Causes of delay in construction projects: The case of oil and gas projects

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***Abstract*— Successful implementation of construction projects is one of the key factors for economic development of every country. Every year, a major part of the countries' capital is allocated to civil and infrastructure projects, most of which are implemented with delay. Construction projects are often criticized for overrunning time and budgets. Analyzing the factors causing delay is essential with the aim of omitting them and timely implementation of these projects. Research to identify the reasons and causes of delays have been conducted in different countries and by various researches. In this paper, various research has studied different factors affecting construction projects delays have been studied. These factors have been identified in four groups consisted of owner, consultant, conductor, and other factors. Moreover, on account of the importance of oil and gas projects, the mentioned factors for these kinds of projects are taken into consideration. The results showed that change orders and changes in scope of work by owner, delay in reviewing of documents by consultant, inadequate experience and knowledge and errors during construction by contractor, and low productivity of laborer have been indicated as key factors comparing with the other as crucial factors causing delay in the oil and gas construction projects.**

***Index Terms*— Project management, oil and gas, construction projects, delay, owner, consultant, conductor**

I. Introduction

Organizations particularly pay special attention to the efficient management of projects and make a lot of efforts to achieve this goal by reducing delay in projects. The significance of project management and the pathology of delay that imposes exorbitant costs on organization will be more noticeable [1].

This research presents a list of construction delay causes retrieved from literature. Considering the importance of oil and gas projects, the factors causing of delay for oil and gas projects are taken in to account.

The article is structured as follows: In Section 2, literature review is presented. Causes of delay in construction projects are given in Section 3. Results and discussion are dealt with in Section 4. Finally, Section 5 concludes the paper.

II. Literature review

Over the years, professionals and researchers from different countries have investigated various aspects of delays in construction projects. Some of these studies are listed below:

Shakeri and Ghorbani [2], Ahmadpour [3], Taghizadeh and Laleh [4], Safavi et al. [5], Shakeri et al. [6], Babaei and Hoseini [7] studied causes of delay in different construction projects in Iran.

Frimpong et al. identified causes of delay and cost overruns in construction of groundwater projects in Ghana [8]. The main causes were monthly payment difficulties from agencies, poor contractor management, material procurement, poor technical performances, and escalation of material prices.

A survey on time performance of different types of construction projects in Saudi Arabia was conducted by Assaf and Al-Hejji to determine the causes of delay and their importance according to each of the project participants, i.e., the owner, consultant and the contractor [9]. Seventy-three causes of delay were identified during this research. The most common cause of delay identified by all the three parties was change order.

Sweis et al. identified and classified causes of construction delays in residential projects in Jordan [10]. Financial difficulties faced by the contractor and too many change orders by the owner were the leading causes of construction delay. Severe weather conditions and changes in government regulations and laws ranked among the least important causes.

Salama et al. investigated the main causes of delays within oil and gas projects in UAE [11]. The data analysis indicated a strong correlation between delays within the front-end engineering and design (FEED) phase and the total delay at the end of the project.

Hamzah et al. identified cause of construction delay in Malaysia [12]. There were two main type of delay: excusable delay and nonexcusable delay.

Ravand and Salahi A. examined the causes of delays in the implementation of oil and gas industrial projects in Iran [13]. These factors were investigated in five groups consist of weaknesses in basic studies, lack of expert labor, lack of timely funding, contractual ambiguities and side problems.

Factors affecting delays in Indian construction projects were analyzed by Doloi et al. [14]. From the factor analysis, most critical factors of construction delay were identified as lack of commitment, inefficient site management, poor site coordination, improper planning, lack of clarity in project scope, lack of communication and substandard contract.

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Regression model indicated slow decision from owner, poor labor productivity, architects' reluctance for change and rework due to mistakes in construction were the reasons that affect the overall delay of the project significantly.

Fallahnejad identified and ranked the causes of delay in gas pipeline projects in Iran [15]. The result revealed that the 10 major delay factors were: imported materials, unrealistic project duration, client-related materials, land expropriation, change orders, contractor selection methods, payment to contractor, obtaining permits, suppliers, and contractor's cash flow.

Aziz determined various factors causing delay in construction projects in Egypt [16]. Ninety-nine factors were short-listed to be made part of the questionnaire survey and were identified and categorized into nine major categories consist of consultant, contractor, design, equipment, external, labor, material, owner and project related factors.

Project pathology and leading causes of delay in the projects of zone 3 of Iranian Gas Transmission Company were investigated by Atafar and Eghbali [1]. Some managers and experts were interviewed. Based on finding from this research, the most effective cause of project delay from the respondents' point of view was the contractor's failure to perform his obligations and the least effective cause was the external issues.

Marzouk and I. El-Rasas presented a list of construction delay causes retrieved from literature [17]. The feedback of construction experts was obtained through interviews. According to the results the important causes were ineffective planning and scheduling of project, difficulties in financing project by contractor, variation orders/changes of scope by owner during construction, poor site management and supervision, type of project bidding and award, low productivity level of labors, effects of subsurface conditions, unqualified workforce, shortage of construction materials in market, and delays in sub-contractors work.

Gluszak and Lesniak studied construction delays from the client's perspective [18]. Three basic categories of delay in construction works were caused by the contractor, investor and, external.

Causes of delay in construction projects in the oil and gas industry in the Persian Gulf cooperation council countries were investigated by Ruqaishi and Bashir [19]. Seven factors were determined as the major causes of project delay. Although six of these identified elements were general factors that could account for delay in any project in any industry, one of them them —poor interaction with vendors in the engineering and procurement stages— was found to be unique to construction projects in the oil and gas industry.

Delay causes of road construction projects in Egypt were explored by Aziz and Abdel-Hakam [20]. A questionnaire and personal interviews formed the basis of this paper listing 293 delay causes.

Alzara et al. identified the major causes of university construction project delays [21]. Nine important delay factors were bidder system (low price), poor contractor performance, lack of experienced contractors, shortage of manpower, contractor's qualifications, material delivery, approval of design documents by owner, delay in progress payments to contractors and lack of consultancy employees.

Al-Hazim et al. investigated factors causing completion delay and cost overrun in infrastructure projects in Jordan [22]. The results showed that delay and cost overrun of infrastructure projects were caused by 20 factors according to the records in the collected final reports of projects. Terrain and weather conditions were the most important factors.

III. Causes of Delay in Construction Projects

In this section factors affecting the delay in the construction projects are categorized in four groups consisted of owner, consultant, conductor, and other factors. Table 1 shows he factors related to owners.

TABLE 1: FACTORS CAUSING DELAY IN CONSTRUCTION PROJECTS RELATED TO OWNERS.

No.	Factors	Authors
1	Slowness in decision making	Frimpong et al. (2003), Assaf and Al-Hejji (2006), Sweis et al. (2008), Salama et al. (2008), Hamzah et al. (2011), Doloi et al. (2012), Shakeri et al. (2012), Atafar and Eghbali (2013), Aziz (2013), Marzouk and El-Rasas (2014), Gluszak and Lesniak (2015), Ruqaishi and Bashir (2015), Aziz and Abdel-Hakam (2016), Al-Hazim et al. (2017).
2	Suspension of work	Assaf and Al-Hejji (2006), Sweis et al. (2008), Hamzah et al. (2011), Aziz (2013), Marzouk and El-Rasas (2014).
3	Delay in reviewing and approving documents	Shakeri and Ghorbani (2005), Assaf and Al-Hejji (2006), Taghizadeh and Laleh (2008), Salama et al. (2008), Sweis et al. (2008), Hamzah et al. (2011), Aziz (2013), Marzouk and El-Rasas (2014), Gluszak and Lesniak (2015), Aziz and Abdel-Hakam (2016), Alzara et al. (2016).
4	Delay in site delivery	Shakeri and Ghorbani (2005), Assaf and Al-Hejji (2006), Sweis et al. (2008), Taghizadeh and Laleh (2008), Safavi et al. (2010), Hamzah et al. (2011), Doloi et al. (2012), Aziz (2013), Marzouk and El-Rasas (2014), Aziz and Abdel-Hakam (2016).
5	Delay in payment	Ahmadpour (2006), Assaf and Al-Hejji (2006), Sweis et al. (2008), Taghizadeh and Laleh (2008), Safavi et al. (2010), Ravand and Salahi A. (2011), Shakeri et al. (2012), Doloi et al. (2012), Aziz (2013), Shakeri et al. (2013), Atafar and Eghbali (2013), Fallahnejad (2013), Babaei and Hoseini (2014), Gluszak and Lesniak (2015), Ruqaishi and Bashir (2015), Aziz and Abdel-Hakam (2016), Alzara et al. (2016), Al-Hazim et al. (2017).
6	Change orders and changes in scope of work	Assaf and Al-Hejji (2006), Sweis et al. (2008), Salama et al. (2008), Safavi et al. (2010), Ravand and Salahi A. (2011), Doloi et al. (2012),Fallahnejad (2013), Babaei and Hoseini (2014), Atafar and Eghbali (2013), Aziz (2013), Marzouk and El-Rasas (2014), Gluszak and Lesniak (2015), Ruqaishi and Bashir (2015), Aziz

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		and Abdel-Hakam (2016), Al-Hazim et al. (2017).
7	Type of project bidding	Frimpong et al. (2003), Ravand and Salahi A. (2011), Shakeri et al. (2012), Aziz (2013), Ruqaishi and Bashir (2015), Aziz and Abdel-Hakam (2016).
8	Underestimation of time for completion of projects	Frimpong et al. (2003), Ahmadpour (2006),Assaf and Al-Hejji (2006), Doloi et al. (2012), Shakeri et al. (2012), Atafar and Eghbali (2013), Aziz (2013), Fallahnejad (2013), Ruqaishi and Bashir (2015), Gluszak and Lesniak (2015), Aziz and Abdel-Hakam (2016).
9	Ineffective delay penalties	Assaf and Al-Hejji (2006), Salama et al. (2008), Aziz (2013), Ruqaishi and Bashir (2015), Aziz and Abdel-Hakam (2016).
10	Interference in the construction operation	Sweis et al. (2008), Shakeri et al. (2012), Aziz (2013).
11	Delay in preparation and approval of plans	Assaf and Al-Hejji (2006), Hamzah et al. (2011), Doloi et al. (2012), Marzouk and El-Rasas (2014), Babaei and Hoseini (2014), Aziz and Abdel-Hakam (2016).
12	Frequent change of managers	Taghizadeh and Laleh (2008), Safavi et al. (2010), Fallahnejad (2013), Marzouk and El-Rasas (2014), Alzara et al. (2016).
13	Selecting inappropriate consultant	Marzouk and El-Rasas (2014).
14	Financial problems	Frimpong et al. (2003), Shakeri and Ghorbani (2005), Taghizadeh and Laleh (2008), Sweis et al. (2008), Safavi et al. (2010), Ravand and Salahi A. (2011), Marzouk and El-Rasas (2014), Gluszak and Lesniak (2015), Aziz and Abdel-Hakam (2016).
15	Lack of incentives for contractor to finish ahead of schedule	Taghizadeh and Laleh (2008), Doloi et al. (2012), Aziz (2013), Ruqaishi and Bashir (2015).
16	Delay in material delivery	Shakeri and Ghorbani (2005), Salama et al. (2008), Safavi et al. (2010), Marzouk and El-Rasas (2014).
17	Improper planning	Frimpong et al. (2003), Ahmadpour (2006), Safavi et al. (2010), Shakeri et al. (2013), Babaei and Hoseini (2014), Gluszak and Lesniak (2015).
18	Deficiencies in cost estimates prepared	Frimpong et al. (2003), Ravand and Salahi A. (2011), Atafar and Eghbali (2013), Aziz and Abdel-Hakam (2016).
19	Inappropriate management methods	Frimpong et al. (2003), Taghizadeh and Laleh (2008), Shakeri et al. (2013), Atafar and Eghbali (2013).
20	land expropriation	Shakeri and Ghorbani (2005), Ahmadpour (2006), Taghizadeh and Laleh (2008), Fallahnejad (2013), Shakeri et al. (2013).
21	Poor communication and coordination with other parties	Assaf and Al-Hejji (2006), Sweis et al. (2008), Salama et al. (2008), Safavi et al. (2010), Hamzah et al. (2011), Atafar and Eghbali (2013), Gluszak and Lesniak (2015), Aziz and Abdel-Hakam (2016).
22	Conflicts between joint ownership	Assaf and Al-Hejji (2006), Aziz and Abdel-Hakam (2016).
23	Conflict between owners and other parties	Doloi et al. (2012), Aziz and Abdel-Hakam (2016).
24	Mistakes and inconsistencies in the design documentation	Shakeri and Ghorbani (2005), Atafar and Eghbali (2013), Gluszak and Lesniak (2015).
25	Errors in plans	Shakeri and Ghorbani (2005), Atafar and Eghbali (2013).
26	Lack of use of consultant	Atafar and Eghbali (2013).
27	Poor technical knowledge	Taghizadeh and Laleh (2008), Safavi et al. (2010).
28	Poorly defined or vague scope of work	Ruqaishi and Bashir (2015).
29	Administrative bureaucracy	Shakeri and Ghorbani (2005), Taghizadeh and Laleh (2008), Shakeri et al. (2012), Doloi et al. (2012), Fallahnejad (2013), Atafar and Eghbali (2013), Aziz and Abdel-Hakam (2016).

As it can be seen in most studies, delay in payment, change orders and changes in scope of work and slowness in decision making have been mentioned as significant factors in the long runtime of the project.

Table 2 shows factors affecting the delay in the construction projects related to consultants.

TABLE 2: FACTORS CAUSING DELAY IN CONSTRUCTION PROJECTS RELATED TO CONSULTANTS.

No.	Factors	Authors
1	Delay in reviewing of documents	Assaf and Al-Hejji (2006), Sweis et al. (2008), Safavi et al. (2010), Hamzah et al. (2011), Fallahnejad (2013), Shakeri et al. (2012), Aziz (2013), Marzouk and El-Rasas (2014), Ruqaishi and Bashir (2015), Aziz and Abdel-Hakam (2016).
2	Technical and managerial weakness	Taghizadeh and Laleh (2008), Safavi et al. (2010), Ruqaishi and Bashir (2015).
3	Slowness in decision making	Safavi et al. (2010), Hamzah et al. (2011), Aziz and Abdel-Hakam (2016).
4	The lack of awareness of consultants about documents, commitments and rights of the parties	Taghizadeh and Laleh (2008), Shakeri et al. (2012).
5	Lack of consultant's site staff experience	Assaf and Al-Hejji (2006), Taghizadeh and Laleh (2008), Sweis et al. (2008), Hamzah et al. (2011).
6	Lack of coordination for solving financial and operational problems	Taghizadeh and Laleh (2008).
7	Lack of coordination with owner or contractor	Sweis et al. (2008), Taghizadeh and Laleh (2008), Hamzah et al. (2011).
8	Underestimation of the costs of projects	Shakeri et al. (2012).

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9	Inflexibility	Assaf and Al-Hejji (2006), Hamzah et al. (2011), Doloi et al. (2012), Aziz and Abdel-Hakam (2016).
10	Conflicts between consultant and design engineer	Assaf and Al-Hejji (2006), Hamzah et al. (2011), Aziz (2013), Aziz and Abdel-Hakam (2016).
11	Inadequate experience	Assaf and Al-Hejji (2006), Hamzah et al. (2011), Aziz (2013), Marzouk and El-Rasas (2014), Aziz and Abdel-Hakam (2016).
12	Financial problems	Hamzah et al. (2011).
13	Lack of working knowledge	Hamzah et al. (2011).
14	Lack of consultant's site staff	Hamzah et al. (2011).
15	Lack of effective project control	Fallahnejad (2013).
16	Poor communication with other parties	Assaf and Al-Hejji (2006), Salama et al. (2008), Aziz (2013), Aziz and Abdel-Hakam (2016).
17	Delay in performing inspection and testing	Frimpong et al. (2003), Assaf and Al-Hejji (2006), Aziz (2013), Ruqaishi and Bashir (2015), Aziz and Abdel-Hakam (2016).

As it can be seen in most studies, delay in reviewing documents has been mentioned as an important factor in the long runtime of the project.

Table 3 shows factors affecting the delay in the construction projects related to contractors.

TABLE 3: FACTORS CAUSING DELAY IN CONSTRUCTION PROJECTS RELATED TO CONTRACTORS.

No.	Factors	Authors
1	Financial problems	Frimpong et al. (2003), Assaf and Al-Hejji (2006), Ahmadpour (2006), Taghizadeh and Laleh (2008), Sweis et al. (2008), Safavi et al. (2010), Ravand and Salahi A. (2011), Hamzah et al. (2011), Doloi et al. (2012), Shakeri et al. (2012), Atafar and Eghbali (2013), Aziz (2013), Marzouk and El-Rasas (2014), Ruqaishi and Bashir (2015), Aziz and Abdel-Hakam (2016).
2	Inadequate experience and knowledge	Taghizadeh and Laleh (2008), Salama et al. (2008), Shakeri et al. (2012), Doloi et al. (2012), Fallahnejad (2013), Atafar and Eghbali (2013), Aziz (2013), Marzouk and El-Rasas (2014), Ruqaishi and Bashir (2015), Aziz and Abdel-Hakam (2016), Alzara et al. (2016).
3	Improper planning	Assaf and Al-Hejji (2006), Sweis et al. (2008), Taghizadeh and Laleh (2008), Safavi et al. (2010), Hamzah et al. (2011), Doloi et al. (2012), Shakeri et al. (2012), Atafar and Eghbali (2013), Aziz (2013), Marzouk and El-Rasas (2014), Ruqaishi and Bashir (2015), Aziz and Abdel-Hakam (2016).
4	Poor site management	Frimpong et al. (2003), Assaf and Al-Hejji (2006), Sweis et al. (2008), Safavi et al. (2010), Hamzah et al. (2011), Doloi et al. (2012), Shakeri et al. (2012), Fallahnejad (2013), Babaei and Hoseini (2014), Atafar and Eghbali (2013), Aziz (2013), Marzouk and El-Rasas (2014), Ruqaishi and Bashir (2015), Aziz and Abdel-Hakam (2016).
5	Inappropriate construction methods	Assaf and Al-Hejji (2006), Hamzah et al. (2011), Doloi et al. (2012), Shakeri et al. (2012), Atafar and Eghbali (2013), Aziz (2013), Ruqaishi and Bashir (2015).
6	Problems related to subcontractors	Assaf and Al-Hejji (2006), Safavi et al. (2010), Hamzah et al. (2011), Shakeri et al. (2012), Atafar and Eghbali (2013), Marzouk and El-Rasas (2014), Babaei and Hoseini (2014), Ruqaishi and Bashir (2015), Aziz and Abdel-Hakam (2016).
7	Errors during construction	Frimpong et al. (2003), Assaf and Al-Hejji (2006), Salama et al. (2008), Hamzah et al. (2011), Doloi et al. (2012), Atafar and Eghbali (2013), Aziz (2013), Fallahnejad (2013), Marzouk and El-Rasas (2014), Ruqaishi and Bashir (2015), Aziz and Abdel-Hakam (2016).
8	Improper pricing by contractors to win the bid	Taghizadeh and Laleh (2008), Safavi et al. (2010), Aziz and Abdel-Hakam (2016).
9	Lack of attention to the advice of owner and consultant	Safavi et al. (2010).
10	The conflict between contractor and other parties (consultant & owner)	Assaf and Al-Hejji (2006), Hamzah et al. (2011), Gluszak and Lesniak (2015), Aziz and Abdel-Hakam (2016).
11	Poor communication with employer and consultant	Sweis et al. (2008), Hamzah et al. (2011), Aziz (2013), Aziz and Abdel-Hakam (2016).
12	Poor qualification of the contractor's technical staff	Hamzah et al. (2011), Aziz and Abdel-Hakam (2016).
13	Personnel changes of contractor's key staff	Gluszak and Lesniak (2015).
14	Lack of contractor's administrative personnel	Sweis et al. (2008).
15	Shortage of technical personnel	Sweis et al. (2008).
16	Delays in payment to subcontractors	Sweis et al. (2008), Salama et al. (2008), Alzara et al. (2016).
17	Frequent change of subcontractors	Doloi et al. (2012), Aziz (2013), Aziz and Abdel-Hakam (2016).
18	Poor performance	Alzara et al. (2016).
19	Lack of control over subcontractor	Doloi et al. (2012).
20	Use of obsolete technology	Aziz (2013).
21	Unreliable subcontractors	Aziz (2013), Aziz and Abdel-Hakam (2016).

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22	Unfamiliarity with government regulations and laws	Ruqaishi and Bashir (2015).
23	Lack of use of experienced technical personnel by contractor	Taghizadeh and Laleh (2008), Ravand and Salahi A. (2011), Alzara et al. (2016).

As it can be seen in most studies, financial problems, poor site management and improper planning have been mentioned as effective factors in the long runtime of the project.

Table 4 shows other factors affecting the delay in the construction projects.

TABLE 4: OTHER FACTORS CAUSING DELAY IN CONSTRUCTION PROJECTS.

No.	Factors	Authors
1	Difficulties in obtaining construction materials	Frimpong et al. (2003), Assaf and Al-Hejji (2006), Ahmadpour (2006), Taghizadeh and Laleh (2008), Salama et al. (2008), Sweis et al. (2008), Doloi et al. (2012), Shakeri et al. (2012), Shakeri et al. (2013), Atafar and Eghbali (2013), Aziz (2013), Fallahnejad (2013), Marzouk and El-Rasas (2014), Gluszak and Lesniak (2015), Aziz and Abdel-Hakam (2016), Alzara et al. (2016).
2	Low quality of construction materials	Ahmadpour (2006), Shakeri et al. (2012), Atafar and Eghbali (2013), Fallahnejad (2013), Aziz and Abdel-Hakam (2016), Al-Hazim et al. (2017).
3	Changes in material types and specifications during construction	Assaf and Al-Hejji (2006), Sweis et al. (2008), Shakeri et al. (2012), Aziz (2013), Marzouk and El-Rasas (2014), Ruqaishi and Bashir (2015), Aziz and Abdel-Hakam (2016).
4	Shortage of labor	Assaf and Al-Hejji (2006), Sweis et al. (2008), Shakeri et al. (2012), Atafar and Eghbali (2013), Aziz (2013), Marzouk and El-Rasas (2014), Ruqaishi and Bashir (2015), Aziz and Abdel-Hakam (2016), Frimpong et al. (2003), Al-Hazim et al. (2017).
5	Low productivity of labor	Assaf and Al-Hejji (2006), Sweis et al. (2008), Salama et al. (2008), Doloi et al. (2012), Shakeri et al. (2012), Atafar and Eghbali (2013), Aziz (2013), Fallahnejad (2013), Marzouk and El-Rasas (2014), Gluszak and Lesniak (2015), Ruqaishi and Bashir (2015), Aziz and Abdel-Hakam (2016).
6	Damage of equipment	Frimpong et al. (2003), Ahmadpour (2006), Assaf and Al-Hejji (2006), Sweis et al. (2008), Shakeri et al. (2012), Atafar and Eghbali (2013), Aziz (2013), Aziz and Abdel-Hakam (2016).
7	Low efficiency of equipment	Ruqaishi and Bashir (2015), Al-Hazim et al. (2017).
8	Shortage of equipment	Assaf and Al-Hejji (2006), Sweis et al. (2008), Salama et al. (2008), Ravand and Salahi A. (2011), Shakeri et al. (2012), Aziz (2013), Babaei and Hoseini (2014), Marzouk and El-Rasas (2014), Gluszak and Lesniak (2015), Ruqaishi and Bashir (2015), Aziz and Abdel-Hakam (2016).
9	Severe weather conditions	Frimpong et al. (2003), Shakeri and Ghorbani (2005), Assaf and Al-Hejji (2006), Ahmadpour (2006), Taghizadeh and Laleh (2008), Sweis et al. (2008), Ravand and Salahi A. (2011), Hamzah et al. (2011), Doloi et al. (2012), Aziz (2013), Shakeri et al. (2013), Atafar and Eghbali (2013), Marzouk and El-Rasas (2014), Babaei and Hoseini (2014), Gluszak and Lesniak (2015), Ruqaishi and Bashir (2015), Aziz and Abdel-Hakam (2016), Al-Hazim et al. (2017).
10	Unforeseen site conditions	Frimpong et al. (2003), Assaf and Al-Hejji (2006), Ahmadpour (2006), Taghizadeh and Laleh (2008), Doloi et al. (2012), Atafar and Eghbali (2013), Aziz and Abdel-Hakam (2016).
11	Changes in government regulations and laws	Assaf and Al-Hejji (2006), Sweis et al. (2008), Hamzah et al. (2011), Shakeri et al. (2012), Atafar and Eghbali (2013), Aziz (2013), Fallahnejad (2013), Marzouk and El-Rasas (2014), Gluszak and Lesniak (2015), Ruqaishi and Bashir (2015), Aziz and Abdel-Hakam (2016).
12	Price fluctuations	Frimpong et al. (2003), Ahmadpour (2006), Ahmadpour (2006), Sweis et al. (2008), Salama et al. (2008), Taghizadeh and Laleh (2008), Ravand and Salahi A. (2011), Shakeri et al. (2012), Doloi et al. (2012), Aziz (2013), Shakeri et al. (2013), Marzouk and El-Rasas (2014), Babaei and Hoseini (2014), Aziz and Abdel-Hakam (2016), Al-Hazim et al. (2017).
13	Public holidays	Babaei and Hoseini (2014), Aziz and Abdel-Hakam (2016).
14	Unexpected events	Shakeri and Ghorbani (2005), Taghizadeh and Laleh (2008), Safavi et al. (2010), Atafar and Eghbali (2011), Atafar and Eghbali (2013), Babaei and Hoseini (2014), Marzouk and El-Rasas (2014), Aziz and Abdel-Hakam (2016).
15	Contract modification	Hamzah et al. (2011), Aziz and Abdel-Hakam (2016).
16	Labor strikes	Hamzah et al. (2011), Fallahnejad (2013), Aziz (2013), Marzouk and El-Rasas (2014), Aziz and Abdel-Hakam (2016).
17	Inadequate modern equipment	Assaf and Al-Hejji (2006), Aziz (2013), Gluszak and Lesniak (2015), Aziz and Abdel-Hakam (2016).
18	Laborers personal conflict	Assaf and Al-Hejji (2006), Aziz (2013), Aziz and Abdel-Hakam (2016).
19	Delay in finalization of rates for extra items	Doloi et al. (2012), Aziz and Abdel-Hakam (2016).
20	Obsolete technology	Aziz and Abdel-Hakam (2016).
21	Site accidents due to negligence	Doloi et al. (2012), Aziz and Abdel-Hakam (2016).
22	Lack of skilled operators for specialized equipment	Doloi et al. (2012), Aziz and Abdel-Hakam (2016).
23	Changes in market conditions	Ruqaishi and Bashir (2015).

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As it can be seen in most studies severe weather conditions, difficulties in obtaining construction materials, and price fluctuations have been mentioned as key factors in the long runtime of the project.

IV. Results

The results showed that payment delay by owner, delay in reviewing of documents by consultant, financial problems of contractor, and severe weather conditions have been mentioned more than other as the critical factors causing delay in construction projects.

For oil and gas projects [1,11,13,15,19] change orders and changes in scope of work by owner, delay in reviewing of documents by consultant, inadequate experience and knowledge and errors during construction by contractor, and low productivity of laborer have been indicated as key factors comparing with the other factors.

V. Conclusions

In this paper, factors affecting delays in construction projects were identified and categorized in four groups consisted of owner, consultant, conductor, and other factors. The more repeated factors for construction projects and especially for oil and gas projects were determined. For future research prioritizing of these factors is suggested.

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