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# Evaluating the Success of Project Management Information Systems' Comprehensive Planning in Industrialized Building Systems

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**Abstract**

The main reason for the failure of most of management information systems is referred to the problems that arise from management factors and strategic components, expectations, complexity, and risks. Finally, the main applicable proposal is giving importance by managers and analysts to the fit between organization and its information system as well as giving attention to training categories in implementation of information system, preparing financial supports and human resource in design, implementation, and development of information system, strengthening progressive factors, and weakening restrictive factors in organization by management to design or develop the system and finally, preparing organizational infrastructures to implement information system. Introduction of an information system has a strong managerial, organizational, and technological impact on industrial building methods. One of the objectives of this study was to identify and introduce key success factors of Project Management Information Systems (PMIS) in Industrialized Building Systems (IBS). The results of hypotheses showed that all dimensions of PMIS influence the performance of projects. But in the second phase of the study, sub-factors were classified using hierarchical analysis approach. This classification helps managers to identify the most important factors and obtain better results concentrating on the main factors compared with using PMIS.

*Keywords:* Management Information Systems; Project Management Information Systems; Project Performance; Industrialized Building Systems.

## 1. Introduction

Nowadays, constructions in Iran are passing from the traditional stage to industrial stage. The advantages of industrialized constructions include retrofitting, saving materials, optimal energy consumption during construction, increased durability and quality of components, predicting the quality, decreased construction period, and decreased construction costs. To decrease time efficiently, control and planning system in projects can be used. It is obvious that taking advantage of modern building technologies and using project management methods in this field can facilitate the achievement of goals. According to the executive problems of industrial construction workshops in industrialized systems, it can be observed that project control and planning system, in addition to construction components, should include management, support, and financial system. Relying upon the implementation of building skeleton based on industrialized methods and avoiding comprehensive perspectives regarding industrialized construction may lead to this risk that after starting projects with industrialized methods and lack of attention to other industrial requirements will not provide desirable results. Namdar et al. [1] conducted a study on planning and controlling building projects based on industrialized methods. The findings showed that according to the summary of executive problems of industrial construction workshops in industrialized systems, it becomes clear that project control and planning system, in addition to the building components, should include management, support, and financial components. In a study by Aghazadeh

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et al. [2] entitled "project management principles in building industry", solutions to create a unified set in building industry were studied. The results showed that building industry is one of the main economic sectors of each country that is responsible for a major part of Gross Domestic Product (GDP) and employment. Construction process is costly that usually results to a unique product such as building. Behnam [3] presented suitable solutions to use light materials in to improve seismic performance of structures. For this purpose, a five floor residential building is Tehran was studied. According to the findings, comparison of the consumed concrete in conditions "c" and "a" shows 27% and 11% decrease in concreting in pillars and beams, respectively. Also, about armatures, slight decrease is observed that is crucial in construction. Relative displacements in conditions "a" and "b" decreased by 14.5% and 13%. Olia et al. [4], in addition to explaining the concept of structure and components of IBS, investigated practical and technical methods to achieve softening, compatibility, and reuse and presented compatibility methods of IBS against effective changes. Attention to the prefabricated reinforced concrete wall system for buildings' industrialization was emphasized in the subsequent research [5, 6]. The standard test of IBS products [7] and exposing that the industrialized steel modular system presents the lowest accident rate in compare with other options were the other research achievements in this filed [8]. Faridah et al. [9] present a research that guides the construction industry's public and private clients on the implementation the concept of supply chain partnering in industrialized building system. To effectively address the interfaces between the design tasks and eventually fulfill the needs of IBS in the design life cycle an integrated life cycle model developed [10].

Hesami et al. [11] compared traditional and industrial methods in construction process. They classified limitations of industrialization into 4 general groups of public willingness to traditionalization, lack of trust in modern technologies, high initial costs of industrialization, and transportation and maintenance costs. Ammar et al. [12] showed significant saving in energy cost during the year by comparing the IBS and the conventional building systems. Other research offered a Sustainability Assessment Analysis of the companies that use different industrialized systems in the construction of housing of social interest in Brazil [13] Emphasize on the Modular System in construction industry has many strong benefits in promoting sustainability [14]. Shamsuddin et al. [15] suggested strategies to strengthen and promotes broader adoption of sustainability in IBS construction, in Malaysia. According to Taherkhani [16], despite the better performance of the conventional method with regards to social concerns, IBS is the best ranked building system which can be utilized. Development of IBS in Malaysia need to be more concentrated toward social sustainability. In this research, we intend to answer the following questions: How comprehensive planning of project management information systems influences the success of projects in industrialized building systems? How modern building methods influence the success of projects in industrialized building systems? How softening influences the success of projects in industrialized building system? How intelligent building system influences the success of projects in industrialized building systems? How financial management of projects influences the success of projects in industrialized building systems?

## 2. Materials and Methods

### 2.1. Method

The present study, in term of purpose, is an applied study and in term of method, it is among survey-analytical studies. In this study, 5 point Likert scale was used to show the importance of each identified factor for the performance of project management information systems. The reason behind using this method was its simplicity in determining the weight of factors. In this scale, numbers 1 to 5 are lack of importance of the factor, low importance of the factor, moderate importance of the factor, high importance of the factors, and very high importance of the factor, respectively.

### 2.2. Population and Data Collection

The population of this study included executive and technical factors and experts of construction projects and questions were asked from them by designing a questionnaire. In this study and to collect data, field and library methods were used, so that according to the resources and reports of different studies, it was attempted to classify information based on the library method. This means that by studying the articles, theses, books, reports, and interview with experts in building industry, key success factors of project management information system were extracted from three groups of employer, counselor, and contractor. Then, using questionnaire, required data were collected and prepared for analysis.

### 2.3. Validity of the Questionnaire

Therefore, to assess the content validity, the questionnaires were provided to relevant research subjects such as the supervisor, senior experts, to present their comments and suggestions on the content of the questionnaire items in line with the research goal. After receiving the questionnaire, the proposed amendments were considered by the experts so that the questionnaire had the necessary content validity.

### 2.4. Reliability of the Questionnaire

In this study, like many other studies, Cronbach's alpha has been used to measure the reliability of the instrument. Cronbach's alpha coefficient is a number between zero and one. Alpha coefficient less than 0.6 indicates weak reliability. Alpha values above 0.7-0.8 represent a relatively good reliability and alpha higher than 0.8 indicates a high reliability of the instrumentation. To calculate Cronbach's alpha, we first need to calculate the variance of the scores for each sub questionnaire or sub-test and the total variance.

### 2.5. Data Analysis Method

In this study, according to previous studies, details about factors in hypotheses were identified and then, according to the standard questionnaires, research hypotheses were tested and for this purpose, Kolmogorov-Smirnov was used and according to the results of this test and in the case on normality of data, Pearson correlation coefficient was used and in the case of lack of normality, non-parametric Spearman correlation test was used. These factors are classified according to pair-wise comparisons in improving AHP (group decision-making) and finally, according to the results of test, a suitable model was presented to investigate the effect of project management information system in IBS.

## 3. Analysis of the Results

### 3.1. Inferential Statistics and Demographic Information

After investigating the descriptive statistics using inferential statistics, first, reliability and validity of the questionnaire and then, normality of data and correlation of variables and hypotheses were examined. In this section, the demographic results of the questionnaire are analyzed. These results show the distribution and variability of respondents. Education level of respondents and their distribution are as follow:

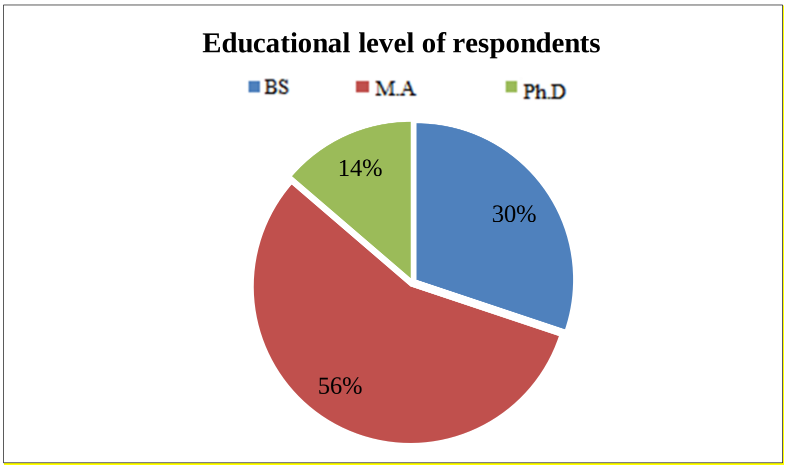


**Figure 1. Education level of respondents**

Work experience of respondents and its distribution are as follow:

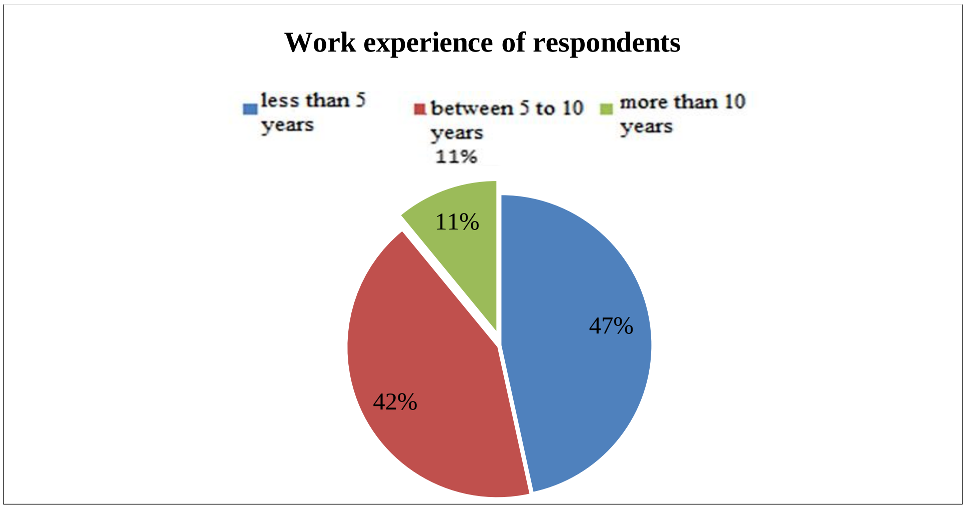


**Figure 2. Work experience of respondents**

As can be seen from the figures, the education level of respondents is acceptable and 86% of respondents have M.A and Ph.D. As a result, respondents have sufficient level of knowledge to answer the questions. Also, more than half of respondents who answered the questions has more than 5 years of work experience; as a result, they had sufficient experience. Therefore, respondents are placed among experts, because they have sufficient knowledge and experience to answer the research questions.

- **The Results of Construct Validity**

The results of Bartlett and KMO tests show that the values of both indices are at optimal level. The KOM value for all variables was larger than 0.5 and the significant value of Bartlett test was smaller than 0.05. After ensuring the appropriateness of the sample size, factor loading of items was examined. Factor loading of all items was larger than 0.4; therefore, none of the items was removed from analysis process.

- **The Results of Reliability**

Reliability was examined using Cronbach's alpha. In this section, the coefficient obtained from each variable is presented in Table 1. Since this value for all variables is larger than 0.6, it can be said that it enjoys from desirable reliability.

**Table 1. Cronbach's alpha coefficient for the main research variables**

| Variables | Cronbach's alpha |
|---|---|
| Reporting the costs | 0.899 |
| Updating | 0.923 |
| Identifying the critical activities and limitation of resources | 0.943 |
| Preparing understandable and graphical data | 0.908 |
| Information quality | 0.953 |
| Structural and communication requirements of the system | 0.978 |
| Project performance | 0.958 |

Prerequisite to perform all parametric tests is normal distribution of variables. To test normality of variables, Kolmogorov-Smirnov test was used. The results show that data enjoy from normal distribution.

## 3.2. Testing the Research Model with SEM Approach

The research hypotheses in the present study are tested by LISREL. A Structural Equation Modelling (SEM) in which partial least square method is used, should be analyzed and interpreted in two phases. First, the model should be measured and then, the structural model has to be analyzed and interpreted.

- **Goodness of Fit of the Measurement Models**

As can be seen in Figures 4 and 5, factor loadings of all dimensions of variables are larger than 0.3 and this shows that the research instrument has desirable validity and all dimensions have explained their constructs very well. Compound Reliability (CR) coefficient is larger than 0.6 [17]. It can be said that the research instrument enjoys from acceptable homogeneity. All items are significant at the confidence level of 95%. In order to examine divergent reliability, correlation matrix of the main components was drawn. According to placing AVE instead of 1 in primary matrix diameter, it can be observed in Table 2 that this value for each variable is more than the correlation of a construct with other constructs; therefore, the research instrument enjoys from suitable divergent validity.

**Table 2. Examining divergent validity in correlation table**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Reporting the costs | 0.806 | | | | | | |
| Updating | 0.04 | 0.736 | | | | | |
| Identifying the critical activities and limitation of resources | 0.07 | 0.02 | 0.767 | | | | |
| Preparing understandable and graphical data | -0.01 | 0.00 | 0.00 | 0.800 | | | |
| Information quality | 0.07 | 0.89** | 0.37 | 0.20 | 0.76 | | |
| Structural and communication requirements of the system | 0.07 | 0.85** | 0.36 | 0.19 | 0.96** | 0.71 | |
| Project performance | 0.05 | 0.63 | 0.26 | 0.14 | 0.71** | 0.74** | 0.901 |

According to confirming the desirability of factor loadings, convergent validity, divergent validity, and compound reliability, the goodness of fit of the measured model is confirmed.

- **Goodness of Fit of the Structural Model**

After analyzing the measurement model, the goodness of fit of the structural model is examined in this section. Figures 3 and 4 show structural equation model and path diagram of the research model.

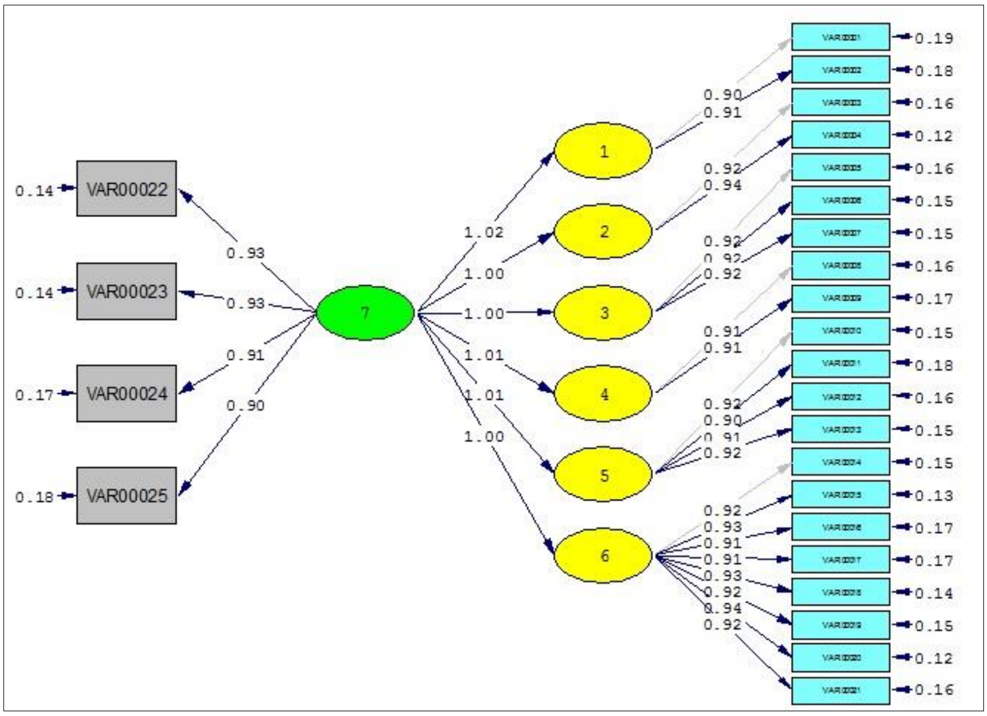


**Figure 3. The fitted conceptual model in standard estimation mode**

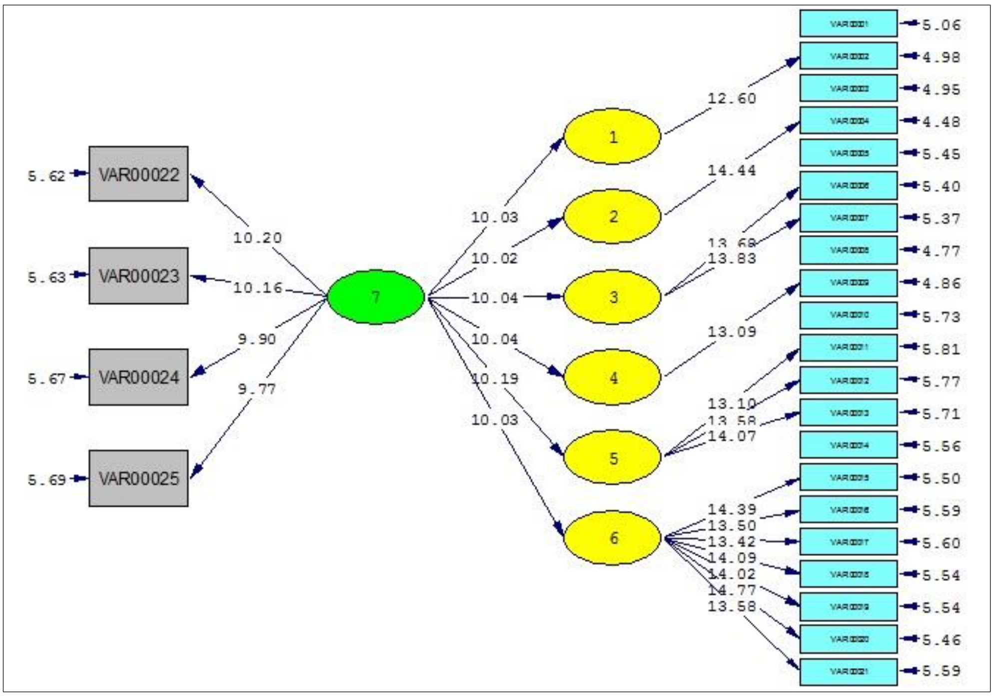


**Figure 4. The fitted conceptual model in significant mode of parameters**

## 3.3. Goodness of Fit Indices of the Model

- **Root Mean Square Residual**

The more this index is closer to zero, the better goodness of fit the model has. RMR value in this model is as follow:

Root Mean Square Residual (RMR) = 0.02

- **GFI and AGFI**

GFI and AGFI that were proposed by Jöreskog and Sorbome [18] are not dependent on the sample size and show that how much the model has goodness of fit. Since GFI is larger than other features of goodness of fit, some researchers have proposed cutting point of 0.75 for it. Conventionally, the value of GFI must be equal or larger than 0.9 to confirm to model. The moderated value of the goodness of fit for the degree of freedom is obtained. This value for the fitted model is obtained as follow:

Goodness of Fit Index (GFI) = 0.74

Adjusted Goodness of Fit Index (AGFI) = 0.68

- **RMSEA**

This index is deviation test for each degree of freedom. For models that have high goodness of fit, it is smaller than 0.05. Values larger than 0.08 show reasonable error for approximation. Models with values larger than 0.1 have weak goodness of fit. The value of this index in the fitted model is as follow:

Root Mean Square Error of Approximation (RMSEA) = 0.045

- **NFI and NNFI**

One of the indices that is very important, is classic formula of Tucker-Lowis [19] that was developed by Bentler and Bonet [9] and has numerous functions compared with different models. This index is also called NNFI. These values for the fitted model are as follow:

Normed Fit Index (NFI) = 0.98

Non-Normed Fit Index (NNFI) = 0.99

The above indices show goodness of fir. Therefore, it can claimed that the presented model can define the relationships between variables very well. For this reason, we can trust on the results of t-test to test the hypotheses.

### 3.4. Hypotheses Testing

- **The Results Of Testing The Main Hypothesis**

The main hypotheses of the study are tested in this section following examining goodness of fit, structural model, and overall model:

**Table 3. Testing the main research hypotheses**

| Row | Hypothesis | Path coefficient | T statistics | Test result |
|---|---|---|---|---|
| 1 | Reporting the costs influences the performance of the project | 1.02 | 10.03 | Confirmed |
| 2 | Updating influences the performance of project | 1.00 | 10.02 | Confirmed |
| 3 | Identifying the critical activities influences the performance of project | 1.00 | 10.04 | Confirmed |
| 4 | Preparing understandable and graphical data influences the performance of project | 1.01 | 10.04 | Confirmed |
| 5 | Information quality influences the performance of project | 1.01 | 10.19 | Confirmed |
| 6 | Structural and communication requirements of the system influence the performance of project | 1.00 | 10.03 | Confirmed |

It is worth mentioning that if the significant numbers are larger than 1.96, the significance of the path can be confirmed.

### 3.5. Hierarchical Analysis to Classify the Options

Drawing hierarchical tree: first, hierarchical structure of decision-making is drawn using criterion and option objective levels. Figure 6 shows hierarchical tree. Figure 6 Research network diagram. In order to achieve the objectives, pairwise comparison questionnaires were designed and distributed among respondents. According to the fuzzy approach in this study, fuzzy numbers and verbal phrases in Table 4 were used.

**Table 4. Fuzzy spectrum and corresponding verbal phrases**

| Code | Verbal phrases | Fuzzy number |
|---|---|---|
| 1 | Preference is absolutely equal | (1,1,1) |
| 2 | Preference is almost equal | (0.5,1,1.5) |
| 3 | Preference is low | (1,1.5,2) |
| 4 | Preference is high | (1.5,2,2.5) |
| 5 | Preference is too high | (2,2.5,3) |
| 6 | Preference is absolutely high | (2.5,3,3.5) |

In this section, pairwise comparison, and modified method by Semih et al. [21], the weight of components is obtained and classification is done. In this study, in order to estimate compatibility, the method proposed by Gogus and Boucher was used. Gugus and Boucher [22] proposed that to investigate compatibility, two matrices of each fuzzy matrix were deviated and then, compatibility of each matrix is estimated based on Saaty method. Estimation phases of fuzzy matrixes of pair-wise comparisons are as follow:

Phase 1: at the first step, divide fuzzy triangular matrix into two matrices. The first matrix is composed of middle numbers of triangular judgments and the second matrix includes upper and lower bounds of triangular numbers.

Phase 2: estimate weight vector of each matrix using Saaty method as follow:

$$w_i^g = \frac{1}{n}\sum_{j=1}^{n}\frac{\sqrt{a_{iju}.a_{ijl}}}{\sum_{i=1}^{n}\sqrt{a_{iju}.a_{ijl}}} \tag{1}$$

$$w_i^m = \frac{1}{n}\sum_{j=1}^{n}\frac{a_{ijm}}{\sum_{i=1}^{n}a_{ijm}} \tag{2}$$

Phase 3: estimate the largest particular value for each matrix using the following relationship:

$$\lambda_{\max}^m = \frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{n}a_{ijm}(\frac{w_j^m}{w_i^m}) \tag{3}$$

$$\lambda_{max}^g = \frac{1}{n}\sum_{i=1}^{n}\sum\nolimits_{j=1}^{n}\sqrt{a_{iju}.a_{ijl}}(\frac{w_j^g}{w_i^g}) \tag{4}$$

Phase (4): estimate compatibility index using the following relationships:

$$\mathrm{CI}^m = \frac{(\lambda_{max}^m - n)}{(n-1)} \tag{5}$$

$$\mathrm{CI}^g = \frac{(\lambda_{max}^g - n)}{(n-1)} \tag{6}$$

Phase (5): to estimate compatibility rate (CR), divide CI by RI. If the resulted value is smaller than 0.1, the matrix is compatible. In order to obtain RI values, Satty formed 100 matrices with random numbers and estimated their CR and means. However, since the numerical values of fuzzy comparisons are not always integer, even if Satty scale is used, it is not possible to use RI. Therefore, Gugus and Boucher by producing 400 random matrices, reproduced RI for fuzzy pair-wise comparison matrices.

Estimating CR for two matrices based on the following relationships, we compare them with the threshold of 0.1. If both of them are larger than 0.1, the decision-maker is asked to revise the priorities and if only$\mathrm{CR}^m(CR^g)$ was larger than 0.1, he makes his decision about fuzzy judgments.

Phase 1: the opinions of experts: in this phase, the mean of pair-wise comparisons of respondents is estimated.

Phase 2: estimating the geometrical mean of lines: in this phase, geometrical mean of the lines of pair-wise comparisons is estimated according to Equation 7.

$$\tilde{z}_i = \left[\Pi_{j=1}^{n}\tilde{t}_{ij}\right]^{\frac{1}{n}} \quad \forall i \tag{7}$$

In this formula, $\tilde{t}_{ij} = (a_{ij}, b_{ij}, c_{ij})$ is a triangular fuzzy number.

Phase 3. Normalizing the geometrical means: in this phase, the obtained values from the second phase are normalized. $\tilde{z}_i$ values for each matrix are normalized with the sum of $\tilde{z}_i$.

$$\tilde{r}_{ij} = \tilde{w}_i = \frac{\tilde{z}_i}{\sum_{i=1}^{n} \tilde{z}_i} \tag{8}$$

If these weights are related to comparing the options they are called $\tilde{r}_{ij}$ and if they are related to comparing the criteria, they are called $\tilde{w}_i$.

Phase 4: combining the weights: by combining the weights of options and criteria according to the Equation 9, final weights are estimated:

$$\tilde{U}_i = \sum_{j=1}^{n} \tilde{w}_i \tilde{r}_{ij} \qquad \forall i \tag{9}$$

Phase 5: defuzzification: in this phase, the obtained fuzzy weights are defuzzificated according to the Equation 10.

$$\text{Crisp}(\tilde{U}) = \frac{(u_l + 2 \times u_m + u_r)}{4} \tag{10}$$

In this relationship, $\tilde{U} = (u_m, u_l, u_r)$ and $\text{Crisp}(\tilde{U})$are deffuzzificated of $\tilde{U}$.

The final weights are obtained according to the following table:

**Table 5. Matrix of the final weights of criteria relative to the classification**

| Components | Final fuzzy weight | Final weight of components |
|---|---|---|
| Reporting the costs | (0.094,0.126,0.178) | 0.131 |
| Updating | (0.092,0.121,0.17) | 0.126 |
| Identifying critical activities and limitations of resources | (0.138,0.198,0.27) | 0.201 |
| Preparing understandable and graphical data | (0.098,0.132,0.191) | 0.138 |
| Quality of information | (0.155,0.216,0.289) | 0.219 |
| Structural and communication requirements of the system | (0.148,0.208,0.28) | 0.211 |

**Table 6. Matrix of the final weights of sub-criteria relative to the classification**

| Components | Final fuzzy weight | Final weight of components |
|---|---|---|
| c1 | (0.028,0.05,0.104) | 0.058 |
| c2 | (0.039,0.075,0.148) | 0.084 |
| c3 | (0.024,0.04,0.075) | 0.045 |
| c4 | (0.047,0.081,0.145) | 0.088 |
| c5 | (0.05,0.085,0.138) | 0.09 |
| c6 | (0.022,0.041,0.076) | 0.045 |
| c7 | (0.04,0.072,0.121) | 0.076 |
| c8 | (0.049,0.066,0.095) | 0.069 |
| c9 | (0.049,0.066,0.095) | 0.069 |
| c10 | (0.04,0.073,0.126) | 0.078 |
| c11 | (0.036,0.068,0.119) | 0.072 |
| c12 | (0.022,0.039,0.072) | 0.043 |
| c13 | (0.02,0.036,0.065) | 0.039 |
| c14 | (0.016,0.033,0.064) | 0.036 |
| c15 | (0.009,0.02,0.049) | 0.025 |
| c16 | (0.008,0.019,0.048) | 0.023 |
| c17 | (0.014,0.032,0.066) | 0.036 |
| c18 | (0.008,0.019,0.044) | 0.023 |
| c19 | (0.009,0.019,0.039) | 0.021 |
| c20 | (0.015,0.033,0.07) | 0.038 |
| c21 | (0.016,0.033,0.064) | 0.036 |

According to the results, the most important factors of this study are as follow:

- Investigating the delay procedure of the project and the related factors
- Presenting a general profile with full details in certain intervals to the employers
- Comparing physical and financial progresses of the project (costs and absorbing credits)
- Emphasis on accuracy of data in information system
- Investigating the performance of information system and identifying internal and external factors

Also according to the results of this study we suggested: Periodic reports based on physical and temporal progresses, Presenting an algorithm to compare the results of real progress and presenting the modified plan, Identifying factors that cause delays in the project, Presenting a procedure to examine the accuracy of data for final processing (a procedure including data investigation), Identifying the factors that influence delay in projects and classifying them using multivariate decision-making approaches, Using expert system approach to develop decision-making system for managers.

## 4. Conclusion

The results of this study confirmed and rejected research hypotheses according to the following table.

**Table 7. The results of hypotheses testing**

| Row | Hypothesis | Test result |
|---|---|---|
| 1 | Reporting the costs influences the performance of the project | Confirmed |
| 2 | Updating influences the performance of the project | Confirmed |
| 3 | Identifying the critical activities influences the performance of the project | Confirmed |
| 4 | Preparing understandable and graphical data influences the performance of the project | Confirmed |
| 5 | Information quality influences the performance of the project | Confirmed |
| 6 | Structural and communication requirements of the system influences the performance of the project | Confirmed |

The results of hypotheses show that all dimensions of project management information system influence the performance of projects in industrial projects. However, in the second phase of the study, sub-factors were classified using AHP. This classification helps managers to identify the most important factors and concentrating on the main factors, obtain better results from applying project information management systems. Using analysis in section 5, the main factor was obtained as follow:

- Investigating the delay procedure of the project and the related factors
- Presenting a general profile with full details in certain intervals to the employers
- Comparing physical and financial progresses of the project (costs and absorbing credits)
- Emphasis on accuracy of data in information system
- Investigating the performance of information system and identifying internal and external factors

One of these factors is about the accuracy of information. Other factors are somehow related to the project progress and those factors that prevent it. Indeed, delay factors and their effect on project progress constitute the most important dimension to use project management information system. Nowadays, a major part of capitals is allocated to construction projects and one of the key success factors of economic development in every society is dependent on these projects. Lack of progress in implementation of these projects shows the existence of obstacles and problems in the implementation of valuable plans that threaten construction projects. This aspect can be considered as the crisis of construction projects. The most important problem that most of construction projects deal with is the delay in different phases. Delay is an even that increases time to do a certain task. If any delay occurs, several projects may lose their economic and technical justifications. As a result, development of a project management information system can be the best supportive system to improve the performance of industrial building projects.

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# 6. Appendix

## Questionnaire

Please specify your answer with the cross-reference:

A.

1. Gender: Female ☐ Male ☐

2. Age:

20 to 30 years old ☐ 30 to 40 years old ☐ 40 to 50 years old ☐ 50 and higher ☐

3. Education degree:

Under diploma ☐ Diploma ☐ B.A. ☐ M.A. ☐ PhD and higher ☐

4. Work experience

Below 5 years ☐ 1-5 years ☐ 5-10 years ☐ 10-20 years ☐

B. How important are the following factors in application of information management system? What are their impacts on building industrialization methods?

| Questions | Answers |
|---|---|
| 1. Reporting on physical and program progress | Very much □ Much □ Somewhat □ Little □ Very little □ |
| 2. Comparison between the physical and financial progresses of the project (Amount spent and percentage of total project credits attraction) | Very much □ Much □ Somewhat □ Little □ Very little □ |
| 3. Updating reports and project information | Very much □ Much □ Somewhat □ Little □ Very little □ |
| 4. Providing a full-detailed overview of the project at specified times for employers | Very much □ Much □ Somewhat □ Little □ Very little □ |
| 5. Studying the delay trend in the project and most of the delay factors | Very much □ Much □ Somewhat □ Little □ Very little □ |
| 6. Recording delays in a mechanized information system in the least time | Very much □ Much □ Somewhat □ Little □ Very little □ |
| 7. Investigating the functioning of the information system and recognizing the internal and external factors of project delays | Very much □ Much □ Somewhat □ Little □ Very little □ |
| 8. Providing understandable and simple physical and data reports | Very much □ Much □ Somewhat □ Little □ Very little □ |
| 9. Simplification of the reporting process by experts | Very much □ Much □ Somewhat □ Little □ Very little □ |
| 10. Emphasis on the "correctness" of data and information in the information system | Very much □ Much □ Somewhat □ Little □ Very little □ |
| 11. Emphasis on the "completeness" of data and information in the information system | Very much □ Much □ Somewhat □ Little □ Very little □ |
| 12. Emphasis on the "sustainability" of data and information in the information system (fixed variables) | Very much □ Much □ Somewhat □ Little □ Very little □ |
| 13. Emphasis on the " appropriateness" of data and information in the information system (up-to-date data) | Very much □ Much □ Somewhat □ Little □ Very little □ |
| 14. Considering "Changes in the technical specifications of the project" in the design of the internal structure of the information system | Very much □ Much □ Somewhat □ Little □ Very little □ |
| 15. Considering "changes in the technical specifications of the project" in the design of the internal structure of the information system | Very much □ Much □ Somewhat □ Little □ Very little □ |
| 16. Considering "procurement limitations" in the design of the internal structure of the information system | Very much □ Much □ Somewhat □ Little □ Very little □ |
| 17. Considering "changes in runtime" in the design of the internal structure of the information system | Very much □ Much □ Somewhat □ Little □ Very little □ |
| 18. Considering "changes in priorities" in the design of the internal structure of the information system | Very much □ Much □ Somewhat □ Little □ Very little □ |
| 19. Considering "increase or decrease in a part of the project during implementation" in the design of the internal structure of the information system | Very much □ Much □ Somewhat □ Little □ Very little □ |
| 20. Considering "procurement limitations" in the design of the internal structure of the information system | Very much □ Much □ Somewhat □ Little □ Very little □ |
| 21. Considering "changes in technical specifications of the project" in the design of the internal structure of the information system | Very much □ Much □ Somewhat □ Little □ Very little □ |