# CANDIDATES RANKING FOR THE PROJECT MANAGER JOB POSITION: ABSOLUTE MEASUREMENT

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**Abstract:** This paper aims at constructing AHP Model for ranking of candidates eligible for a job position of a Project Manager. For the purpose of candidates ranking absolute measurement shall be used. According to both the interview carried out with the owner who is at the same time a manager of a consultancy company, the interview being about the criteria that are considered to be important for the job position of a Project Manager, as well as the results from the survey questionnaire submitted through e-mail to 30 owners and/or managers of small and medium enterprises, there were selected seven criteria. There were also established the intensities of the criteria, whereas as alternatives shall be considered the candidates who shall apply for this job position. The constructed AHP Model is presented in this paper together with the hypothetical example for ranking of four candidates.

**Keywords:** AHP, absolute measurement, criteria, intensities, ranking, project manager

## 1. INTRODUCTION

The most important resource in one company is the man. Choosing the best candidate for certain job position is of crucial importance to the development of the company. The multi-criteria method analytic hierarchy process (AHP) enables that the best alternative is chosen out of the available ones which are evaluated on the basis of several criteria/subcriteria.

It is crucial to structure the complex decision problem into a hierarchy, details of which are further available in (Saaty and Vargas, 1994, p. 2). When doing this, it is recommended that there are $7 \pm 2$ elements at one same level, see more in (Miller, 1956).

Within this paper there is constructed AHP Model for ranking of candidates for the job position of a Project Manager, and there is also given an example of the such ranking of four candidates.

The paper is structured as follows: apart from the Introduction that is given in Section 1, Section 2 refers to the structuring of the decision problem. The analytic hierarchy process is explained in Section 3, whereas the results are presented in Section 4, and the Conclusion is given in Section 5.

## 2. STRUCTURING THE DECISION PROBLEM

The person who is owner and manager of a consultancy company in the Republic of Macedonia is in a need of employing a Project Manager. In order to choose the best

candidate for this position, he engaged an operational researcher the assistance of whom shall be further used to construct AHP Model for ranking the applicant candidates.

The goal is to rank the candidates who shall apply for the job position of a Project Manager. In order to identify the criteria that are important for this job position an interview had been made with the person who is both owner and manager of the consultancy company. He defined 14 criteria, the criteria being the following ones: education, level of English proficiency, team work, communication skills, specific work experience, computer skills, attended trainings in the required field of expertise, recommendations, PM software usage skills, leadership, PMP Certificate, overall working experience, driver's license and attended trainings in fields different than the required field of interest. Also, there was determined to send this list of 14 criteria to 30 owners and/or managers of small and medium enterprises and require that they widen the list with criteria which they find important for the job position of a Project Manager, and which are not given on the list. The interviewees added the following 7 criteria: multi-tasking, negotiation skills, networking and establishing new contacts, motivation of the candidate, managing the interests of the stakeholders, organization skills and analytical skills. There was a survey questionnaire made which lists all the 21 determined criteria, and the interviewees were required to select seven of them that they find as being the most important ones for this job position. The representative sample of the interviewees remains that same one (i.e. 30 owners and/or managers of small and medium enterprises).

The results from the survey questionnaire are given in Table 1. This Table shows that the mostly chosen criteria is education (it was selected 20 times), after which follows the specific work experience (selected 19 times), then the next one in the row is the level of English proficiency and the PM software usage skills (selected 15 times) etc. whereas the motivation of the candidate and the attended trainings in fields different than the required field of interest were not selected at all. Because of the fact that the person who is both owner and manager of the consultancy company has a remarkable accumulated experience in the field, there was determined that for the criteria which shall be selected intensities shall be established.

Table 1. Results from the Survey Questionnaire

| Criteria | The number of times this criteria was selected by the total of 30 interviewees |
|---|---|
| 1. Education | 20 |
| 2. Specific Work Experience | 19 |
| 3. Level of English Proficiency | 15 |
| 4. PM Software Usage Skills | 15 |
| 5. Organization Skills | 14 |
| 6. Analytical Skills | 14 |
| 7. PMP Certificate | 13 |
| 8. Leadership | 13 |
| 9. Team Work | 12 |
| 10. Attended trainings in the required field of expertise | 12 |
| 11. Computer Skills | 11 |
| 12. Multi-tasking | 11 |
| 13. Communication Skills | 11 |
| 14. Recommendations | 8 |
| 15. Networking and establishing new contacts | 8 |
| 16. Managing the interests of the stakeholders | 7 |
| 17. Overall Working Experience | 3 |
| 18. Negotiation Skills | 3 |
| 19. Driver's License | 1 |
| 20. Motivation of the Candidate | 0 |
| 21. Attended trainings in fields different than the required field of interest | 0 |

## 3. THE ANALYTIC HIERARCHY PROCESS

Developed by Thomas L. Saaty at the beginning of the 70's of the XX century (Saaty, 1977, 1980), AHP is a systematic procedure which enables a hierarchical presentation of the elements of any decision problem (Saaty and Vargas, 1991, p. 19). The decision-maker compares, in pairs, the elements of each of the levels of the constructed hierarchy and expresses his/her preferences by using the scale of relative importance (Saaty and Vargas, 1991, p. 27), (Table 2). In order to calculate the weights of the criteria and the priorities of the alternatives, appropriate mathematical model is used; see more in (Saaty, 1990), (Saaty and Vargas, 1991).

The focus of this paper is the absolute measurement. "*After setting priorities for the criteria (or subcriteria, if there are any), pairwise comparisons are also made between the ratings themselves to set priorities for them under each criterion and dividing each of their priorities by the largest rated intensity to get the ideal intensity. Finally, alternatives are scored by checking off their respective ratings under each criterion and summing these ratings for all the criteria. This produces a ratio scale score for the alternative. The scores thus obtained of the alternatives can in the end be normalized by dividing each one by their sum.*" (Saaty and Vargas, 1994, p. 5). See more on absolute measurement in (Saaty and Vargas, 1994, p. 17-19), (Saaty, 2005, pp. 20-23).

Table 2. Scale of Relative Importance (Saaty and Vargas, 1991, p. 27)

| Intensity of relative importance | Definition | Explanation |
|---|---|---|
| 1 | Equal importance | Two activities contribute equally to the objective. |
| 3 | Moderate importance of one over another. | Experience and judgment slightly favour one activity over another. |
| 5 | Essential or strong importance. | Experience and judgment strongly favour one activity over another. |
| 7 | Demonstrated importance. | An activity is strongly favoured and its dominance is demonstrated in practice. |
| 9 | Extreme importance. | The evidence favouring one activity over another is of the highest possible order of affirmation. |
| 2, 4, 6, 8, | Intermediate values between the two adjacent judgments. | When compromise is needed. |
| Reciprocals of above non-zero numbers. | If an activity has one of the above numbers (e.g. 3) compared with a second activity, then the second activity has the reciprocal value (i.e., 1/3) when compared to the first. | |

The information on whether the decision-maker was consistent or not in the process of comparing the elements of the hierarchy can be checked by calculating the Consistency Ratio (C.R.), C.R.=C.I./R.I., where the Consistency Index (C.I)= $(\lambda_{max} - n)/(n-1)$, $\lambda_{max}$ represents the largest eigenvalue of the matrix of pairwise comparisons (*A*), (Saaty and Vargas, 1994, p. 8-9). The values of the Random Index (R.I.) are given in Table 3. The decision-maker is considered to be consistent if it is obtained that the Consistency Ratio is about 10% or less; if that is not the case then the consistency should be improved (Saaty, 1990, p. 13).

Table 3. Average Random Consistency Index (Saaty and Vargas, 1994, p. 9)

| n | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Random Consistency Index (R.I.) | 0 | 0 | .52 | .89 | 1.11 | 1.25 | 1.35 | 1.40 | 1.45 | 1.49 |

The analytic hierarchy process is a method that is most widely accepted, (Triantaphyllou and Mann, 1995), and for its application see more in (Saaty and Vargas, 1994, p. 24).

### 3.1. AHP MODEL FOR CANDIDATES RANKING FOR THE POSITION OF A PROJECT MANAGER

In this paper, the decision problem is decomposed into: goal (candidates ranking for the position of a Project Manager), seven criteria were determined, the criteria being those that were the mostly chosen ones by the interviewees (Table 1), such as: education (criterion 1), specific work experience (criterion 2), level of English proficiency (criterion 3), PM Software usage skills (criterion 4), organization skills (criterion 5) analytical skills (criterion 6) and PMP Certificate (criterion 7). The criteria PMP Certificate and leadership, which are listed under 7 and 8 respectively in Table 1, are selected equal number of times by the interviewees (13 times each), whereas the owner and the manager of the consultancy company chose the criterion PMP certificate.

On his behalf there were also established so called intensities of the criteria, the intensities being the following ones: regarding the education criterion the intensities are: PhD degree, Master's Degree, Bachelor's Degree and secondary education graduate certificate; regarding the specific work experience criterion the intensities are: exceptional, large, average, small; regarding the level of English proficiency the intensities are: A1, A2, B1, B2, C1 and C2 (according to the Common European Framework of Reference for Languages (CEFR)[8]); regarding the PM Software usage skills criterion the intensities are: excellent, very good, average, below-average and insufficient; regarding the criteria organization skills and analytical skills same intensities were established: excellent, average, below-average, weak and unsatisfactory; and regarding the PMP Certificate criterion, if the person has this Certificate he/she shall be given the priority value of this criterion; whereas if he/she does not have it then he/she shall get 0. The constructed model is shown in Figure 1.

Comparisons of the elements in pairs are made by the person who is both owner and manager of the consultancy company, and the obtained results are given and interpreted in the following section.

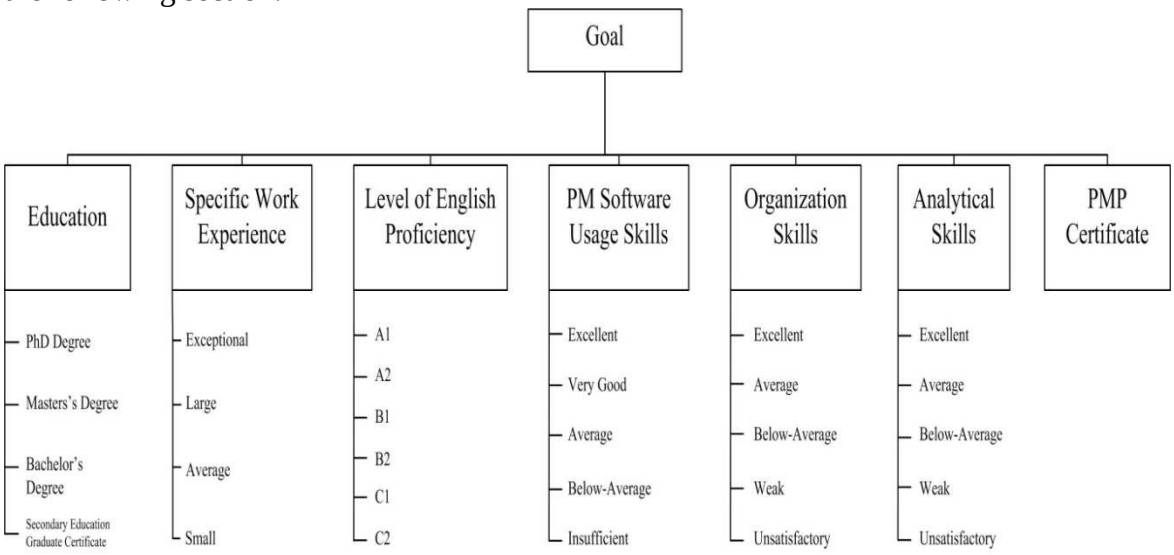


Figure 1. AHP Model for Applicant Candidates Ranking for the Job Position of a Project Manager

[8] http://www.coe.int/t/dg4/linguistic/Source/Framework_en.pdf (accessed: 9 March 2014).

## 4. RESULTS

The matrix of pairwise comparisons of the criteria is shown in Table 4, whereas the normalized matrix and the priorities are given in Table 5. Table 5 shows that the second criterion i.e. the specific work experience has the highest priority (0.284), and after this criterion follow the fifth and the sixth criterion i.e. the organization and analytical skills with 0.187 priority, etc.

The matrix of pairwise comparisons of the intensities with respect to the first criterion i.e. education, the priorities and the idealized priorities are given in Table 6, whereas the matrix of pairwise comparisons of the intensities with respect to the second, third, fourth, fifth and the sixth criterion are given in Appendix 1.

The person who is both the owner and the manager of the consultancy company was consistent in the process of comparing the elements of the constructed hierarchy (Consistency Ratio is less than 10%, i.e. less than 0.10).

Table 4. Matrix of pairwise comparisons of the criteria

| | **C1** | **C2** | **C3** | **C4** | **C5** | **C6** | **C7** |
|---|---|---|---|---|---|---|---|
| **C1** | 1 | 1/5 | 1/2 | 1/5 | 1/6 | 1/6 | 1/5 |
| **C2** | 5 | 1 | 7 | 1 | 3 | 3 | 2 |
| **C3** | 2 | 1/7 | 1 | 1/6 | 1/6 | 1/6 | 1/6 |
| **C4** | 5 | 1 | 6 | 1 | 1/2 | 1/2 | 1 |
| **C5** | 6 | 1/3 | 6 | 2 | 1 | 1 | 2 |
| **C6** | 6 | 1/3 | 6 | 2 | 1 | 1 | 2 |
| **C7** | 5 | 1/2 | 6 | 1 | 1/2 | 1/2 | 1 |

Table 5. Normalized matrix and priorities

| | **C1** | **C2** | **C3** | **C4** | **C5** | **C6** | **C7** | **Priorities** |
|---|---|---|---|---|---|---|---|---|
| **C1** | 0.033 | 0.057 | 0.015 | 0.027 | 0.026 | 0.026 | 0.024 | 0.030 |
| **C2** | 0.167 | 0.285 | 0.215 | 0.136 | 0.474 | 0.474 | 0.239 | 0.284 |
| **C3** | 0.067 | 0.041 | 0.031 | 0.023 | 0.026 | 0.026 | 0.020 | 0.033 |
| **C4** | 0.167 | 0.285 | 0.185 | 0.136 | 0.079 | 0.079 | 0.120 | 0.149 |
| **C5** | 0.200 | 0.095 | 0.185 | 0.271 | 0.158 | 0.158 | 0.239 | 0.187 |
| **C6** | 0.200 | 0.095 | 0.185 | 0.271 | 0.158 | 0.158 | 0.239 | 0.187 |
| **C7** | 0.167 | 0.142 | 0.185 | 0.136 | 0.079 | 0.079 | 0.120 | 0.130 |

C.I. = 0.076 C.R. = 0.057

Table 6. Matrix of pairwise comparisons of the intensities with respect to the criterion 1, priorities and idealized priorities

| **Criterion 1** | **PhD Degree** | **Master's Degree** | **Bachelor's Degree** | **Secondary Education Graduation Certificate** | **Priorities** | **Idealized Priorities** |
|---|---|---|---|---|---|---|
| **PhD Degree** | 1 | 2 | 3 | 4 | 0.466 | 1.000 |
| **Master's Degree** | 1/2 | 1 | 2 | 3 | 0.277 | 0.595 |
| **Bachelor's Degree** | 1/3 | 1/2 | 1 | 2 | 0.161 | 0.346 |
| **Secondary Education Graduation Certificate** | 1/4 | 1/3 | 1/2 | 1 | 0.096 | 0.206 |

C.I. = 0.010 C.R. = 0.012

A short version of how the applicant candidates ranking for the job position of a Project Manager shall be made is given in Table 12.

Into consideration are taken four alternatives i.e. four candidates (A, B, C, D), and in the following lines there is an illustration how the total score for Candidate B is calculated:

$0.030 \times 0.346 + 0.284 \times 0.472 + 0.033 \times 0.642 + 0.150 \times 0.590 + 0.187 \times 0.518 + 0.187 \times 0.518 + 0.130 = 0.578$

In an analogical way there is calculated the total score for the rest of the candidates. Then, the normalized priorities are calculated, and the last column in Table 12 (Ranking) shows that first ranked is the Candidate B, after which follow the Candidates D, A and C.

Table 7. Ranking Candidates

| | C1 0.030 | C2 0.284 | C3 0.033 | C4 0.150 | C5 0.187 | C6 0.187 | C7 0.130 | Total score | Priorities (norma-lized) | Ranking |
|---|---|---|---|---|---|---|---|---|---|---|
| A | Bachelor | Average | B2 | Average | Average | Below average | No | 0.284 | 0.180 | 3 |
| B | Bachelor | Large | C1 | Very Good | Average | Average | Yes | 0.578 | 0.366 | 1 |
| C | Master | Small | B2 | Below average | Below average | Below average | No | 0.190 | 0.121 | 4 |
| D | Master | Average | C2 | Very Good | Average | Average | Yes | 0.525 | 0.333 | 2 |

## 5. CONCLUSION

This paper aimed at constructing AHP Model for ranking of applicant candidates for the job position of a Project Manager. For that purpose there is used the absolute measurement approach of the analytic hierarchy process.

Through the carried out interview with the person who is both owner and manager of a consultancy company and also on the basis of the obtained results from the survey questionnaire that was submitted via e-mail to 30 owners and/or managers of small and medium enterprises, there were seven criteria selected: education, specific work experience, level of English proficiency, PM software usage skills, organization skills, analytical skills and PMP Certificate. On behalf of the person who is both owner and manager of the consultancy company there were established intensities of the criteria, whereas as alternatives shall be considered the candidates who shall apply for this job position.

According to the obtained results, the criterion specific work experience has the highest priority, after which follow the organization skills and analytical skills criteria which have the same priority; and after these follows the PM Software usage skills criterion, then follows the PMP Certificate criterion, then the level of English proficiency, after which is the education.

Through the hypothetical example there is illustrated how the applicant candidates ranking shall be made for the job position of a Project Manager, and how this process shall enable the person who is both owner and manager of the consultancy company to choose the best candidate for this position.

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## APPENDIX 1

Table 7. Matrix of pairwise comparisons of the intensities with respect to the criterion 2, priorities, and idealized priorities

| Criterion 2 | Exceptional | Large | Average | Small | Priorities | Idealized priorities |
|---|---|---|---|---|---|---|
| **Exceptional** | 1 | 3 | 5 | 7 | 0.558 | 1.000 |
| **Large** | 1/3 | 1 | 3 | 5 | 0.263 | 0.472 |
| **Average** | 1/5 | 1/3 | 1 | 3 | 0.122 | 0.218 |
| **Small** | 1/7 | 1/5 | 1/3 | 1 | 0.057 | 0.102 |

C.I. = 0.039 C.R. = 0.044

Table 8. Matrix of pairwise comparisons of the intensities with respect to the criterion 3, priorities, and idealized priorities

| Criterion 3 | A1 | A2 | B1 | B2 | C1 | C2 | Priorities | Idealized priorities |
|---|---|---|---|---|---|---|---|---|
| **A1** | 1 | 1/2 | 1/3 | 1/4 | 1/5 | 1/7 | 0.042 | 0.108 |
| **A2** | 2 | 1 | 1/2 | 1/3 | 1/4 | 1/5 | 0.065 | 0.168 |
| **B1** | 3 | 2 | 1 | 1/2 | 1/3 | 1/4 | 0.102 | 0.263 |
| **B2** | 4 | 3 | 2 | 1 | 1/2 | 1/3 | 0.159 | 0.413 |
| **C1** | 5 | 4 | 3 | 2 | 1 | 1/2 | 0.247 | 0.642 |
| **C2** | 7 | 5 | 4 | 3 | 2 | 1 | 0.385 | 1.000 |

C.I. = 0.021 C.R. = 0.017

Table 9. Matrix of pairwise comparisons of the intensities with respect to the criterion 4, priorities, and idealized priorities

| Criterion 4 | Excellent | Very Good | Average | Below Average | Insufficient | Priorities | Idealized priorities |
|---|---|---|---|---|---|---|---|
| **Excellent** | 1 | 2 | 3 | 5 | 7 | 0.443 | 1.000 |
| **Very Good** | 1/2 | 1 | 2 | 3 | 5 | 0.262 | 0.590 |
| **Average** | 1/3 | 1/2 | 1 | 2 | 3 | 0.153 | 0.344 |
| **Below Average** | 1/5 | 1/3 | 1/2 | 1 | 2 | 0.089 | 0.201 |
| **Insufficient** | 1/7 | 1/5 | 1/3 | 1/2 | 1 | 0.053 | 0.119 |

C.I. = 0.007 C.R. = 0.006

Table 10. Matrix of pairwise comparisons of the intensities with respect to the criterion 5, priorities, and idealized priorities

| Criterion 5 | Excellent | Average | Below Average | Weak | Unsatisfactory | Priorities | Idealized priorities |
|---|---|---|---|---|---|---|---|
| **Excellent** | 1 | 3 | 5 | 7 | 9 | 0.503 | 1.000 |
| **Average** | 1/3 | 1 | 3 | 5 | 7 | 0.260 | 0.518 |
| **Below Average** | 1/5 | 1/3 | 1 | 3 | 5 | 0.134 | 0.267 |
| **Weak** | 1/7 | 1/5 | 1/3 | 1 | 3 | 0.068 | 0.135 |
| **Unsatisfactory** | 1/9 | 1/7 | 1/5 | 1/3 | 1 | 0.035 | 0.069 |

C.I. = 0.061 C.R. = 0.055

Table 11. Matrix of pairwise comparisons of the intensities with respect to the criterion 6, priorities, and idealized priorities

| Criterion 6 | Excellent | Average | Below Average | Weak | Unsatisfactory | Priorities | Idealized priorities |
|---|---|---|---|---|---|---|---|
| **Excellent** | 1 | 3 | 5 | 7 | 9 | 0.503 | 1.000 |
| **Average** | 1/3 | 1 | 3 | 5 | 7 | 0.260 | 0.518 |
| **Below Average** | 1/5 | 1/3 | 1 | 3 | 5 | 0.134 | 0.267 |
| **Weak** | 1/7 | 1/5 | 1/3 | 1 | 3 | 0.068 | 0.135 |
| **Unsatisfactory** | 1/9 | 1/7 | 1/5 | 1/3 | 1 | 0.035 | 0.069 |

C.I. = 0.061 C.R. = 0.055