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# Designing of portfolio management of comprehensive model of construction projects

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**Abstract**

Nowadays a lot of organizations and project-oriented governmental and private companies have been leading their approach from project-oriented management to project-oriented basket management to answer to pointed problems, the necessity of having meaningful relation of approaches, themes, and projects and aim of them to more efficiency to themes and their projects. Project basket management is a new approach is grown from project management knowledge and the meaning was focused on the management of combining targeted projects and special situations it deemed to be a high level of project management and themes of them in organizations and offering the model of effective criterion models and optimal projects in selecting portfolios of constructions projects were studied in this survey. The results showed that five effective and basic indexes for optimal selecting of construction projects are: budget indexes and supply of resources, scheduling of management indexes, management indexes and risk reduction, detailed documental indexes, and parallel operation of indexes. The results showed that there is a meaningful and positive effect in surveys of hypothesis 1, budget indexes, and supplying resources in optimal management of construction project portfolios. The meaningful levels of hypothesis equals 0 and lower than 0.05 according to results and then the project hypothesis is approved by this meaning that budget and supplying resources have a positive and meaningful effect on optimal management of construction project portfolios. The amount of this effect is 0.513 By noticing this coefficient is positive and the effect of that is direct. In other words, changing a unit (increasing) budget index and supplying resources by the amount of 0.513% leads to increasing optimal management on construction project portfolios. The meaningful level of the hypothesis was equal to 0 and lower than 0.05 according to the results. The meaningful hypothesis of this hypothesis is approved by the meaning that parallel operation of them on construction projects of portfolio and optimal management have a meaningful and positive effect. The amount of this effect is 0.615 and the effect of that is direct by noticing that this coefficient is positive. In other words, changing a unit of parallel operation by the amount of 0.165 percent is increased in the optimal management of construction project portfolios.

Keywords: portfolio management, comprehensive model, construction projects
2020 MSC: 68V30, 90B50

## 1 Introduction

Development is the final aim of human activities. Construction parts are one of the main substructures in human development. High levels of validation are allocated to the construction development of countries and this is a sign of

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the importance of this subject. But some of the more important things are: prioritizing processes, knowing standards and management of detailed knowledge of projects, and generally approaching them in the shape of an effective portfolio it can pave the way for sublimity route and development of construction projects stability. The goal of stability is the level of stability and balance in the project. The wrong selection of these projects has two negative effects. On the one hand, resources are spent for no suitable projects and organizations achieve low benefits on the other hand. If suitable projects are selected, more benefits will belong to the organization. The first step of a project-oriented organization approaching and targeted management in a project basket is the correct selecting of projects [1]. Projects should be scheduled and allocated resources for executing approaches in the next step. By noting these restrictions of organization, especially the level of budget one of the most important problems of this organizing is basket management of project (Portfolio) (PPM) [7].

One of the unknown things in this project in which the researcher should respond to detailed dimensions is a set of indexes, standards, and priorities to access a comprehensive optimal pattern of a portfolio of construction projects. Through these characteristics such as restriction resources in planning, some of them need a comprehensive and seamless system, planned financial optimal resources, the needs of the beneficiary, and smart scheduling of unknown dimension unction. On the other hand, there were concerns about analyzing accessing to a desirable pattern of this project and there is a process in which a basket of projects can develop in the direction of the organization of approach aims or more prominent aligned to develop programs in local, national, five years and perspective of the country during that. In the other viewpoints, by noticing urban projects portfolios, there are indexes such as strategic knowledge and management of urban projects basket and necessary and complement substructure of project basket management are some of the requirements of this project.

## 2 Background of thesis

Projects are tools of change in an organization for changing itself and others. Nowadays the number of project-oriented companies is decreasing and most of them don't have a destination and a short maturity period. Project project-oriented organization needs to invest in projects to guarantee benefits and advancement. Nevertheless, some of them are faced with a lot of projects which should be projects by noticing to restriction of resources, budget, scheduling, and etc, which can fulfill the aims of the organization [4].

Deciding to select a project is the best subset and the project basket directed to the aim of the company is the most important and the most challenging problem for managers [5]. The wrong selection of projects has two negative effects. It is spent for no suitable projects on the one hand and low benefit of organizing on the other hand. If suitable projects are selected, more benefits are for the organization.

The first step of project-oriented organizations in the strategic and targeted management of the portfolio of projects is the correct selection of projects. In the next step, to implement the strategies, the projects must be properly scheduled and allocated resources. Considering the limitations of organizations, especially the budget level, one of the most important issues of these organizations is project portfolio management (PPM) [2].

ANP network analysis process is chosen as a method for choosing their construction projects due to the dependence between criteria and options [3].

Kim et al. [6] proposed a fuzzy network analysis process for selecting information systems projects, taking into account the interrelationships between criteria and options and the presence of quantitative and qualitative criteria in the selection of projects.

In many previous researches, the issues of project portfolio selection and project timing were investigated separately. Despite this, the importance of simultaneous selection and timing of projects led to research in this field [2, 9]. On the other hand, risk exposure is inevitable, especially under conditions of uncertainty.

The importance of simultaneous selection and timing of projects led to research in this field [2, 9]. On the other hand, risk exposure is inevitable, especially under conditions of uncertainty. They considered the cost of the projects as certain and the income of the projects as uncertain and predicted them using time series models.

Leo discusses the fuzzy optimization of the investment portfolio so that the investment return is represented by fuzzy numbers, in his article, the topic of risk and financial aspect is taken into consideration, and he deals with investment portfolios under conditions of uncertainty. Also, the validity of the model is checked by the Taiwan Stock Exchange Organization [8].

Reginaldo suggested evaluating and balancing a portfolio of projects with a supporting tool for multi-criteria decision-making to reduce internal risk and increase profitability [10].

In this section, the research method and the way of conducting the research, the statistical community and the data collection tools, and their analysis methods are explained. Expert Choice software was used in data analysis. The working procedure of the AHP model starts with specifying the elements making decisions and prioritizing them. These elements include different ways of working and prioritizing features.

### 2.1 Creating a hierarchical structure

Converting the topic or problem under investigation into a hierarchical structure is considered the most important part of the hierarchical analysis process. In the issue of determining the indicators of the optimal project portfolio selection model in Iranian organizations and companies, the aim is to investigate the appropriate model of construction project portfolio management based on the system of planning and budgeting and providing resources for the country's construction sector. Criteria and sub-criteria include factors that cause differences in options. The validity of each place is measured according to criteria. In the AHP method, each criterion has a specific weight that must be applied by the user in different ways. It is also possible to divide each criterion into several smaller components and compare and weigh them with each other.

In the implementation of the research, first, studies have been done in the field of construction project management. Then it is tried to identify the features of a suitable model for the optimal management of construction projects. This will be done through game questionnaires that are given to the employees of organizations and contractors, and also by relying on library studies.

In the continuation of the research, the design of the model is discussed. This design is based on the identification and determination of indicators that are a suitable criterion for evaluating the performance of Iranian organizations and companies based on the optimization of project management. This identification is done using library studies as well as the opinions of technical experts. After identifying the indicators using the Analytic Hierarchy Process (AHP), these indicators are assigned weights based on their importance. Identified indicators and assigned weights will be evaluated using questionnaires that will be provided to experts.

### 2.2 Sample and statistical population

The statistical population of the research includes managers and senior experts of management and planning organizations and municipalities. The informant community includes technical office experts and project experts. To collect information, the opinions of experts have been used in different parts of the project.

## 3 Research method

### 3.1 Data collection method

In total, within a period of nearly one month, 181 experts were interviewed. In the interview sessions, after providing explanations about the topic and purpose of the research, they were asked to answer the following questions:

**According to the structure of Iranian organizations and companies, what are the important parameters for determining the appropriate model for choosing the project portfolio in these organizations?**

It should be noted that this interview was semi-structured and semi-directed. The results of these interviews have been summarized, the answers that are close to each other have been merged.

### 3.2 Presenting the model

#### 3.2.1 Determination of indicators and their weighting

After collecting data from the experts and analyzing them, the introduced indicators were classified into 5 main groups according to the content and the topic they discuss, the results of which can be seen in Table 1.

The frequency of index design it should be noted that these results are given without considering the importance/weight factor. To determine the weight according to the frequencies as well as the identified subgroup indicators, we normalize the class of each indicator for future decisions according to the following formula. In these calculations, we consider an as the number of sub-set indices, q as the frequency of index design by experts, and w as the weight of each index. Therefore, to calculate the weight of each group of indicators, we will have the following formula: experts

Table 1: Grouping of indicators, after their classification

| Row | Class allocated with the specified index | Subset index number | The frequency of index design by experts |
|---|---|---|---|
| 1 | Budget indicators and supply of resources | 40 | 181 |
| 2 | Schedule management indicators | 124 | 181 |
| 3 | Management indicators and risk reduction | 41 | 181 |
| 4 | Detailed documentation indicators | 8 | 152 |
| 5 | Parallel performance indicators | 5 | 101 |

$$W_1 = \frac{a_1 \times q_1}{\sum_{i=1}^{5} a_i \times q_i}$$
$$W_2 = \frac{a_2 \times q_2}{\sum_{i=1}^{5} a_i \times q_i}$$
$$\vdots$$
$$W_5 = \frac{a_5 \times q_5}{\sum_{i=1}^{5} a_i \times q_i}$$

As a result, after performing the calculation for each of the specified groups, we will have weights as follows:

$$W_1 = 0.19$$
$$W_2 = 0.58$$
$$W_3 = 0.19$$
$$W_5 = 0.03$$
$$W_5 = 0.01$$

## 4 Analysis results

Analyzing statistical data is one of the basic steps in research and the results of research depend on it. In this chapter, which is designed to analyze the collected data, firstly, the questionnaires that were completed by the respondents were collected and the raw data needed to test the hypotheses with the help of a computer. and the software are recorded and then these data are analyzed and converted into the information used in this research in two steps. In the first stage, which is descriptive analysis, the collected data is presented in the form of descriptive statistics tables (frequency, percentage, minimum and maximum score, average, standard deviation, and variance), and in the second stage, which is inferential analysis. is, using Pearson's correlation coefficient test and univariate regression, the research hypotheses are tested, and finally, it is possible to comment on the acceptance or non-acceptance of each of the statistical hypotheses.

### 4.1 Statistical description of research variables

Description of the budget and resource supply variable: According to Table 2, it can be seen that the budget and resource supply variable has an average of 2.65 and a standard deviation of 1.413. This trend means that the respondents think that the budget and provision of resources are below average.

Table 2: Description of the budget variable and supply of resources

| | number | min | max | Average | Standard deviation | Variance |
|---|---|---|---|---|---|---|
| Budget and supply of resources | 181 | 1 | 5 | 2.6556 | 1.41330 | 1.997 |

Description of the scheduling management variable: According to Table 3, it can be seen that the scheduling management variable has a mean of 3.10 and a standard deviation of 0.763. This trend means that schedule management is average from the point of view of the respondents in the statistical population.

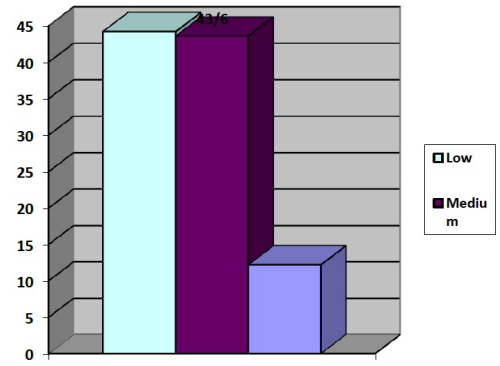


Figure 1: Bar graph of budget and resource supply variable

Table 3: Description of schedule management variable

| | number | min | max | Average | Standard deviation | Variance |
|---|---|---|---|---|---|---|
| Timing management | 181 | 1 | 5 | 3.1041 | 0.76320 | 0.582 |

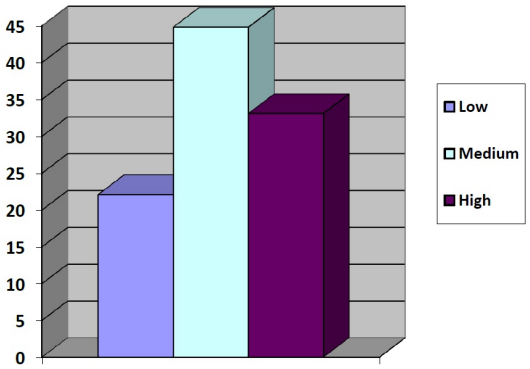


Figure 2: Bar chart of schedule management variable

Description of the management and risk reduction variable: According to Table 4, it can be seen that the risk management and reduction variable has a mean of 3.48 and a standard deviation of 0.550 from the point of view of the respondents. This trend means that the participants in this research believe that risk management and reduction is more than average.

Table 4: Description of risk management and risk reduction variables

| | number | min | max | Average | Standard deviation | Variance |
|---|---|---|---|---|---|---|
| Management and reducing risk | 181 | 1 | 5 | 3.4862 | 0.55050 | 0.303 |

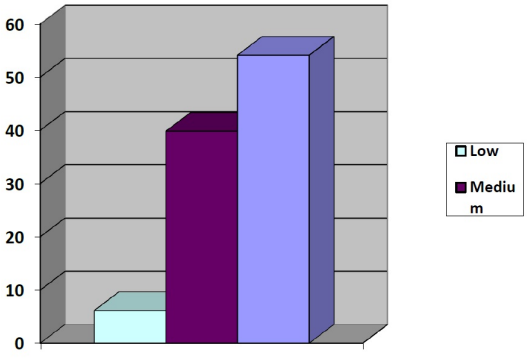


Figure 3: Bar chart of risk management and risk reduction variable

Description of the variable of detailed documentation: According to Table 5, it can be seen that the variable of detailed documentation from the perspective of the participants in this research has a mean of 3.50 and a standard deviation of 0.587. This trend means that participants believe that detailed documentation is more than average.

Table 5: Detailed documentation variable description

| | number | min | max | Average | Standard deviation | Variance |
|---|---|---|---|---|---|---|
| Detailed documentation | 181 | 1 | 5 | 3.5000 | 0.58689 | 0.344 |

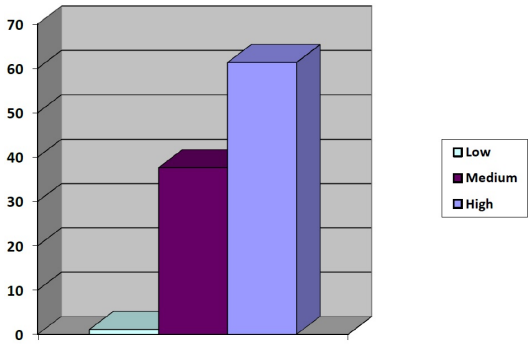


Figure 4: Detailed documentation variable bar chart

Description of the parallel performance variable: According to Table 6, it can be seen that the parallel performance variable has an average of 3.11 and a standard deviation of 0.759. This trend means that the respondents think that parallel performance is average.

Table 6: Parallel function variable description

| | number | min | max | Average | Standard deviation | Variance |
|---|---|---|---|---|---|---|
| Parallel function | 181 | 1 | 5 | 3.1105 | 0.75935 | 0.577 |

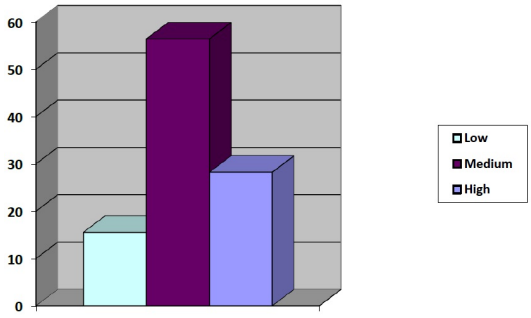


Figure 5: Bar chart of parallel performance variable

After determining the main criteria and sub-criteria, we determine the hierarchical model as described in Figure 6. We specify this form after determining the goal and identifying the main criteria and sub-criteria. In this analysis, according to the points obtained from the designed checklists, we compare the points obtained from each index, and at the end, we decide on the selection of effective and optimal criteria in the selection of the portfolio of construction projects.

## 5 Discussion and conclusion

In the present research, the presentation of the model of effective and optimal criteria in the selection of the portfolio of construction projects was investigated. The results of this thesis are:

5 main indicators are budget and resource supply indicators, schedule management indicators, risk management, and reduction indicators, detailed documentation indicators, and parallel performance indicators.

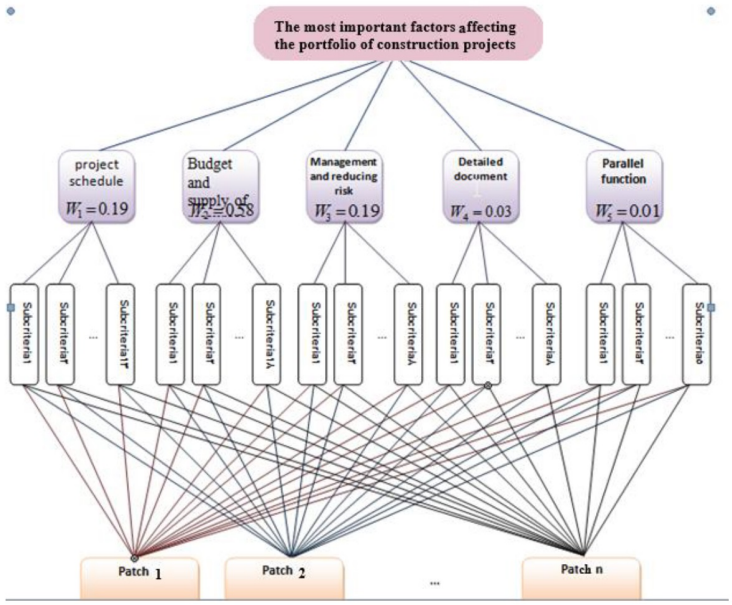


Figure 6: Hierarchical analysis model of effective and optimal criteria in choosing a portfolio of construction projects

Among the investigated indicators, the budget and resource supply index has the most impact and weight of 0.58, which is the most important evaluated index. Next, the index of project timing and management and risk factors with a weight of 0.19 are the next indicators. The least effective index obtained is parallel performance with 0.01 weight.

**Hypothesis 1:** Budget indicators and the supply of resources have a positive and significant effect on the optimal management of the portfolio of construction projects.

Zero hypothesis: Budget indicators and supply of resources do not have a positive and significant effect on the optimal management of the portfolio of construction projects.

Research hypothesis: Budget indicators and resource provision have a positive and significant effect on the optimal management of the portfolio of construction projects.

According to the results, the significance level of the hypothesis is equal to 0 and less than 0.05, so the research hypothesis is confirmed, which means that the budget and supply of resources have a positive and significant effect on the optimal management of the portfolio of construction projects. The amount of this effect is 0.513, considering that this coefficient is positive, its effect is direct, in other words, by changing one unit (increase) of budget indicators and providing resources to the amount of 0.513%, it increases the optimal management of the portfolio of projects. It will be construction.

**Hypothesis 2:** Scheduling management has a positive and significant effect on the optimal management of the portfolio of construction projects.

Zero hypothesis: Schedule management does not have a positive and significant effect on the optimal management of the portfolio of construction projects.

Research hypothesis: Schedule management has a positive and significant effect on the optimal management of the portfolio of construction projects.

According to the results, the significance level of the hypothesis is equal to 0 and less than 0.05, so the null hypothesis is rejected, which means that scheduling management has a positive and significant effect on the optimal management of the portfolio of construction projects. The amount of this effect is 0.170, considering that this coefficient is positive, its effect is direct, in other words, by changing one unit (increase) of scheduling management by 0.170%, it will increase the optimal management of the portfolio of construction projects.

**Hypothesis 3:** Access to the materials and expertise required by the project has a positive and significant effect on the optimal management of the portfolio of construction projects.

Hypothesis zero: Access to the materials and expertise required by the project does not have a positive and significant effect on the optimal management of the portfolio of construction projects.

Research hypothesis: Access to the materials and expertise required by the project has a positive and significant effect on the optimal management of the portfolio of construction projects.

According to the results, the significance level of the hypothesis is equal to 0 and less than 0.05, so the hypothesis of the research is confirmed, which means that access to materials and expertise required by the project has a positive and significant effect on the optimal management of the portfolio of construction projects. The amount of this effect is 0.270. In other words, by changing one unit (increasing) the access to materials and quality required by the project by 0.270%, it will increase the optimal management of the portfolio of construction projects.

**Hypothesis 4:** Parallel performance has a positive and significant effect on the optimal management of the portfolio of construction projects.

Zero hypothesis: Parallel performance does not have a positive and significant effect on the optimal management of the portfolio of construction projects.

Research hypothesis: Parallel performance has a positive and significant effect on the optimal management of the portfolio of construction projects.

According to the superficial results, the significance of the hypothesis is equal to 0 and less than 0.05, so the hypothesis of the significance of the research hypothesis is confirmed, which means that parallel performance has a positive and significant effect on the optimal management of the portfolio of construction projects. The amount of this effect is 0.163, considering that this coefficient is positive, its effect is reliable. In other words, by changing one unit (increase), the parallel performance increases by 0.163% of the optimal management of the portfolio of construction projects.

**Sub-hypothesis 5:** Parallel performance has a positive and significant effect on the optimal management of the portfolio of construction projects.

Zero hypothesis: Parallel performance does not have a positive and significant effect on the optimal management of the portfolio of construction projects.

Research hypothesis: Parallel performance has a positive and significant effect on the optimal management of the portfolio of construction projects.

According to the results, the significance level of the hypothesis is equal to 0 and less than 0.05, so the hypothesis of the significance of the research hypothesis is confirmed, which means that parallel performance has a positive and significant effect on the optimal management of the portfolio of construction projects. The amount of this effect is 0.165, considering that this coefficient is positive, its effect is reliable. In other words, by changing a parallel performance unit, the optimal management of the construction project portfolio increases by 0.165%. After determining the main criteria and sub-criteria, we determine the hierarchical model as described in Figure 6. We specify this form after determining the goal and identifying the main criteria and sub-criteria. In this analysis, according to the points obtained from the designed checklists, we compare the points obtained from each index, and at the end, we decide on the selection of effective and optimal criteria in the selection of the portfolio of construction projects.

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