



Financial Risks Contributing to Delay of Oil and Gas Projects in Egypt

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Abstract: Delay is a universal phenomenon in construction industry; and oil and gas construction projects in Egypt are not an exception. Oil and gas projects have a long construction cycle, huge investments, and multitudinous risks which negatively affect these projects' objectives. One of the main risks which have been identified to hinder the projects development is the financial risks. This paper addresses the issue of financial risks contributing to the delay of oil and gas projects in Egypt. Outlining a detailed literature review, 18 financial risks have been identified and grouped into 4 main categories—namely: late payment, financial market instability, fiscal mismanagement, and imperfect policies and project studies. The identified risks are tabulated in a questionnaire form which was sent to engineers specialized in construction of oil and gas projects in Egypt asking their contribution to specify the severity of impact and frequency of occurrence of the 18 identified risks. The results reveal that the top ranked risks according to the severity of impact and likelihood of occurrence are project materials monopoly by suppliers and delay in subcontractors/suppliers progress payment by the main contractor respectively. While, delay in subcontractors/suppliers progress payment by the main contractor, lack of costs following-up during the project execution by the construction parties, owner delay in freeing the main contractor financial payments, project materials monopoly by suppliers, and contractor handling too many projects at the same time are the most important financial risks contributing to the delay of oil and gas projects in Egypt.

Keywords: Delay, Financial Risks, Oil and Gas Construction Projects, Egypt

1. Introduction

Construction delays become an integral part of the project's construction life. Even with today's advanced technology, and management understanding of project management techniques, construction projects continue to suffer delays and project completion dates still get pushed back [1]. The delay issue specifically in oil and gas construction is a scary and frequent phenomenon. For instance, in a recent review of 365 upstream, liquefied natural gas, pipeline, and refining megaprojects with a price tag of at least US\$1 billion, the global consulting firm Ernst and Young found that 73% of these oil and gas projects reported schedule delays [2]. Further, the National Iranian Gas Company indicated that over 90% of the constructed projects in Iran are behind schedule [3]. Most recently, the findings of a study conducted by Khan [4] in oil and gas construction projects in Kuwait reported that, the oil and gas construction are exposed to delays of over twelve months.

Construction delay is a costly, complex, and risky problem encountered in construction projects [5]. Apart from its negative impact on project delivery, project delay can cause cost overrun, disputes, and loss of profit [6-8]. In construction of mega projects such as oil and gas projects, delay could cost contracting companies trillions of dollars in lost investments. Furthermore, project delays in the oil and gas industry can also hamper the economic development of countries whose economies are heavily dependent on the lucrative oil and gas sector. According to Abd El-Razek et al. [9], Fugar and Agyakwah-Baah [10], and Kazaz et al. [11] construction delay can be affected by several types of risks such as contractual, environmental, financial risks...etc. Furthermore, financial risks are considered the most important risks which have a severe effect on the projects time performance.

Around the world numerous studies were carried out to identify the root financial causes contributing to the delay of construction projects. More or less, these studies focused on building projects or construction projects of all types except oil and gas projects [12-14]. In addition, most of the

background studies in Egypt focused only on identifying delay causes in all types of construction projects except oil and gas projects such as the studies of Aziz and Abdel-Hakam [15] in road construction projects and Kholifet al. [16] in educational building projects. According to Chang [17] identifying the reasons is usually the first step when addressing a problem and then corrective actions can be taken. So, it is hoped that the findings of this paper will guide efforts to enhance the time performance of oil and gas projects in Egypt through identifying the financial risks responsible for delay in this important industry.

2. Study Objectives

The main objectives of this study include the following points:

1. Identifying the causes and groups of financial risks contributing to the delay of oil and gas construction projects.
2. Determining the most effective and frequent financial risks contributing to the delay of oil and gas projects in Egypt.
3. Suggesting recommendations to minimize consequences of financial riskson delay of oil and gas projects in Egypt.

3. Literature Review

In this paper, the literature review is undertaken in two fields. While the first field includes factors influencing delay of oil and gas projects, the second field comprises the financial risks contributing to the delay of construction projects. In oil and gas field, Jergeas [18] surveyed international senior project manager ownership, engineering procurement, and construction organizations in Canada, the United States, the United Kingdom, Norway, Germany, Spain, Chile, India, and Australia. Based on the analysis of the survey results, the causes of cost and schedule overruns were classified under the following four categories: 1) unrealistic or overly optimistic original cost estimates and schedules, 2) incomplete scope definition or inadequate front-end loading and poorly completed front-end deliverables, including milestone schedule slippage, 3) inappropriate project strategies for the mega-oil sands environment, and 4) mismanagement of the construction phase.

Jergeas and Ruwanpura [19] expanded the work of Jergeas [18] and reclassified the causes of cost and schedule overruns in mega oil sands projects in Alberta, Canada, into the following five categories: 1) misplaced optimism, 2) misguided objectives, 3) misaligned strategies, 4) misdirected execution, and 5) missing links. Salamaet al. [20] conducted a study in order to investigate the main causes of delays within oil and gas projects in UAE. They identified 35 causes of delay. Out of this delay in start of purchasing long-lead items, delay in material and equipment delivery, lack of experience and knowledge of contractor technical, poor project management by contractor, and shortage of experienced and qualified

engineers' were the first five causes of delays.

Fallahnejad [3] exploited a survey to prioritize the causes of delay in gas pipeline construction projects in Iran. Based on responses from 23 experts in executions of oil/gas pipeline projects, it was found that the five most significant causes of project delay (from among 43 factors) were related to imported materials, unrealistic project duration, client-related materials, land expropriation, and change in orders. Ruqaishi and Bashir [21] discussed delays in construction projects in oil and gas processing facilities in Oman. A total of 44 possible causes were outlined during the research. The results of the study revealed that poor site management and supervision by contractors, problems with subcontractors, inadequate planning and scheduling of projects by contractors, poor management of contractors' schedules, delay in delivery of materials, lack of effective communication among project stakeholders, and poor interaction with vendors in the engineering and procurement stages were the seven major factors responsible for project delay.

Khan [4] identified the importance index of 70 causes of delay in oil and gas projects in Kuwait. The findings of the study showed that scope variations, shortage of skilled labor, inadequate planning and scheduling, poor subcontractor performance, and long wait for approval of drawings/documents were the most important causes of delay in oil and gas projects. Most recently, Long [22] highlighted that the typical problems leading to delay on process plant and offshore oil and gas projects are insufficiently defined front end engineering designed, inadequate design, multiple change orders, insufficient management of multiple prime contractor design and construction interfaces, and owners have not a sufficient number of experienced personnel.

Financial problems have been noticed as the root cause of delay by many scholars. Abd El- Razeke et al. [9], Fugar and Agyakwah-Baah [10], Kazaz et al. [11], Abdul-Rahmanet al. [12], Vu et al. [13], Saisi et al. [14], and Abdul-Rahmanet al. [23] are perhaps the only studies that focused on specifying financial causes contributing to the delay of construction projects. Abd El- Razeke et al. [9] in Egypt, Fugar and Agyakwah-Baah [10] in Ghana, and Kazaz et al. [11] in Turkey identified several groups of delay in their studies such as financial, materials, equipment, managerial, and labors. One of the main objectives of these studies was to identify the importance index of their studied groups. The findings of the previously mentioned studies showed that the first and most important group responsible for delay of construction projects is the financial group.

Abdul-Rahmanet al. [12], and Abdul-Rahmanet al. [23] in their studies identified 19 financial root causes contributing to the delay in Malaysian construction projects. The identified factors were subjected to a questionnaire survey which was sent to clients, contractor, consultants, and bankers. The study results indicated that the five predominant financial causes affecting projects delay were: contractors' unstable financial background, client's poor financial and business management, difficulties in getting loan from financiers, and inflation. Further, Vu et al. [13] in Vietnam showed that the five

categories of financial factors, including the policy change, slow payment, financial mismanagement, financial market changes, and lack of fiscal, have significant effects on schedule delay of Vietnam highway BOT construction projects.

This brief review of the literature reveals the following points:

- Factors affecting schedule delay in oil and gas projects vary from one country to another.
- Few studies have been conducted to identify the financial factors responsible for projects delay and there has not been any study investigating the root financial causes of delay in oil and gas projects whether in Egypt or any country around the world.

4. Study Methodology

This section describes the methodology for investigating the financial risks contributing to the delay of oil and gas construction projects in Egypt. It focuses on the process of identifying the financial risks, questionnaire design, collecting data, and the used analysis tools.

4.1. Identifying Financial Risks Contributing to Project Delay

In the present study 18 financial risks have been identified to examine their effect on the delay of oil and gas projects in Egypt. Furthermore, the identified financial risks have been classified into four groups as follow: group (1) late payment, group (2) financial market instability, group (3) fiscal mismanagement, and group (4) imperfect policies and project studies. Table 1 shows the identified financial risks and their related groups.

4.2. Questionnaire Design

After the financial risks which may affect the delay of oil and gas projects have been identified, a questionnaire has been designed in order to achieve the study objectives. The designed questionnaire consists of two parts. The first part includes general information questions about the respondents such as his/her name (optional) and relevant working experience. While, the second part is designed to identify the severity of impact and frequency of occurrence of the identified financial risks based on a scale as shown in Table 2.

4.3. Data Collection

A very important step in the data collection process is to select the sample size. From many experienced practitioners contacted, 23 were willing to participate in the study. All the respondents were involved in the construction of oil and gas projects in Egypt with average of 10 years of experience in this industry. The appropriateness of a small-sample size is not uncommon issue in the construction management studies. For instance, the sample size of the studies of Tah et al. [24], Chua et al. [25], Fallahnejad [3], Gudiene et al. [26], and Akal et al. [27] were 7, 20, 23, 5 and 5, respectively. Thus, the sample size

of the present study compares favorably with those reported in earlier relevant studies.

Table 1. Financial risks contributing to the delay of oil and gas projects.

Sr.	Financial Risk
1	Group (1): Late Payment
F1.1	Owner delay in freeing the main contractor financial payments
F1.2	Delay in subcontractors/suppliers progress payment by the main contractor
F1.3	Delay in valuation and certification of interim payment by consultant
2	Group (2): Financial Market Instability
F2.1	Project materials monopoly by suppliers
F2.2	Difficulties in getting loan from banks
F2.3	The increase in taxes approved by the government
F2.4	High interest rate charged by banks on loans
F2.5	The increase in the price of the project construction materials
F2.6	Increment of foreign exchange rate
3	Group (3): Fiscal Mismanagement
F3.1	Difficulties in financing the project by the contractor
F3.2	Contractor handling too many projects at the same time
F3.3	Lack of costs following-up during the project execution by the construction parties
F3.4	The project corruption, such as bribes and kickbacks
F3.5	Difficulties in financing the project by the owner
4	Group (4): Imperfect Policies and Project Studies
F4.1	Bidding management policy is not perfect (award the project to the lowest bidder)
F4.2	Contractor's ignores of conducting adequate study of the project costs before introducing the tender
F4.3	Imprecise technical description of the project's clauses by the owner
F4.4	Owner's ignores of conducting adequate feasibility study before the project execution

Table 2. Scale used to identify risk's severity of impact and frequency of occurrence.

Scale	1	2	3	4	5
Severity of Impact	Very low	Low	Moderate	High	Very High
Frequency of Occurrence	Very low	Low	Moderate	High	Very High

4.4. Analysis Tools

To analyze the collected data, the following four tools have been used: Cronbach's coefficient alpha, the relative indexes for severity of impact, frequency of occurrence, and importance. Cronbach's coefficient alpha is used to measure the reliability of the questionnaire. While, the relative indexes for severity of impact, frequency of occurrence, and importance are used to prioritize and rank the identified financial risks. Equations (1), (2), (3), and (4) show the forms of these tools.

$$\alpha = \left[\frac{K}{K-1} \right] \times \left[1 - \frac{\sum S_i^2}{S_{sum}^2} \right] \quad (1)$$

Where:

s_i^2 : is the variance for the current sample of respondents;
 k : is the total number of risks affecting delay;
 s_{sum}^2 : is the variance for the sum of the respondents.

$$RSI = \frac{\sum Si}{AN} \quad (2)$$

Where:

RSI: is the relative index for severity of impact;

Si: is the score given to the severity of impact of each risk;

A: is largest amount of score (here 5);

N: is the number of valid responses.

$$RFI = \frac{\sum Fi}{AN} \quad (3)$$

Where:

RFI: is the relative index for frequency of occurrence;

Si: is the score given to the frequency of occurrence of each risk;

A: is largest amount of score (here 5);

N: is the number of valid responses.

$$RII = RSI \times RFI \quad (4)$$

Where:

RII: is the relative index for importance;

RSI: is the relative severity index;

RFI: is the relative frequency index.

5. Analysis of Data

This section presents the analysis of survey responses on the financial risks contributing to the delay of oil and gas projects in two areas: a) reliability testing, and b) major financial risks responsible for project delay.

5.1. Reliability Testing

Through the application of SPSS 16, the questionnaire reliability has been computed. Table 3 shows a summary of the reliability test results for the severity of impact and frequency of occurrence. According to Nunnally and Bernstein [28], a Cronbach's alpha value greater than 0.7 implies that the instrument is acceptable. Therefore, based on these results, the questionnaire is considered reliable.

Table 3. Reliability statistics.

Scale	Number of Items	Cronbach's Alpha
Severity of Impact	18	0.829
Frequency of Occurrence	18	0.869

5.2. Major Financial Risks Responsible for Project Delay

Based on the responses from all the respondents to the questionnaire, the relative indexes for severity of impact, frequency of occurrence, and importance of the identified risks have been identified as shown in Table 4. According to Table 4 project materials monopoly by suppliers is the top ranked risk relative to the severity of impact. While, the top ranked risk according to the likelihood of occurrence is delay in subcontractors/suppliers progress payment by the main

contractor. Furthermore, the results of Table 4 illustrate that the five most important financial risks responsible for the delay of oil and gas projects with respect to their relative index for importance are: 1) delay in subcontractors/suppliers progress payment by the main contractor, 2) lack of costs following-up during the project execution by the construction parties, 3) owner delay in freeing the main contractor financial payments, 4) project materials monopoly by suppliers, and 5) contractor handling too many projects at the same time.

Table 4. Relative indexes for severity of impact, frequency of occurrence and importance and ranking of financial risks.

Code	RSI	Rank	RFI	Rank	RII	Rank
F1.1	0.895652	2	0.826087	5	0.739887	3
F1.2	0.895652	2	0.921739	1	0.825558	1
F1.3	0.800000	10	0.678261	14	0.542609	13
F2.1	0.956522	1	0.747826	7	0.715312	4
F2.2	0.547826	18	0.782609	6	0.428733	16
F2.3	0.800000	10	0.747826	7	0.598261	10
F2.4	0.791304	12	0.713043	10	0.564234	12
F2.5	0.652174	16	0.626087	18	0.408318	17
F2.6	0.686957	15	0.695652	13	0.477883	14
F3.1	0.608696	17	0.634783	15	0.386389	18
F3.2	0.826087	9	0.860870	3	0.711153	5
F3.3	0.895652	2	0.860870	3	0.771040	2
F3.4	0.834783	8	0.704348	12	0.587977	11
F3.5	0.791304	12	0.895652	2	0.708733	6
F4.1	0.886957	6	0.721739	9	0.640151	7
F4.2	0.852174	7	0.713043	10	0.607637	8
F4.3	0.895652	2	0.678261	14	0.607486	9
F4.4	0.713043	14	0.634783	15	0.452628	15

6. Discussions of Results

This section discusses the results obtained in the earlier section for the major financial risks responsible for the delay of oil and gas projects in Egypt according to their relative index for importance.

6.1. Late Payment by the Construction Parties

Previous literature such as Fallahnejad [3] in Iran, Abd El-Razek et al. [9] in Egypt, Fugar and Agyakwah-Baah [10] in Ghana, Kazaz et al. [11] in Turkey, and Kaleemet al. [29] in Pakistan also have determined delay of payment by the construction parties as a major financial risk causing time overrun of construction projects. The illation of this finding is that delayed payment by a party who is involved in the process of payment is a major factor in limiting the cash flow of the next party. Consequently, the financial strength of the next party to carry out the duties and roles assigned to him will be affected which, in turn, directly tie up progress and cause project delay.

6.2. Lack of Costs Following-up During the Project Execution by the Construction Parties

Undoubtedly, the lack of costs following-up during the project execution is a major success-hindering factor and considered main cause of projects delay. The illation of this

finding is that during the project construction phase the cost of implementing any clause or activity of the contract items may exceed its planned budget. Thus, the construction project will be performed over the estimated budget without the knowledge of those in charge of implementing the project. This negatively affects the financial capabilities of the construction parties to deliver the project with the required resources and, hence, the project progress will be obstructed.

6.3. Project Materials Monopoly by Suppliers

The findings of this study show that project materials monopoly by suppliers is one of the major risks contributing to the delay of oil and gas projects in Egypt. The interpretation of this result is that project materials monopoly by suppliers lead to an increase in the prices of the construction materials. Consequently, this will have negative implications on the financial capabilities and cash flow of the construction parties to supply the construction materials to the project in accordance with the project time schedule which, accordingly, subjected the project to schedule delay.

6.4. Contractor Handling Too Many Projects at the Same Time

Abdul-Rahman et al. [12] and Vu et al. [23] also identified that contractor handling of too many projects at the same time as one of the most important fiscal factors affecting the cash flow of the contracting companies and always causing financial difficulties to the contractors. The negative consequences of these financial difficulties will affect the contractor ability to finance and provide the project with the necessary resources. Henceforth, the construction progress will be impeded and the project timetable lies behind schedule.

7. Conclusions

The issue of financial risks contributing to the delay of oil and gas projects in Egypt is discussed in a field survey. Through a detailed literature review, 18 financial risks have been identified and grouped into 4 main categories—namely: late payment, financial market instability, fiscal mismanagement, and imperfect policies and project studies. The field survey included 23 engineers specialized in the construction of oil and gas projects in Egypt. Furthermore, the study adopted the relative indexes for severity of impact, frequency of occurrence, and importance in order to prioritize and rank the identified financial risks. The main findings of the study have been summarized in the following points:

- The top ranked risks according to the severity of impact and likelihood of occurrence are project materials monopoly by suppliers and delay in subcontractors/suppliers progress payment by the main contractor respectively.
- The most important financial risks contributing to the delay of oil and gas projects in Egypt according to the relative index for importance are:

1. Delay in subcontractors/suppliers progress payment by the main contractor.
2. Lack of costs following-up during the project execution by the construction parties.
3. Owner delay in freeing the main contractor financial payments.
4. Project materials monopoly by suppliers.
5. Contractor handling too many projects at the same time.

Recommendations

According to the above-mentioned findings, the following points can be recommended in order to improve the time performance of oil and gas projects in Egypt:

- *Project Financing:* Project financing is essential in every capital project. Financing a project involves the arrangement of adequate funds to pay for the development and operation of a clearly defined project. Delayed payments due to complex financial processes in owner or contractor organizations directly lead to late completion of projects. Therefore, it is recommended for the owners to ensure that they have funds available for projects before they are commissioned. Furthermore, during the bidding process it is too important to check the financial capabilities of all competitors in order to reduce the risk of awarding the contract to an financially sound contractor.
- *Government Regulations and Policies:* The government should enact strict laws and firms in order to eliminate the supplier manipulation. In addition, The regulations and laws should be modified and improved to meet the decline in the economic and political conditions. Furthermore, strengthening policy research and improving financial management ability should be used to minimize the impacts of relevant financial risks on the time performance, and to enhance the profitability of international businesses and the motivation of foreign enterprises to participate in the Egyptian oil and gas projects.
- *Project Budget Updates:* It is recommended to the construction parties to periodically update the cost of the project. This action will help following-up the cost during the project life cycle and determine whether the project cost is over or under the estimated cost and, consequently, take the necessary action in the suitable time toward any overrun in the project budget.

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