various viewpoints on the necessary criteria for selection of a project manager as well. Kats defined the following items as the main factors for project managers [2]:

- Conceptual Skill: The ability to comprehend abstract or general ideas and apply them to specific situation is conceptual skill.
- Technical Skill: The ability to use specific knowledge, methods and techniques in performing work is technical skill.
- Human Skill: The ability to understand, motivate and get along with other people is human skill.

Perini counted the following items as the main specifications of a successful project manager [3].

- Possess superior technical skills,
- Communicate effectively,
- Build and maintain effective team dynamics,
- Work hard,
- Focus on client needs,
- Make safety a top priority,
- Remain calm under pressure,
- Always ask the right questions,

- Take responsibility and appropriate risks to achieve excellence,
- Above all-lead by example.

Meredith et al. divided the main skills of project manager into six groups which are:

Team skills, organizational skills, communication skills, technical skills, coping skills and leadership and building skills [4]. Goodwin counted the conceptual skills, technical skills, negotiation skills and human skills as the main four skills essential for a project manager [5]. Despite existence of different opinion on necessary

criteria required for selection of an appropriate project manager, it can be observed that most of these criteria are common [6].

In this paper, however, a questionnaire has been sent to senior managers of 12 giant oil and gas contractors for the purpose of the project. They were requested to specify all criteria considered in this regard for the selection of a competent project manager. After summing up, a number of 23 criteria were classified in four main groups as criteria for selection of appropriate project manager presented in Table 1.

Table 1. Criteria for Selection of Construction Project Managers

No.		Criteria
1	Technical and professional records	Total Job experience
2		Management experience
3		Work experience in the company
4		Work experience in similar projects
5		Work experience under project owner's organization
6		Work experience in similar project sites
7		Having a share or being a member of managing board of the company
8		Quality assessment of pervious projects
9	Educational background	Major
10		Degree
11		Quality of the university where the applicant is graduated
12		Specialization
13		Attended technical & educational workshops
14		Language ability (English)
15	Demographic features	Gender
16		Age
17		Physical and mental health
18		Appearance
19	General management abilities	Abilities in human resource management (number of employees working under his supervision)
20		Abilities in communicating effectively with project owner
21		Decision making ability under critical circumstances
22		Accountability in task performing
23		Ability in project conditions assessment and in offering predictions

3. COLLECTION OF HISTORICAL DATA

Coefficients of importance of criteria are specified through fuzzy curves method based on the specific data. For this reason, the required data were to be provided as well. For the provision of the required data, managers of the giant contractors were requested to register status of each candidate on various criteria while holding interview for the selection of a competent project manager. Also, they were requested to consider a final privilege, i.e., from 0 to 100 for each candidate. The said

final privilege was considered as a criterion for the selection of a competent manager.

Table 2 shows the data pertaining to an actual interview carried out between the two candidates, details of which have been registered. Column 3 shows 23 criteria and column 4 indicates the possible situation and status for each criterion. For example, criteria 14 (indicating ability of each candidate in verbal communication) can be considered as a figure from 0 to 100. In the same direction, criteria 15 (indicating gender of the candidate) is limited to one of the choices of being male or female.

Columns 5 and 6 indicate information related to two participating candidates in this interview. If we divide the information related to two candidates with each other, the numbers mentioned in column 7 will be achieved. For example, at the first criterion, (general working experience), the first and second candidates enjoy 25 and 30 years experience, respectively. Actually, the figure 0,83 is obtained through the division of 25 to 30. Also, in terms of interviewer (regarded as senior manager of contracting company), the final privilege of the first candidate is 70 while the final privilege of the second candidate is 80 in a way that the figure 0,875 at the last line of seventh column has been obtained as a result of division of these two privileges. It is obvious that if this figure is found less than one, the second candidate will be selected and vice versa.

Three points should be clarified on Table 2:

- Where the figure is zero, the number is considered to be 0/1 for the possibility of division
- For multiple-choice criteria such as education, an appropriate number is given to each choice and the comparisons are made upon these numbers (for example M.S. is 3 and B.S. 2). To compare the candidates in each criterion, candidates' degrees are divided into each other.
- For age criterion, firstly each participant's age is subtracted from the ideal age, 45, defined by experts, and the comparison is based on these subtractions' divisions. It should be added that choosing the mentioned age for the ideal age is fully based on experts' opinions.

Table 2. Two interviewees' features and comparison of the results from their mutual comparisons

No	Criteria	Possible options	Applicant 1 and his/her scores	Applicant 2 and his/her scores	Relative score of the applicants
1	Total Job experience	0-30 years	25 years	30 years	25/30=0.83
2	Management experience	0-30 years	12 years	5 years	2.4
3	Work experience in the company	0-30 years	0	0	1
4	Work experience in similar projects	0-30 years	25 years	0	25/0.1=250
5	Work experience under project owner's organization	0-30 years	7 years	0	70
6	Work experience in similar project sites	0-30 years	25 years	15 years	1.67
7	Having a share or being a member of managing board of the company	Yes(2) – No(1)	No(1)	No(1)	1
8	Quality assessment of pervious projects	0-100 points	80	70	1.14
9	Major	Mechanical Eng. Civil Eng Chemical Eng. Electrical Eng. Others	civil engineering (2)	Chemical engineering (1)	2
10	Degree	BS-MS-PhD	BS(2)	MS(3)	0.67
11	Quality of the university where the applicant is graduated	0-100 points	95	80	1.19
12	Specialization	Design-Construction-Supervision-Management-others	Management(4)	Supervision(3)	1.33
13	Attended technical & educational workshops	0-200 hours	50	150	0.33
14	Language ability (English)	0-100 points	90	20	4.5
15	Gender	Male(2)-Female(1)	Male(2)	Male(2)	1
16	Age	18-80 years	52	55	0.95
17	Physical and mental health	Health(2)-Unhealthy(1)	Healthy(2)	Healthy(2)	1
18	Appearance	0-100 points	70	60	1.17
19	Abilities in human resource management (Number of employees working under his supervision)	0-500 persons	300persons	10persons	30
20	Abilities in communicating effectively with project owner	0-100 points	90	70	1.29
21	Decision making ability under critical circumstances	0-100 points	60	40	1.5
22	Accountability in task performing	0-100 points	50	80	0.625
23	Ability in project conditions assessment and in offering predictions	0-100 points	60	75	0.8
	Final Score (output)	0-100 points	70	80	0.875

If interview is held between more than two candidates (e.g., three or four candidates), pair-wise (mutual) comparison is made between the two of them in a way that the figure obtained in this regard will be considered as of comparison of mutual candidates as final data system. If, however, three candidates are being interviewed, three columns will be considered as pair-wise comparison of candidates. In case of participation of n candidate, the number of even comparisons will be made through $n(n-1)/2$ procedures.

Finally, the data related to a number of 37 interviews, organized by the senior managers of 12 giant contractors in a period of two years, were gathered. Three or four candidates participated in most of interviews held in this regard. A number of 160 pair-wise comparisons between candidates were made in whole 37 interviews carried out in this regard.

4. CALCULATION OF IMPORTANCE COEFFICIENTS OF CRITERIA

Fuzzy curves method, introduced by Lin and Cunningham, is applied to identify importance coefficient of each criterion, [7]. Fuzzy curves are drawn as follows:

- 1- All $x_{ik} - y$ points are diagramed for each criterion.
- 2- For each point of $x_{ik} - y$, a fuzzy membership function is calculated based on the following formula:

$$\mu_{ik}(x_i) = e^{-\left(\frac{x_{ik}-x_i}{b}\right)^2} \quad (1)$$

In which,

x_i : i^{th} input ($i=1,2,3,\dots,23$)

Y : output

x_{ik} : k^{th} data for x_i input. ($k=1,2,\dots,160$)

b : special percent of x_i span. (for example 10%)

3- For each 23 criteria, one fuzzy curve is diagramed through the following relation:

$$C_i = \frac{\sum_k^m \mu_{ik}(x_i) \cdot y_k}{\sum_k^m \mu_{ik}(x_i)} \quad (2)$$

Through the application of MATLAB, the said fuzzy curves have been drawn for all 23 criteria, details of which have been shown in Figure 1. With regard to the significant criteria, the rate of changes of width of fuzzy curve (change in y axis) is found more and on the contrary, the criteria, which their fuzzy curve enjoy less width changes, is of meager significance. On the other hand, coefficient of importance (weight of each criterion) was obtained from the following method:

$$W_i = y_{\max} - y_{\min} \quad (3)$$

Based on which, W_i is significance of i^{th} criterion while y_{\min} and y_{\max} are minimum and maximum of the i^{th} criterion fuzzy curve width respectively.

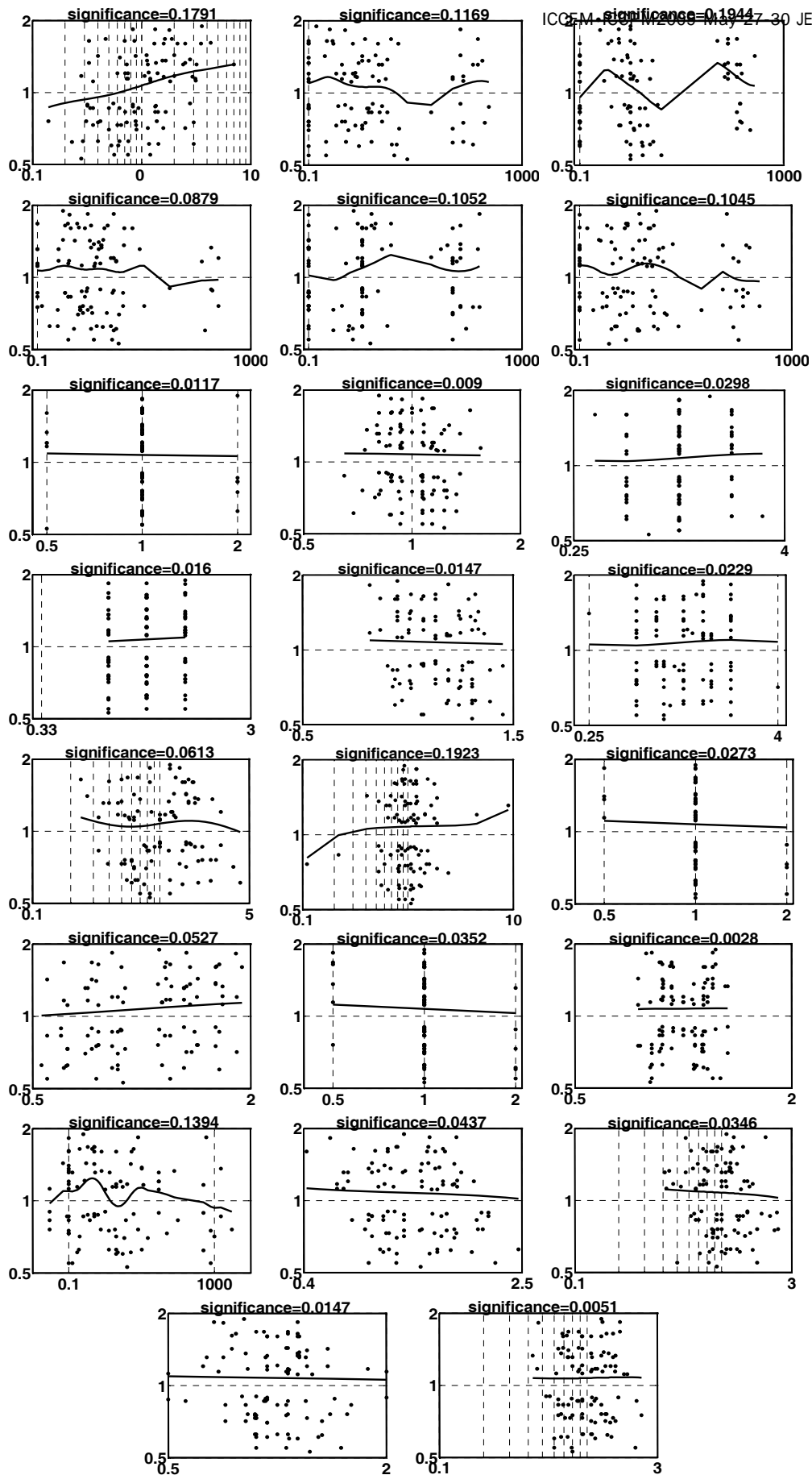


Figure 1. Fuzzy Curves for Different Criteria

Through the application of the mentioned method, it became clear that the first, third and the fourteenth criteria (indicating total job experience, work experience in the company and gender) enjoyed the highest importance in view of senior managers of companies. Also, 18th and 23rd criteria enjoyed the least coefficient of importance. It should be noted that this finding accords with the viewpoints made by expert in the field. Coefficient of importance of other criteria has been shown in Table No. 3.

Table 3. Coefficients of Importance for different criteria

Number of Criterion	W_j	Number of Criterion	W_j
1	0.179	13	0.061
2	0.117	14	0.0613
3	0.194	15	0.192
4	0.088	16	0.053
5	0.105	17	0.035
6	0.105	18	0.003
7	0.012	19	0.139
8	0.009	20	0.044
9	0.03	21	0.035
10	0.016	22	0.015
11	0.015	23	0.005
12	0.023		

5. CONCLUSION

The coefficient of significance for each criterion--suggested by managers of giant Iranian contractors for the selection of project manager in petrochemical, oil and gas projects-- was calculated numerically. The data, required for this model, was accumulated based on the previous interviews made in the companies as well. Then, the coefficient of significance for the criteria was specified through the application of fuzzy curves method. It is found that the coefficients can be considered as a numerical framework in the selection of a competent

project manager. Also, these coefficients are considered as an appropriate guideline for managers of leading petrochemical, oil and gas contractors in case of lacking enough experience in the selection of a competent project manager. The following points should, however, be taken into consideration strictly while using these coefficients:

- The required data to identify the coefficients are obtained through interviews, done by construction company managers of a particular country, Iran. Obviously, the criteria for selecting a project manager in different countries and conditions are various. It is recommended to include this issue when using such coefficients.
- The coefficients have been calculated for petrochemical, oil and gas projects. It should be noted that calculation of significance coefficients of criteria for selection of project managers in other fields such as residential construction can be topic for further investigations and research projects.

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