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Causes of Delay in Khuzestan Steel Company Construction Projects

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ABSTRACT

Construction project is a competitive business with high risk especially in developing countries like Iran which faces with many problems such as delay and time and costs increases. Thus, the first priority here is to determine the causes of prolongation of construction projects and to evaluate their importance. Khuzestan Steel Company (KSC) has made important contribution to the projects in Iran and in turn is required to finish them on time. In this study, an attempt was made to investigate the causes of delay in implementation of construction projects held by this company. Data was collected through questionnaire distributed among the sample including 10 owners, 10 consultants and 15 contractors. Accordingly, participants rated the causes in the questionnaire so the most important priorities of each area were specified using TOPSIS method. The results showed that according to the employers, consultants and contractors' viewpoints, the most important reason for delays in construction projects of KSC is related to the financial matters. Hence, according to the results obtained, causes for delays in the company's projects are largely related to the drilling permits and long administrative cycle to renew them. Besides, continuous production of steel in this company is another reason to delays of construction projects.

Keywords: Construction Projects, Delay, Khuzestan Steel Company, Prolongation

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1. INTRODUCTION

One of the characteristics of each country's economic development is its construction projects which are examined as the major indices of economic development. Besides, the bulk of the capital in every country especially developing countries is dedicated to construction and infrastructure projects. The main issue in front of largest projects is a delay in different phases and finally finishing the project. Delay is an action or event that prolongs the time referred to in the contract to perform a certain action and appears as longer duration of activity or delay in its start date. Delays in a construction project affects time and costs. One of the biggest problems in many construction projects worldwide is delay. Delay is one of the most popular events of projects and it varies from one country to another and from one project to another one with regard to their circumstances (Aziz and Abdel-Hakam, 2016; Ezeldinand Abdel-Ghany, 2013; Aziz, 2013; Schumacher, 1995; Trohid, 2004). In general, delays arise from various causes resulted from functions of groups involved in and out of the project. There are many reasons for delays in construction projects including lack of sufficient and updated information at the start of project, insufficient knowledge of project features and disregarding management choice at the right time, lack of clear explanations and specific guidelines to implement the projects in most contracts, assigning the services to consultants and contractors without considering their backgrounds and experiences, lack of trained manpower etc.

The reasons named are the main parameters of management and technology as well as physical, social and financial issues. Research has shown that delays and increased costs in large scale projects occur in many developing countries (Mola'ie and Ghazanfari Nia, 2009).

Delay as a common issue in all development projects is so unpleasant for all stakeholders. The employee gets affected due to the lost profit resulted from delay in operation, the contractor because of price increases and people due to not having the chance of using the social interests of the project (Assaf and Al-Hejji, 2006). Delays can be classified based on criteria such as the origin of creation, occurrence time mode and compensability. Delays solely caused by contractors which are related to causes such as low production capacity and lack of coordination among project components is called inexcusable delays. This type of delay will not entitle contractor to ask for additional time. Another type is compensable delays where the employer is the main reason. Delays not cause by contractor nor employer is called irreversible delay. Some examples of this type are natural disasters and adverse weather (Golenko-Ginzburg *et al*., 2003). Delay is one of common events in projects. Employers are looking for reasons of delay so they could calculate liquidated damages and contractors delay penalty and have a good estimate of the additional costs imposed on contractor. The contractors will also seek to justify their delays and evasion of damage compensation. Or when contractors' losses are caused by lack of timely fulfillment of their own obligations they need to analyze delays to a delay claim form which states that the employers are responsible for damages.

If the operation of projects is delayed, besides wasting national wealth they may not be justifiable technically and economically anymore (Assaf and Al-Hejji, 2006). To limit delays in projects, factors affecting them should be identified to be able to take necessary measures. These factors and indicators and their effect vary according to projects terms including an examination of factors such as selection of subcontractors from various engineering sections, proportion of subcontractors' obligations with company's obligations to employer, optimal control and guidance of contractors by the engineering sections and subcontractors commitment to the quality of work provided by them (Yang and Wei, 2013). Given that delay and its importance is a common and popular matter in all countries, many studies have investigated causes of delay and its mechanisms in construction projects (Hasseb *et al*., 2011; Aibinu and Odeyinka, 2006; Chan and Kumaraswamy, 2002; Ogunlana *et al*., 1996). The results showed that delay rates on average in the United States and England are respectively 2.5 weeks and about a month (James and Zack, 2004). Since delay in a project is considered a product economically, what is concerned along with economic expansion and increased income is lower delays. Higher revenue of the government and contractors in this regard should lead to a higher quality and lower delay of the projects. The fact that despite rising public and government revenue compared to previous years in a developing country like Iran we see more delay in projects is still a vague debate. In contrast, it is absolutely understandable that higher income in developed countries leads to more restricted delays in projects. Figure 1 represents the logical relationship between delay and income.

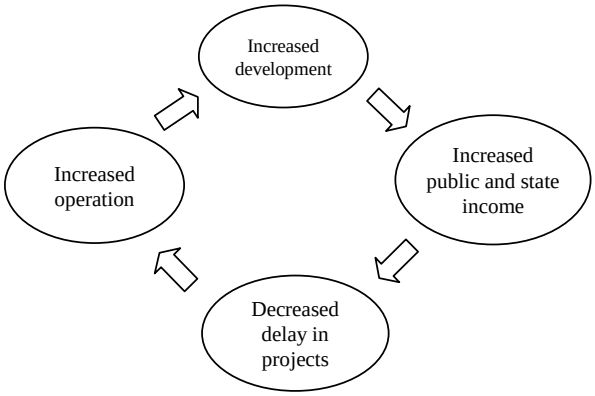


Figure 1. Logical relationship between delay and income.

Irrational relationship in Iran reflects huge weaknesses which in case are not identified and explored will disrupt sustainable domestic production and development. On the other hand, due to the increasing need for metal products in the construction sectors, steel manufacturing is of strategic importance and known as the mother industry. However, a prerequisite for the survival of this industry is to advance in the competitive and global steel market.

So, in order to maintain its dominance in the competitive market and increase its production, KSC as the second largest steel producer in Iran has tended to define and plan on implementation and operation of construction projects. But since the average time from execution to the operation of construction projects is high in this company, planning to reduce delay time appears necessary. According to documents of KSCas the scope of this research, the duration of project is on average about 1.5 times the anticipated time. Hence, in this study we aim to evaluate causes of increased time of the construction projects implementation in KSC.

2. LITERATURE REVIEW

Aziz and Abdel-Hakam (2016) investigated reasons of delays in road construction projects in Egypt. In this study, a list of reasons for delay in construction from various types of literature in this field, in different coun-

tries, eras and a number of different delays and reasons were reviewed. The results suggested that some of the main causes of delays in Egypt's road construction projects are high price of heavy equipment used in road building, contractors inadequate supply of materials, poor experience of contractors or improper performance of the subcontractor and changes in design or implementation stages of the project.

Ruqaishi and Bashir (2015) examined causes of delays in construction projects of Oman gas and oil facilities and employed it as a case study for the countries of the Persian Gulf Cooperation Council (GCC). The results showed that there is a high degree of consensus among stakeholders, employers, contractors and consultants about causes of delays one of which is poor interaction with vendors in the engineering and goods supply stages.

Hamzah *et al*. (2012) studied delay causes in Malaysia construction industry based on previous research conducted worldwide. This field study was performed using experiences of developers, consultants and contractors in Malaysia. In the end, 34 delay causes were identified among which 24 ones were selected. Some of the main reasons of delay in Malaysia construction industry included increased price of materials, poor site management, improper planning, contractors' inadequate experience and construction errors and shortcomings.

Khanzadi *et al*. (2011) estimated delay in road construction projects based on weather conditions using fuzzy-probability analysis. In this research, a decision support system (DSS) including a fuzzy inference system (FIS) was developed to estimate the effect of precipitation and temperature on delays in different road construction stages. The results indicated that daily precipitation and temperature rates difference leads to various delays. Findings also provoked that delay rate depends on in what month and stage the construction is.

Thomas Ngand Tang (2010) explored the intense work of construction subcontractors as critical factors of project success. In this study, a managed questionnaire based survey was conducted in Hong Kong. A series of critical factors for success related to the hard work of subcontractors was initially specified through descriptive statistics. Then these factors were compared with items that are linked to severe equipment business professionals. In the end, critical success factors were divided into three components using factor analysis method. The findings of this study provide the basis for hard work of contractors upon which they could enhance their success rate in the organization and projects.

Yang and Wei (2012) focused on delays in the design phase of project. According to their results, "changing the needs of employer" was the most important factor among factors affecting delay in design and planning phase.

Kaliba *et al*. (2009) evaluated delays in road construction projects in Zambia. They identified the main factors affecting road projects delay. According to the results, some of the most important factors are delay in payment of the employer, contractor and employer's problems related to financial processes, Changes made compared to the original contract, economic problems, providing materials, changes in drawings and plans, human resources issues, problems related to the provision of the necessary equipment.

Al-Kharashiand Skitmore (2009) reviewed 10 studies done on the projects performed in Saudi Arabia and introduced factors affecting delay in target projects. Of the main causes of delay were contractor expertise and inadequate monitoring.

Ndekugri *et al*. (2008) investigated varied surveys according to various criteria of delay causes in construction projects carried out in Egypt. Among these criteria, factors affecting delayed projects based on the groups involved, project size and the type of industry can be named. According to the corresponding surveys done in the field of construction industry in this country, the most important factors causing delay are respectively contractor's liquidity issues, changes in project scope and interferences by employer and lack of appropriate financing for the projects by the owner.

Sambasivan and Soon (2007) classified delay factors into eight main categories and included three groups of owners, consultants and contractor in research using questionnaires completed by Malaysian experts. They eventually identified 10 factors influencing projects delay among which the most important ones are contractor's poor planning, contractor weak management on the site, contractor's inadequate background and work experiences, inadequate an insufficient payments of owner for terminated work, subcontractor's problems, shortage of materials, labor and equipment problems.

Menesi (2007) studied causes of delays in the construction industry of developing countries all over the world. The results emphasized that timely transfer of the project with optimal and standard costs and quality by employer is one of the major reasons to a successful delivery of the project. Failure to perform a project on time with costs and quality predetermined is resulted from negative and unpredictable effects.

Assaf and Al-Hejji (2007) examined construction projects and suggested that only 30% of them were completed within the time predefined and that time increase is 10-30% on average. They introduced 56 main reasons of delay in construction projects. According to the researchers, the most important reasons are delay on provision of detailed maps, delay in the progression of contractor's work, delays in payments of employer to contractor and changes in the original plan.

Williams (2003) elaborated current standard methods that assess time delays of large projects and in the end offered a new method to evaluate delays in such projects. Williams's studies are focused on delays affected by owners' performance or conditions as well as forgivable and unforgivable delays which led in the end to offering various methods of critical path network in different circumstances.

Frimpong *et al.* (2003) studied construction projects and demonstrated that more than 33 cases out of 47 projects had been delayed. Some of the reasons for delays in construction projects of Ghana here included poor technical implementation due to weak planning, lack of cooperation required between the teams involved in the project, failure to use proper scheduling techniques and lack of skilled manpower in the field of project management.

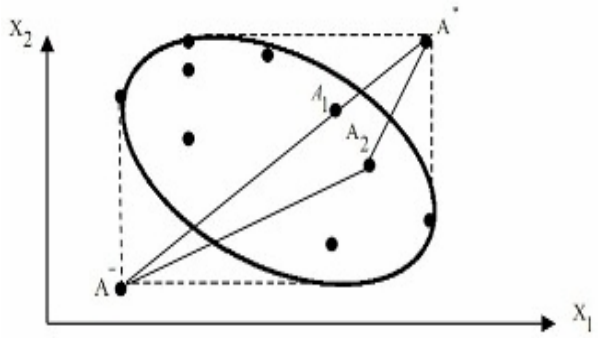
Kamikg *et al*. (1997) consideredcauses of delay in Indonesia's construction projects. They stated in their study: however, it should be noted that delay in construction projects is not specified to the present time nor to a certain country as many other countries all over the world are also involved in this matter. But the factors and their effects vary in different countries depending on their culture, sources of credits and development rate. Researcher also emphasized that although the above study is specified to Indonesia, the results obtained reflect construction management problems in all developing countries. As mentioned earlier, the present study also aims to investigate causes of delay in construction projects of Khuzestan Steel Company.

3. METHODOLOGY

There are three contract parties in each construction project of Khuzestan Steel Company including owners, consultant and contractor. Thus research population in this study consists of the three groups employed at the company. To determine the sample size of the population, Morgan table was used. Accordingly, 10 owners, 10 consultants and 15 contractors were selected as samples. A list of factors affecting the delays was prepared then considering the special circumstances of this company, a number of items were excluded and some other factors were added to the list. In the end, questions were categorized in three sections related to owners (33 items) consultants (24 items) and contractors (32 items) (89 items overall). Hence, a separated questionnaire was prepared where five options were defined for each question to assess the impact of each factor influencing project delays (ranked as very low, low, medium, high and very high). To test the reliability of questionnaire, Cronbach's alpha coefficient applied in spss was used. The operation was performed on a five-point Likert scale separately in three questionnaires dedicated to owners, consultant and contractor. The results of reliability are represented in Table 1.

Table 1. Cronbach's alpha values for all three questionnaires

Questionnaire's name	Cronbach's alpha value
Questionnaire related to the owners	0.829
Questionnaire related to the consultants	0.706
Questionnaire related to the contractors	0.837



[X_1: Criterion with positive aspect, X_2: Criterion with positive aspect]

Figure 2. Distribution of alternatives in TOISIS method.

Given that Cronbach's alpha coefficients for all three questionnaires are greater than 0.7, so their reliability is confirmed. After confirming the validity and reliability of the questionnaires, they were distributed among participants and completed by them and then again were collected. Every item's option was given a score (from 1 for very low to 5 for very high). The scores were summed up and thereby TOPSIS method was used to determine the priorities of each field from the viewpoint of employers, consultants and contractors through rating causes identified.

3.1 TOPSIS Method

TOPSIS is aprioritization method based on the similarity of ideal solution. This method was proposed by Hwang and Yoon in 1981. In this method, m alternatives are evaluated by n criteria. The logic underlying this method defines ideal solution (positive (PIS)) and negative ideal solution (NIS). The ideal solution (positive) is a solution that increases profit criterion and decreases cost criterion. The optimal alternative is the one with minimum distance from ideal solution and yet is in the furthest distance from the negative ideal solution. In other words, in this method, alternatives that have the greatest similarity to the ideal solution earns the highest rank. The target space between two criteria is shown in Figure 2. Here, A+ and A- are respectively the ideal and negative ideal solutions. The alternative A1 has shorter distance from the ideal solution and greater distance from the negative ideal solution than A2 (Habibi *et al*., 2014).

3.1.1 TOPSIS technique algorithm

In this part, TOPSIS technique steps are listed as follows:

1. Create a decision matrix: in TOPSIS technique, m alternatives are evaluated using n criteria. So any alternative is given a score based on each criterion. These scores can be either based on quantitative and real or qualitative and theoretical values. In any case, a decision matrix m×n should be formed as follows:

$$D=\begin{bmatrix} A_1 \\ \cdot \\ \cdot \\ \cdot \\ A_i \\ \cdot \\ \cdot \\ \cdot \\ A_m \end{bmatrix}\begin{bmatrix} x_1 \cdots x_j \cdots x_n \\ x_{11} \cdots x_{1j} \cdots x_{1n} \\ \cdots \cdots \cdots \cdots \\ \cdots \cdots \cdots \cdots \\ x_{i1} \cdots x_{ij} \cdots x_{in} \\ \cdots \cdots \cdots \cdots \\ \cdots \cdots \cdots \cdots \\ \cdots \cdots \cdots \cdots \\ x_{m1} \cdots x_{mj} \cdots x_{mn} \end{bmatrix} \quad (1)$$

2. Normalize the decision matrix: like other multi-criteria decision methods, the decision matrix should be normal. To normalize the values, the vector method is used. Unlike simple linear normalization, vector method is done as follows:

$$n_{ij}=\frac{x_{ij}}{\sqrt{\sum_1^m x_{ij}^2}} \quad (2)$$

Where, x_{ij} is every element of the decision matrix, j is the column and i is the row and n_{ij} represents every element of normalized decision matrix.

3. Calculate the weighted normalized decision matrix: the next step is to form a weighted normalized matrix based on indicators' weights. Thus, the weights should be calculated beforehand using a technique such as analytical hierarchy process (AHP) or Shannon entropy method. In this regard, the most important indicators have higher weights.

4. Calculate the positive and negative ideals: the next step is to calculate the positive and negative ideals. In this step, one positive ideal (A+) and one negative ideal (A-) is calculated for every criterion.

5. Distance from positive and negative ideals and calculate the ideal solution: in this step, the relative proximity of each alternative to the ideal solution is estimated. So, the Euclidean distance of each alternative from positive and negative ideals is calculated.

6. Calculate the ideal solution: this is the final step. In this stage, relative proximity of each alternative to the ideal solution is calculated (Habibi *et al*., 2014). Hence, the steps described above are as follows:

$$d_i^+=\sqrt{\sum_{j=1}^n\left(V_{ij}-V_j^+\right)^2} \quad (3)$$

$$d_i^-=\sqrt{\sum_{j=1}^n\left(V_{ij}-V_j^-\right)^2} \quad (4)$$

$$CL_i^*=\frac{d_i^-}{d_i^-+d_i^+} \quad (5)$$

Where, d_i^+ is the distance of alternative i from positive ideal and d_i^- is the distance of alternative i from negative ideal. $\boldsymbol{V_{ij}}$ is any element in the weighted decision matrix. V_i^+ is the distance of the weighted matrix-alternative i from positive ideal and V_i^- is the distance of weighted matrix alternative i from negative ideal. CL_i^+ is the relative closeness of each alternative to the ideals whose value is between zero and unit. The closer this value to unit is, the closer the solution to the ideal is thus it is a better solution.

3.2 Decision Matrix Design

Developing a questionnaire in TOPSIS technique is derived from the concept of decision matrix. Most multi-criteria decision making techniques begin with a decision matrix. A decision matrix is a matrix to evaluate m options based on n criteria. Every option in this type of matrix is given a specific score based on all criteria one by one. These scores can be a real data such as age, weight or price of the item or be evaluated qualitatively and on a Liker scale (Habibi *et al*., 2014). In this article, 45 options that were more important than the others were selected as the main factors to be inserted into the TOPSIS program. Comments given by the sample of employyers were chosen as the option and delay reason was introduced to the program as the criterion. Thus, 10 options and 45 criteria were obtained here. All the criteria affect delays though they are different in terms of impact intensity so the effects of all criteria was considered to be positive. Furthermore, some specific methods and software were used to recognize more important options then they were ranked. What was achieved in the end was a number of sorted options of factors affecting delay from the viewpoint of owners, consultants and contractors which was obtained with regard to the conditions and environment in which the three groups are working. What is clear according to the results is the disagreement between three groups on some options while they have the same opinions on some other ones. Tables 2 and 3 illustrate decision matrix and normal matrix for criteria related to each factor in the questionnaire.

4. RESULTS

According to the results obtained in decision matrix and normal matrix tables, the most important causes of delay in company's projects in owners, consultants and contractors' idea are represented in tables 4 to 6.

After examining tables 4 to 6, the common items were identified. It should be noted that in each group's viewpoint these items have different levels of importance. The common items are:

*** Inflation and price changes from the date price offer to the end of the project and lack of compensation through modulating:** this item was ranked 1 by owners, 11 by consultant and 1 by contractor. According to the agreement between three groups and the rank given to this item, it is known as the most important cause of delay.

Table 2. Decision matrix related to the criteria of questionnaire

Weight of criteria (entropy)	0.09	0.11	0.13	0.07	0.12	0.12	0.13	0.06	0.11	0.08
Effect of criteria	Positive	Positive	Positive	Positive	Positive	Positive	Positive	Positive	Positive	Positive
Decision matrix	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Q2	5	5	4	4	3	4	1	4	2	3
Q3	3	4	5	3	2	4	2	5	3	3
Q4	2	5	5	4	3	5	3	4	4	4
Q5	2	4	5	4	4	3	2	4	4	3
Q6	3	5	4	4	3	4	4	5	3	3
Q7	3	3	4	4	2	4	3	5	4	3
Q8	3	4	2	3	2	4	2	4	4	4
Q9	4	3	1	4	2	4	4	3	4	4
Q10	4	3	2	4	3	4	5	3	3	3
Q13	2	3	3	4	4	2	5	4	2	3
Q17	4	3	4	4	3	4	5	5	4	3
Q18	3	3	3	4	4	4	5	5	4	5
Q22	3	3	3	4	2	4	3	4	3	3
Q25	4	4	4	4	1	3	5	5	2	3
Q26	4	4	3	4	3	3	5	4	3	3
Q27	3	4	4	4	4	3	4	5	3	3
Q28	4	3	3	4	2	3	2	5	3	3
Q31	4	3	3	5	2	3	4	5	2	3
Q43	2	5	2	4	2	2	3	3	4	4
Q44	4	5	2	4	3	4	3	2	5	4
Q45	3	3	4	4	4	4	3	4	4	5
Q46	2	4	3	2	2	3	3	5	1	4
Q47	2	4	3	5	2	2	3	4	1	4
Q50	3	4	4	4	3	2	3	3	2	1
Q53	4	4	4	3	2	4	3	4	2	5
Q55	3	2	5	4	5	1	3	4	3	4
Q56	3	4	4	4	2	2	3	2	2	4
Q57	2	4	3	2	4	2	3	4	4	5
Q58	2	4	4	2	3	4	3	4	4	5
Q60	2	4	3	4	4	3	3	3	4	3
Q61	2	4	3	4	4	4	1	3	4	3
Q62	4	3	4	4	5	3	3	4	3	4
Q63	3	3	4	4	4	1	1	4	3	3
Q65	4	2	2	4	4	4	3	3	2	4
Q66	5	1	2	2	4	4	2	4	4	2
Q68	4	2	1	2	4	3	3	3	5	2
Q72	3	2	2	2	3	4	4	3	4	3
Q75	3	2	2	4	5	5	4	3	4	5
Q77	5	2	2	2	4	4	3	4	5	5
Q78	3	3	3	3	3	1	2	3	4	3
Q81	4	2	2	3	3	4	2	3	2	4
Q86	4	4	3	3	4	2	2	3	3	4
Q87	5	5	2	2	5	5	3	3	4	4
Q88	4	2	2	3	5	5	3	3	3	5
Q89	3	2	2	3	4	3	3	3	3	5

Table 3. Normal matrix related to the criteria of questionnaire

Normal matrix	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Q2	0.218	0.211	0.183	0.165	0.131	0.171	0.046	0.154	0.088	0.12
Q3	0.131	0.169	0.228	0.124	0.088	0.171	0.091	0.193	0.132	0.12
Q4	0.087	0.211	0.228	0.165	0.131	0.213	0.137	0.154	0.176	0.159
Q5	0.087	0.169	0.228	0.165	0.175	0.128	0.091	0.154	0.176	0.12
Q6	0.131	0.211	0.183	0.165	0.131	0.171	0.183	0.193	0.132	0.12
Q7	0.131	0.127	0.183	0.165	0.088	0.171	0.137	0.193	0.176	0.12
Q8	0.131	0.169	0.091	0.124	0.088	0.171	0.091	0.154	0.176	0.159
Q9	0.175	0.127	0.046	0.165	0.088	0.171	0.183	0.116	0.176	0.159
Q10	0.175	0.127	0.091	0.165	0.131	0.171	0.228	0.116	0.132	0.12
Q13	0.087	0.127	0.137	0.165	0.175	0.085	0.228	0.154	0.088	0.12
Q17	0.175	0.127	0.183	0.165	0.131	0.171	0.228	0.193	0.176	0.12
Q18	0.131	0.127	0.137	0.165	0.175	0.171	0.228	0.193	0.176	0.199
Q22	0.131	0.127	0.137	0.165	0.088	0.171	0.137	0.154	0.132	0.12
Q25	0.175	0.169	0.183	0.165	0.044	0.128	0.228	0.193	0.088	0.12
Q26	0.175	0.169	0.137	0.165	0.131	0.128	0.228	0.154	0.132	0.12
Q27	0.131	0.169	0.183	0.165	0.175	0.128	0.183	0.193	0.132	0.12
Q28	0.175	0.127	0.137	0.165	0.088	0.128	0.091	0.193	0.132	0.12
Q31	0.175	0.127	0.137	0.207	0.088	0.128	0.183	0.193	0.088	0.12
Q43	0.087	0.211	0.091	0.165	0.088	0.085	0.137	0.116	0.176	0.159
Q44	0.175	0.211	0.091	0.165	0.131	0.171	0.137	0.077	0.22	0.159
Q45	0.131	0.127	0.183	0.165	0.175	0.171	0.137	0.154	0.176	0.199
Q46	0.087	0.169	0.137	0.083	0.088	0.128	0.137	0.193	0.044	0.159
Q47	0.087	0.169	0.137	0.207	0.088	0.085	0.137	0.154	0.044	0.159
Q50	0.131	0.169	0.183	0.165	0.131	0.085	0.137	0.116	0.088	0.04
Q53	0.175	0.169	0.183	0.124	0.088	0.171	0.137	0.154	0.088	0.199
Q55	0.131	0.085	0.228	0.165	0.219	0.043	0.137	0.154	0.132	0.159
Q56	0.131	0.169	0.183	0.165	0.088	0.085	0.137	0.077	0.088	0.159
Q57	0.087	0.169	0.137	0.083	0.175	0.085	0.137	0.154	0.176	0.199
Q58	0.087	0.169	0.183	0.083	0.131	0.171	0.137	0.154	0.176	0.199
Q60	0.087	0.169	0.137	0.165	0.175	0.128	0.137	0.116	0.176	0.12
Q61	0.087	0.169	0.137	0.165	0.175	0.171	0.046	0.116	0.176	0.12
Q62	0.175	0.127	0.183	0.165	0.219	0.128	0.137	0.154	0.132	0.159
Q63	0.131	0.127	0.183	0.165	0.175	0.043	0.046	0.154	0.132	0.12
Q65	0.175	0.085	0.091	0.165	0.175	0.171	0.137	0.116	0.088	0.159
Q66	0.218	0.042	0.091	0.083	0.175	0.171	0.091	0.154	0.176	0.08
Q68	0.175	0.085	0.046	0.083	0.175	0.128	0.137	0.116	0.22	0.08
Q72	0.131	0.085	0.091	0.083	0.131	0.171	0.183	0.116	0.176	0.12
Q75	0.131	0.085	0.091	0.165	0.219	0.213	0.183	0.116	0.176	0.199
Q77	0.218	0.085	0.091	0.083	0.175	0.171	0.137	0.154	0.22	0.199
Q78	0.131	0.127	0.137	0.124	0.131	0.043	0.091	0.116	0.176	0.12
Q81	0.175	0.085	0.091	0.124	0.131	0.171	0.091	0.116	0.088	0.159
Q86	0.175	0.169	0.137	0.124	0.175	0.085	0.091	0.116	0.132	0.159
Q87	0.218	0.211	0.091	0.083	0.219	0.213	0.137	0.116	0.176	0.159
Q88	0.175	0.085	0.091	0.124	0.219	0.213	0.137	0.116	0.132	0.199
Q89	0.131	0.085	0.091	0.124	0.175	0.128	0.137	0.116	0.132	0.199

Table 4. The most important items of delay according to owners

Rank	Description of items
1	Inflation and price changes from the date price offer to the end of the project and lack of compensation through modulating
2	Delays in payment of contractor's statement of financial position due to long administrative process (department of monitoring and administrative affairs)
3	Delays in payment of contractor's statement of financial position due to lack of liquidity
4	Changes in project figures (changes in plans, descriptions) and finally changing the price of the entire project
5	Improper interaction with contractor
6	Ambiguities in the contract
7	Designing without getting sufficient information about the project site (remotely)
8	Contractor's inefficient human resources (masons, welders, head workman, workshop supervisor, etc)
9	Executive errors which cause rework and such delays
10	Delays in approval of plans
11	Insufficient information about terms of contract, instructions and circulars or disregarding them
12	Changing the plans during project implementation
13	Employer's direct intervention in the plans and neglecting the consultant
14	Improper interaction with consultant

Table 5. The most important items of delay according to consultants

Rank	Description of items
1	Contractor's inability to provide the machinery and equipment required
2	Contractor's acceptance and approval of a bid lower than the reasonable price
3	Offering a price lower than the reasonable price
4	Hiring inexperienced or less experienced and low vague subcontractors
5	Contractor's incomplete technical, financial and equipment evaluation in order to participate in the tender
6	Contractor's incomplete technical, financial and equipment evaluation in order to participate in the tender
7	Delays in payment of contractor's statement of financial position due to lack of liquidity
8	Lack of cooperation to stop the production or stop it in less time than it takes to complete the project
9	Delay in dealing with opponents (green space, electricity, water, etc) when there is a problem during the project
10	Contractor's financial weakness (for guarantee, performance, etc)
11	Inflation and price changes from the date price offer to the end of the project and lack of compensation through modulating
12	Failure to pay the salaries on time and employees' dissatisfaction in general
13	Not having a design permit and problems related
14	Failure to pay the salaries on time and employees' dissatisfaction in general

Table 6. The most important items of delay according to contractors

Rank	Description of items
1	Inflation and price changes from the date price offer to the end of the project and lack of compensation through modulating
2	Delays in payment of contractor's statement of financial position due to long administrative process (department of monitoring and administrative affairs)
3	Delays in payment of contractor's statement of financial position due to lack of liquidity
4	Changes in project figures (changes in plans, descriptions) and finally changing the price of the entire project
5	Improper interaction with contractor
6	Ambiguities in the contract
7	Designing without getting sufficient information about the project site (remotely)
8	Contractor's inefficient human resources (masons, welders, head workman, workshop supervisor, etc)
9	Executive errors which cause rework and such delays
10	Delays in approval of plans
11	Insufficient information about terms of contract, instructions and circulars or disregarding them
12	Changing the plans during project implementation
13	Employer's direct intervention in the plans and neglecting the consultant
14	Improper interaction with consultant

- **Delays in payment of contractor's statement of financial position due to lack of liquidity:** this item was ranked 8 by owner, 7 by consultant and 3 by contractor with a score similar to the rank 1 (scores of ranks 1 to 4 are equal). This consensus reflects the importance of this item.

  Moreover, according to the tables in this research, common items between two groups out of three include:
- **Contractor's inefficient labor:** these items were ranked 3 and 8 by owner and contractor respectively which reveals its importance.
- **Not having a permit for plans and related problems:** this item was ranked 6 by owner and 13 by consultant. So it is considered as one of the great importance.
- **Contractor's incomplete technical, financial and equipment evaluation in order to participate in the tender:** this item was ranked 7 by owner and 5 by consultant.
- **Contractor's inability to provide the machinery and equipment required:** ranks 9 and 1 were given to this item respectively by owner and consultant.
- **Changes in project figures (changes in plans, descriptions) and finally changing the price of the entire project:** ranks 10 and 4 were given to this item respectively by owner and contractor.
- **Delay in dealing with opponents (green space, electricity, water, etc) when there is a problem during the project:** this item was ranked 11 by owner and 9 by consultant.
- **Hiring inexperienced or less experienced and low vague subcontractors:** this item was ranked 12 by owner and 4 by consultant.
- **Changing the plans during project implementation:** this item was ranked 13 by owner and 12 by contractor.

5. DISCUSSION

Delays as a common issue happen in all construction projects from the simple one to the most complicated. Given the limited sources available and the fierce market competition, today most developed countries are seeking to find the underlying causes of delays in previous projects to be able to take more advantages of resources and earn higher profits. This way they can offer some solutions to reduce the amount of delays in upcoming projects that will result in increased time and costs. It could be identified the guilty parties who are responsible for delays and thus act on receiving compensation. Identification of delays profits any institutions involved. Delays are destructive and costly. Therefore, it needed to explore causes of delay especially in construction projects. These factors and their effects vary according to the circumstances of the project. On the other hand, KSC as one of the most fundamental industries in Iran has various construction and non-construction projects under execution. Considering company's continuous production and special conditions, indicators influencing delay in its projects are a little different than the other sectors thus it is essential to recognize these factors in order to efficiently implement the projects. Therefore, this study sought to evaluate causes of delay in construction projects of KSC.

According to the results represented in tables 4 to 6, the most important cause of delay as stated by owner, consultant and contractor is financial matters.

Furthermore, hiring inexperienced low-wage salary subcontractors was prioritized as the third and second most important reason respectively by owner and consultant. The ranking is followed by the first option of owner and sixth of consultant which is contractor's financial weakness (to guarantee, performance, etc). According to the results, the most important reasons of delay associated with projects particular conditions in this company are the same from employer and consultant perspective which are to some extent related to the permits of drilling and its long administrative process. In addition, company's continuous steel manufacturing could delay projects that are ongoing at production site. A comparison of the results obtained from previous research and the present study indicates a relative similarity between them. For example, results of this study correspond with research done by Odeh and Battainah (2002). They considered projects delay from perspective of contractors and consultants. The results of their research revealed that contractors and consultants unanimously, employer interventions factors, insufficient experience of contractor, payments and financial issues, labor productivity, slow decision making process, poor planning and subcontractors play the most highlighted role in delay of projects. The items mentioned above were also specified as factors influencing delays in projects of KSC. The same results were obtained in most studies conducted in various fields (Marzouk *et al*., 2008; Mansfield *et al*., 1994). However, the item addresses less in previous research and yet was identified as an effective factor in the present study is the matter of inflation and failure to provide it by adjusting. It seems that this factor has created so many problems in recent years due to Iran's bad economic conditions and inflation. Therefore, special attention should be paid to this issue to avoid losses originating from failure to timely finish the projects.

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