Project manager competency Model based on ANP method in construction projects

Ali Maaleki
M.Sc Social & Economical engineering
NO 501,Enterance 3,Block 3,Baharan Complex, Av.bayat, Shahr-e-rey,Tehran
9192240632. 0098
Ali.maleki66@live.com

Kaveh mohammad cyrus
Asistant Professor Amirkabir university
Amirkabir University, Tehran ,Iran
64545360, 021. 0098
cyrusk@aut.ac.ir

ABSTRACT

Most developed countries have already accepted ''Competency'' as the major factor in making management more competitive, therefore they have discovered the importance of Qualification Models and their application to cause human resources growth. Consequently, their aim is to improve the qualification of their human resources, and to reach this end, considering different ways of assessing competence takes precedence. Correct choice of assessment depends on enough resources, factual support, suitable time and of course high level of coincidence of results in assessment with business aims, so it is possible to say that in order to design a robust model of assessing qualification, we are confronted with a process of decision- making with multiple limitations or a problem of MCDM.

In this research, we have used ANP method as one of the new MCDM methods to assess qualification because this method raises the possibility to coordinate the effects of correlation and their reactions and simultaneously takes some systematic correlations under a close scrutiny.

In this essay, by the help of these methods, we have presented a model that according to it the most significant qualifications of a construction manager has been classified and the most fundamental of them has been detected in order to find the best manager.

Keywords
Competency Model, MCDM, Human Resource, ANP.

1. INTRODUCTION

Companies have always hoped to be taken to the development period by their managers. That's why they have taken steps to recognize and improve manager's qualifications. This strategy is also known as ''Leading towards Development'' or ''Model of Qualified Manager''. One model of competency consists of a collection of qualifications that are often organized according to their own features such as knowledge, skill and motivation. In 2002, Sinnote shed lights on the model of qualified manager and claimed that a true model of competency must aid the workers to discover their own competence, and by the improvement of their capabilities in the recognized fields they could better their activities or even prepare themselves for another occupation. Thus, it is expected that the model must familiarize the incompetent manager with the necessary qualifications to enhance their performance. 1

This model, in most organizations, is likely to ameliorate the situation; however, it would not have the desirable effect on the project-oriented organizations because entering slack period and then gradually getting out of it would increase the project's expenses and brings about a sharp decline in the quality of the work, and even occasionally it brings the economic justification of the projects into question. As a result, a qualified manager who leads the project towards the correct path is needed in the project-oriented organizations to begin with, further more than the demand of improving the approach and increasing the competency of the manager.

Considering the point that one of the most important project-oriented organizations that covers a large area of market, and its rise or fall brings about national and even international consequences is construction projects, in this essay selecting the most qualified manager in these companies is considered as the main goal .To design this model, ANP (The Analytic Network Process) method is used as one of the new ways of problem-solving methods of MCDM (Multi Criteria Decision Making)..

2. PROBLEM DEFINITION

Since late 1980s and after the advent of TQM, projects matching the factors below are considered to be successful: 2

1. Finished on time.
2. Done within estimated cost.
3. Final quality is the same as promised quality.
4. Appreciated by the customers.
5. Makes the customers loyal to the company.

Based on such a definition, not only should we expect to rarely succeed in the projects, but also we may witness recession and a decline in the amount of investment in the housing section and construction project, which is one of the most fundamental factors in development. Construction projects usually face either timing or finance failure. There is a huge difference between what is first presented and what is considered to be the final product. Then, managers are accused of both being incompetent to get fully acquainted with the market, and even incapable of correctly presenting the plans. In this case, then people grow suspicious about the market and they become quite dissatisfied with the company's performance. In this situation, selecting a manager who can decisively run the organization and lead the company towards the right path is of paramount importance.

To reach this end, in this essay, by thoroughly comparing the questionnaires that were given to the members of the board in two different companies, a model is presented that results in identifying the most qualified and most competent manager and also distinguishes between the competent managers and incompetent ones.

3. RESEARCH METHOD

In order to design a model for a competent manager in the construction projects, it is a necessary step to find out more about the manager's responsibilities in the projects, and this is achieved via gathering correct systematic knowledge of the projects, region, environment and their reception. After gaining the necessary knowledge, the manager's activities can be analyzed from both managerial and personal dimensions. Due to the possibility of subjectivity of the testes, because their notions are formulated in accordance with their positions, we have used scientific research instead of the interviewing and questionnaires to single out the most suitable and competent manager.

In addition to scientific researches, it can be possible to identify the criteria of the successful models of a project manager. In order to do so, the study of conventional texts and analyzing prosperous projects have been applied . It deserves mention that after detecting and classifying these factors based on ANP, by the use ideas of the pioneers, we have ranked these factors and finally we have chosen the most basic factor of competence of the qualified manager. After each presentation, if the questionnaires lacked less than 0.1 adaptations, in order to improve the opinions, they were returned to the testes and this was done till the amount of adaptation reached less than 0.1.

3.1 Competent Manager according to the Conventional Notions

Selecting the competent manager, as one of the most serious issues, is not only confined to the present time, but it was also high on the agenda in the past.3

Thanks to different tales of the past indicate that project management is deeply rooted in thousands of years ago, since the construction of Pyramids of Egypt. Therefore, one way to identify the qualified manager is to examine the main historical resources and delve into the issue to find out about the reasons of their success. Among these resources, the Quran is used as the most authentic ancient resource because of the following two reasons:

1. Among the ancient books that tell the tales of the past, the Quran, because of its nearness in time to the era of these tribes, is more reliable than the other resources

2. One of the considerable subjects in the Quran that has drawn researchers' attention is the characteristics of the qualified manager.4

After studying the book, we have identified the criteria.

Table 1. Identified Criteria base on Quran

CODE	FACTORS
C1	Personal skills
1-1	Satisfy of employees
1-2	Finality in talking
C2	Personal Typicality
2-1	Humility
2-2	Good tempered
2-3	trusteeship
2-4	perseverance
C3	Power
C4	Knowledge and Specialty
C5	Experience

3.2 Competencies according to the scientific notions

Different scientists define competency differently 5. This idea suggests that we cannot get various definitions to agree with each other. In 1982, a research was carried out by Zemek to find a comprehensive definition for qualification. He discussed this subject with several teaching specialists to determine what brings about qualification and then concluded as below:

‘**’There is no definite agreement upon what determines qualification.’’**

Hence, here we take an analytic look at the practical definitions of competence in different books. These definitions are as follows 6:

Hayes (1979): competences generally include knowledge, motivation, social characteristic and roles, or skills of one person in accordance with the demands of organizations of their clerks.

Boyatzis (1982): Competence lies in the individual's capacity which superposes the person's behavior with needed parameters as the results of this adaptation make the organization to hire him.

Albanese (1989): Competences are individual's characteristics which are used to effect on the organization's management.

Woodrufee (1991): Competence is a combination of two topics of personal competence and merit at work. Personal merit is a concept which refers to the dimensions of artificial behavior in order to show the competence performance and merit at work depends on the competences of the person in his field.

Ansfield (1997): The personal specifications which effect on a better performance are called competence.

Standard (2001) ICB (IPMA Competence Baseline): Competence is group of knowledge, personal attitudes, skills and related experiences which is needed for the person's success.

Rankin (2002): A collection of behaviors and skills which people are expected to show in their organization.

Unido (United Nations Industrial Development Organization) (2002): Competence is defined as knowledge, skill and specifications which can cause one person act better, not considering his special proficiency in that job.

Industrial Development Organization of United States (2002): Competences are a collection of personal skills related to knowledge and personal specifications which can make competence in people without having practices and related specialized knowledge.7

CRNBC (College Of Registered Nurses Of British Columbia) (2009): Competences are a collection of knowledge, skills, behavior and power of judging which can cause competence in people without having enough practice and specialized knowledge.8

Hay group (2012): Measurable characteristics of person which is related with his efficient act at work, organization and special culture .9

After examining the scientists' definitions for competency, to some extent, we get acquainted with the scientific aspect of it. In order to complete the studies, we have gotten help from the books on ''Human Resources Management''. Further studies showed that in the definitions above we have ignored the factor of power. So, different kinds of power are considered to be deciding factors in qualification.10

Powerful managers can decrease the possibilities of unexpected events and help to achieve the aims. The leader is usually chosen from the most powerful people; power is the energy that is used in different approaches based on the resource that causes power. A project needs a powerful leader or manager because they are the ones who shoulder the burdens of the work. Manager's power is divided into several parts:

1. Position power that is given to the manager from the head manager.
2. Resource power that means to operate properly.
3. Expert power that means to use knowledge, skill and experience
4. Personal power that means to gain the important information.
5. Information power that according to it the manager can informally assign his employers to different sections.

4. The Model Demonstration

After the detection of factors via both scientific and conventional methods and also by gathering the testes to brainstorm ideas in each company, our classification resulted in the Table 2 below.

Table 2. Identified Criteria and Sub-Criteria

CODE	FACTORS
C1	Personal skills
1-1	Satisfy of employees
1-2	Finality in talking
C2	Personal Typicality
2-1	Humility
2-2	Good tempered
2-3	trusteeship

2-4	perseverance
C3	Power
3-1	Position power
3-2	Resource power
3-3	Expert power
3-4	Personal power
3-5	Information power
C4	Knowledge and Specialty
4-1	Management knowledge
4-2	Civil knowledge
4-3	Construction knowledge
C5	Experience
5-1	Civil Experience
5-2	Management Experience
5-3	Project manager Experience

According to the table which is above, a competency model is made by this type:

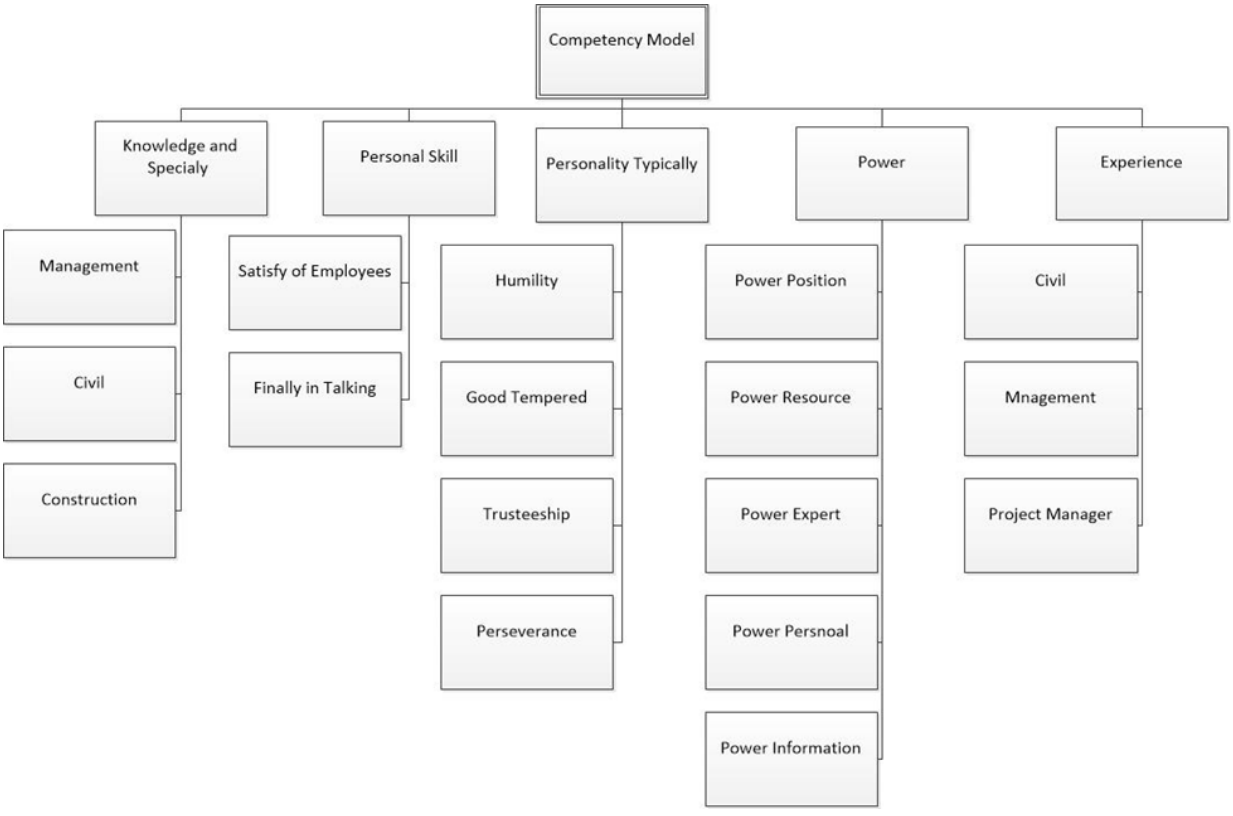

Figure 1. The Analytic Network Process for Competency model

According to figure.1, a complex pattern to determine the qualifications is extracted. In this stage, therefore it is necessary to specify the general structure of the super matrix or the initial super matrix according to the structure of the pattern (Figure.2).

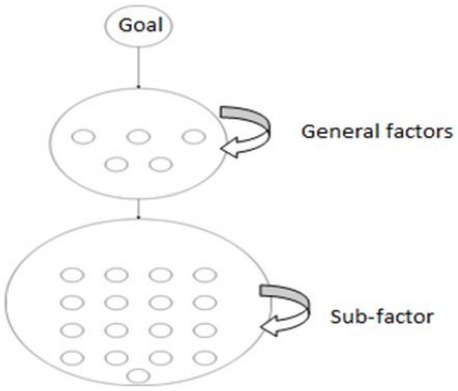

Figure 2. Relationship between Goal, General factors and Sub factors

5. CHOOSE THE MOST EFFECTIVE FACTOR IN THE SELECTION OF THE COMPETENT MANAGER

To choose the most effective factor in the selection of the competent manager, MCDM methods must be used. The most significant of these methods are ''Hierarchical Analysis'' and ''Network Analysis''.

Unlike Hierarchical analysis, in which there is a one-way relation between the criteria, sub-criteria and the options, in Network analysis, in addition to Hierarchical relation, there could be, in some sections of the model, direct relations between the criteria and the sub-criteria. In this model, these relations are also possible. These relations have been created by brainstorming.

Table 3. Dependence between general-factors

Factors	Personal skills	Personality	Typically	Power	Knowledge and Specially
Personal skills					
Personality					
Typically					
Power					
Knowledge and Specially					

In order to break this model down by the help of ANP method, first it is essential to compare their relations of the main criteria with one another and with sub-criteria and finally we must get to compare the pair relations between the sub-criteria with one another. Then we must control the matrix adaptation, and in the end we must deal with the creation of the asymmetrical and symmetrical super matrix and the super matrix of limitation.

According to table.3 that demonstrates the relation and the dependence between the criteria and the sub-criteria, the structure of the initial super matrix could be demonstrated as the following table 4.

Table 4. Structure of Super Matrix

Factors	Sub factors	General-Factors	Goal
Goal	0	0	0
General factors	W21	W22	0
Sub factors	0	W32	W33

By considering the structure of the initial super matrix, each one of the necessary matrixes has been calculated and in each stage, after making sure of the adaptation of the pair comparisons of the matrix, for each, its special vector is then estimated. It is necessary to mention that, all the matrixes are calculated first by using the first residing board's ideas and then by the second residing board's ideas. So, in order to simplify the results demonstration, we only show the first residing board's opinions and results, and then the comparisons between the ideas of each group will be shown.

For compare of general factors, we use from Saaties quantity. In this stage questioning is as the following:

''What is the ratio of the individual skills to personal characteristics to select a competent manager "

Table 5. Even compare between general factors

Factors	Personal skills	Personality	Typically	Power	Knowledge and Specially
Personal skills	1				
Personality	0.48	1			
Typically	1.75	1.44	1		
Power	2.52	2.29	0.79	1	
Knowledge and Specially	2.62	2.08	0.79	1	1

According to the table above and the amount of the matrix adaptation, matrix W21 is achieved.

W21	0.14
	0.11
	0.25
	0.25
	0.25

In order to design the W22 matrix, for the inside relations of the main criteria, we must compare the criteria in pairs. How the question is asked is as it is followed: **'what is the relative importance of personal characteristics to**

experience when the personal skills are being controlled?' .So we earned 5 different matrixes and after checking compatibility rate for every matrix, we achieved W22.

Table 6. Dependence between General Factors (W22)

Factors	Personal skills	Personality	Typically	Power	Knowledge and Specially
Personal skills	0	0.13	0.11	0.14	0.15
Personality	0.1	0	0.45	0.32	0.175
Typically	0.41	0.19	0	0.26	0.35
Power	0.2	0.31	0.12	0	0.325
Knowledge and Specially	0.29	0.37	0.32	0.28	0

After the pair comparisons of the dependence of the following sub-criteria of the main criteria, matrix W32 is achieved. We found 17 sub-factors for 5 general factors. We show dependence between sub-factors in table 7. These dependences are shown with comparable Matrixes head. We show in appendix 1.

Table 7. Dependence between Sub-factors and Factors (W32)

Factors	Personal skills	Personality	Typically	Power	Knowledge and Specially
Satisfy of employees	0.5	0	0	0	
Finality in talking	0.5	0	0	0	
Humility	0	0.0392	0		0
Good tempered	0	0.01945	0		0
trusteeship	0	0.03442	0		0
perseverance	0	0.05219	0		0
Position power	0	0	0.03362	0	0
Resource power	0		0.02710	0	0
Expert power	0		0.0392	0	0
Personal power	0		0	0.0668	0
Information power	0		0	0.0175	0
Management knowledge	0	0	0	0.0156	0
Civil knowledge		0	0	0	0.02548
Construction knowledge		0	0	0	0.245
Civil Experience		0	0	0	0.195
Management Experience		0	0	0	0.14
Project manager Experience		0	0	0	0.164

5.1 Calculation of Super Matrix of the Limit

In order to calculate the super matrix of the limit we must follow the steps below.

Asymmetrical Super Matrix Creation

Considering the fact that all the comparable matrixes in the structure of the Asymmetrical super matrix, W32, W22, W21, and W33 have been calculated and their adaptation has been controlled, it is possible that by replacing these matrixes in the initial super matrix, we calculate the asymmetrical super matrix. Now, this asymmetrical matrix must be changed into a symmetrical matrix that the total of its figures in a column must equal one. In order to change the asymmetrical matrix to a symmetrical one we must multiply the asymmetrical super matrix by the clustering matrix. The clustering matrix reflects the level of the efficacy of each cluster to accomplish the goals of our study. The clustering matrix is achieved via the pair comparison of the clusters in the structure of the initial super matrix. Based on the Saati suggestion to estimate the importance of the clusters in the initial super matrix, it is necessary to calculate the clustering matrix in a way that its column clusters are considered to be the controlling elements. In other words, we must draw a pair comparison between the column clusters, which are not zero, in one column in the initial asymmetrical matrix to figure out the vector of the importance for each column cluster and in the end by mixing up the vectors of each cluster, the clustering matrix is achieved. By taking the structure of the initial super matrix into observation, we can understand that only in the column cluster related to the main criteria one cluster must be compared to a cluster of the sub-criteria. Therefore, the Table.8 below is created.

Table 8. Even compare between clusters

Factors	General factors	Sub factors	Special vector
General factors	1	1.912	0.656
Sub factors	1.912	1	0.344

Calculation of the Symmetrical Matrix

Now in order to calculate the symmetrical super matrix, we must multiply each column cluster in the asymmetrical super matrix by the relative vector of importance of that cluster. This symmetrical super matrix is coincidental, which means that the total of its figures in a column equals one.

Calculation of Super Matrix of the Limit

For earn of super matrixes of limitation, we power them. In this situation we earned super Matrix of limitation. In this article we made super matrix of limitation for W21 in exponent 48 and super matrix of limitation for w22 in exponent 53. After that we normalized super matrixes of limitation. You can see importance of vector for W1 and W2 in below.

Satisfy of Employees		0.062187		0.0501002
Finality in talking		0.098295		0.075150301
Humility		0.027081		0.008016032
Good Tempered		0.032096		0.043086172
Trusteeship		0.001003		0.003006012
Perseverance		0.006018		0.007014028
Position Power		0.043129		0.039078156
Resource Power		0.115346		0.107214429
Expert Power	W 2	0.060181	W 1	0.05511022
Personal Power		0.035105		0.074148297
Information Power		0.117352		0.139278557
Management Knowledge		0.051153		0.083166333
Civil Knowledge		0.041123		0.051102204
Construction Knowledge		0.041123		0.068136273
Civil Experience		0.033099		0.039078156
Management Experience		0.085256		0.04008016
Project Manager Experience		0.150451		0.117234469

Analysis of the deciding factors in selection of the qualified manager shows the most important factors in both residing boards' ideas are as the following:

The first residing board:

Classification of the main criteria

1. Power
2. Knowledge
3. Experience
4. Personal characteristics
5. Behavioral characteristics

Classification of the most important sub-criteria

1. Political power
2. Experience of project management
3. Power of exploitation

The second residing board:

Classification of the main criteria

1. Power
2. Experience
3. Behavioral characteristics
4. Knowledge
5. Personal characteristics

Classification of the most important sub-criteria

1. Experience of project management
2. Political power
3. Power of exploitation

6. Conclusion

Based on everything which were explained before, It should be mentioned that the major issue in furtherance of the goals in project-based organization is selecting the best persons for holding the position of project managers.

According to the results gained from both groups who were questioned, the first and most significant factor for choosing the competent project manager in project-based companies is his power of decisions making. It should be noted that the criteria prioritization process is an independent act of sub-criteria prioritization. Furthermore, the studies done on sub-criteria, show that having the experience of project management plus owning the political power are more essential than other identified factor as well.

Consequently a competent project manager can be defined as a person having the experience of succeeding in management projects in accord with the goals of the organization, in addition to having the great capability to gain and maintain the confidence bestowed on him by the members of board of directors so that he could participate in making fundamental decisions and finally applying the political power relegated to him by them.

Conspicuously, if further research is carried out on the sub-criteria and their methods of creation in people, we can train the most competent managers in the future. It is highly recommended that in order to become successful in this field, future projects deal with the model designing of the behavioral characteristics of the managers in relation to the members of the residing board.

7. REFERENCES

[1] Designing a Favorable Method For Developing Managers Competency Mode– Lee Y.T 2007 - the first decision making symposium.

[2] The identification of some effective factors on industrial projects based on EFQM and BSC – Neda Abdolrashidi, second conference on project management, Tehran.

[3] A Short History Of Project Management – Alan Stretton – October 2007 – PM World Today.

[4] Competence manager on Quran – Reza Amirkhani 2010.

[5] Training managers with Competency model, Morteza Karami, Tadbir manager, 2007

[6] Competency Mapping for Managers in Governmental Organizations, The 4th International Conference on Management and Industrial Engineering, Georgia, Tbilisi, 2016.

[7] Delegation: A Core Competency for the Graduate Nurse Carolyn Eschak, Faculty of Human and Social Development (2012).

[8] The Management Competency Model was prepared by Hay Group for use by the Government of the Northwest Territories (GNWT) (2012). Hay Group Company Report.

[9] Azar, A (Spring 2001). Expanse and development of Shannon entropy to analyze data in content analysis, Scientific and research quarterly of humanities of Alzahra University37 and 38,number 11

[10] Managing Projects In Human Resource-V.Martin -page 141.

8. Biography

Ali Maaleki is a member of the board of director in one of the important consultant firm in Tehran which is called Atieh Sazan Hooman. He had finished his education as a Master of Science in Industrial Engineering in the Department of Industrial Engineering at the AmirKabir University of Technology, Tehran, Iran. He earned B.S. in Industrial Engineering from Islamic Azad University which was in Firouzkooh, Iran.

Kaveh Mohammad Cyrus holds a Bachelor of Science degree in Industrial Engineering from Sharif University of Technology, Tehran, Iran and a Master of Science degree in Industrial and Systems Engineering from University of Southern California and a Ph.D. from Amirabad University of Technology