

Construction Delays in Iranian Civil Engineering Projects: An Approach to the Financial Security of Construction Business

Behzad Abbasnejad, Hashem Izadi Moud

Department of Civil and Environmental Engineering, Chalmers University of Technology, SE-412 96, Gothenburg, Sweden

abbasnejad_behzad@yahoo.com

Abstract: Delay in implementation and operation is one of the common problems and challenges of construction projects. Generally, one of the main criteria in assessing the success of a project is delivering it on time and without delay. In most cases, the delay means increased overhead costs and exposure by inflation for contractor. Even with modern technology, project completion time still falls behind the schedule due to delays in running the projects. In the Middle East, due to changes in the structural economy, oil price fluctuations and rising international trade, these delays are more common. One of the reasons for this situation is the traditional style of governing contracts and projects. Since in the traditional styles, contracts are usually awarded to the bidder offering the lowest price. Furthermore, delays and increased costs usually occur during the construction phase rather than the pre-construction phase. To deal with these delays, the project manager needs to know what factors cause delays and try to address these issues. Therefore, with regard to the factors causing delay in general and considering contract and project governing conditions, the main aim of this paper is to identify the major factors leading to delay in construction projects of Iran by using questionnaires and statistical analysis. The findings indicate that the most significant cause of delay is the lack of enough knowledge about the nature of construction industry among the involved members of the projects. It is concluded that further attention and training are essential for senior managers of construction firms and organizations.

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1. Introduction

There is a huge demand in different sectors of the construction industry in Iran. In addition, Iran's geographical position over the seismic belt necessitates the reinforcement and renovation of old buildings in this country (Australian Government-Austrade, 2007).

However, the process of construction in Iran is slow and delay as well as prolongation of contract time is considered as a common problem in the Iranian construction projects (Pourrostam and Ismail, 2012). The delay time depends on such factors as the governing conditions on contracts, the available funds, contractors' experience, consultants' experience, construction materials and the environmental conditions. Prolongation of contract duration seems to be an important problem in construction projects in the developing countries.

In Iran, the majority of projects are completed with delay. The delays inflict major damages to both the employers and contractors. Although, as a result of the government's assistance, the employers' losses, in comparison with losses of contractors which are sometimes unbearable and lead to bankruptcy, are much more bearable. In this paper, the authors try to identify the major factors leading to

delay in construction projects with special emphasis to Iran.

2. Material and Methods

The delay problem has deep roots in the literature on project management since one of the main aspects of project management is time management. Here, firstly, we review the studies undertaken in this respect in some developing countries. Afterwards, the main aspects and specifications of construction projects are introduced. And, thirdly, we concentrate on the delay factors in construction projects in Iran.

In order to evaluate the delay factors, commonly, questionnaires are prepared according to the views of the author(s). In these questionnaires, several causes are proposed for the delays. Every respondent must express his/her own views about the contribution of each proposed factor in the delay. The respondents may complete either four-choice or five-choice answers which include "very much, much, medium, trivial" or "very much, much, medium, slight and negligible".

3. Situation in other developing countries

It is worth mentioning the causes of delays in some other developing countries which make the situation in Iran more apparent. The main causes of

delay in Jordan include: (1) financial difficulties of contractors; (2) interventions and change orders in projects scope by employers, (3) poor planning and scheduling of the project by the contractor, (4) shortage of manpower and (5) insufficient experts in the contractor system (Sweis et al., 2008; Abdalla and Battaineh, 2002). It is concluded that these problems are firstly related to employers and secondly to contractors, because employers by performing traditional bidding method and awarding the contract to the lowest price and also lack of proper financing of project gives rise to the problems. Contractor also due to unfamiliarity and applying the traditional management system instead of proper and scientific project management system heightens the problems related to delay causes.

According to studies undertaken by Frimponga et al. (2003), the delays in construction projects in Ghana country are the result of (1) monthly payment difficulties from agencies, (2) poor contractor management, (3) material procurement, (4) poor technical performances, and (5) escalation of material prices. In this country, employers have been mentioned as the main agents of delays. Moreover, the inflation factor is considered as an independent factor whereas in other papers this factor is neglected (Frimponga et al., 2003; Assaf and Sadiq, 2007).

El-Razek et al. (2008) has evaluated the main causes of delays in Egypt. According to this study, the main causes include: (1) financial difficulties of contractors during construction, (2) changes by employers or his agent and (3) payment problems by employers.

According to the study undertaken by Sambasivan and Soon (2007), the construction projects are delayed in Malaysia as a result of: (1) contractor's improper planning, (2) contractor's poor site management, (3) inadequate contractor experience, (4) inadequate client's finance and payments for completed work, (5) problems with subcontractors, (6) shortage in material, (7) labor supply, (8) equipment availability and failure, (9) lack of communication between parties, and (10) mistakes during the construction stage.

Even though in this paper contractor has been identified as the most significant factor in causing delays, it is worth noting that the factors relating to contractors are caused by employers. The reason is that awarding projects by means of tender is done by considering the lowest price in most cases which in turn leads to the selection of less experience and incompetence contractors. Lack of project funding is also directly associated with employer.

4. Causes of delays in Iran

Several studies have been undertaken in Iran

to examine the causes of project's delays. For example, Pourroostam and Ismail (2012) by using a questionnaire survey studied the causes of delay from consultants and contractors' viewpoint in some residential, office and administration building, and road projects. But, the major criticism of this group of study is the way they neglect to consider the role of employers in the project's delays. But, in Iran, the projects are composed of three factors, namely, employers, consultants and contractors (Rezazadeh Azar, 2005) so in this study we also consider the role of employer in causes of construction projects' delays.

In this study, we distribute the questionnaires among project managers, senior managers and site managers who take the responsibility as consultant, contractor and employer in different construction firms and organizations. Selected employers were 81 project managers (Project executives) and 60 senior managers. Selected consultants were 81 project managers and 80 senior managers of consultation engineering firms. Chosen contractors also include 81 project managers and 100 senior managers of contractor firms as well as 81 site managers. Analysis of the answers to the questions raised in these questionnaires would reveal the major causes of delay from the point of employers, consultants and contractors. The average answers of these three groups by applying the correlation coefficient among them, reveals the major causes of delays.

The proportion of returned questionnaires to distributed questionnaires is 60%, 64% and 65% for employers, consultants and contractors respectively. In order to analyze the returned questionnaires, the relative importance index (RII) was calculated using the following formula:

$$RII = \frac{\sum P_i U_i}{N(n)}$$

Where,

RII = relative importance index,

Pi = respondent's rating of cause of delay,

Ui = number of respondents placing identical weighting/rating on cause of delay,

N = sample size; and

n = the highest attainable score on cause of delay.

The score for each factor is calculated by summing up the scores given to it by the respondents. To examine the undertaken ranking correlation for each of the parties, we also applied the Spearman's rank correlation coefficient. The Spearman's rank correlation coefficient (ρ) was calculated as follows:

$$\rho = \frac{1 - 6 \sum d^2}{n(n^2 - 1)}$$

Where:

d = the difference between the ranks given by any two respondents for an individual cause and

n = the number of causes or groups.

In the questionnaires, the causes of delays are categorized in different groups as follows:

A: delays from employers

The main causes of delays by employers include financial statement, adjustments and other payments to contractors which may engage in delays as a result of such factors as administrative bureaucracy

- Interferences by employers: because the projects are conducted three factorials (contractors, employers and consultants).
- Delays in decisions by employers.
- The proposed project-time is too short.
- Administrative bureaucracy in the organization of employer.
- Selection of contract type for awarding the project.
- Bidding method and contractor selection (lowest price) which may lead to selection of less experienced and incompetent contractor(s).
- Changes in scope of projects' activities.

B: delays from contractors

Contractors are also responsible for delays as a result of:

- Sub-contractors
- Contractors being less experienced and incompetency
- Mismanagement of workshop
- Unsuitable performance method
- Improper planning
- Mistakes during activities and operations.
- Financially improper contractors

C: delays from consultants

Consultants may also influence the delays via several ways:

- Lack of complete awareness on conditions of the contracts.
- Delays in shop drawings approval
- Quality control and supervision problems
- Delays in receiving the results of tests and surveys.
- Mistakes in planning
- Incorrect estimation of the project costs

D: the Influence of construction materials

The main roles of Construction materials on prolongation of projects are as follows:

- Quality of materials
- Shortages of materials
- Delay in supplying construction materials
- Changes in the variety and characteristics of construction materials during construction

E: factors relating to construction work-force

These include:

- Supplying human force
- Efficiency of work force
- Skillfulness and specialization of work force

F: factors relating to machinery and equipment

The main causes relevant to this factor include:

- Absence of required equipment and machinery or their spares
- Destructed machinery
- Efficiency of the available machinery

G: factors relating to contraction

In this respect, the following factors have been recognized:

- Prolonged negotiations and disputes
- Improper linkage between the groups involved in the project.
- Problems, mistakes and ambiguities in contraction

Table 1. Ranking of delay causes from the employer, consultant and contractor perspective in Iran

causes of delays from the point of contractors	causes of delays from the point of consultants	causes of delays from the point of employers
Financial statement, adjustments and other payments	Mismanagement of workshop	Mismanagement of workshop
Improper understanding of the project scope	Contractors being less experienced and incompetency	Financial statement, adjustments and other payments
Incorrect estimation of the costs of projects	Financial statement, adjustments and other payments	Mistakes in planning
Delays in preparing shop drawings	Skillfulness and specialization of work-force	Skillfulness and specialization of work-force
Improper planning	Incorrect estimation of the costs of projects	Delays in preparing shop drawings
Traditional bidding method and contractor selection (lowest price)	Delays in preparing shop drawings	Contractors being less experienced and incompetency
Financially non-proper contractors	Improper planning	Unsuitable performance method

H: external factors

The main external factors include:

- Inflation and increase in prices
- Changes in laws and standards
- Conflicts with neighbors and residents of the area.
- Political problems
- Social and cultural conditions of the area

In this study, questionnaires were distributed among senior managers of employers, contractors and consultants which include the above-mentioned factors. Compilation and analysis of questionnaires revealed the main causes of delays from the point of contractors, employers and consultants (Table 1).

According to this table, the main causes of delays include non-payment of the list of expenses (financial statements), adjustment and insufficient financial support by employers. The other factors are also indirectly related to employers. Because employers may not select skillful contractors, contractors suffer from such problems as mismanagement in sites, improper estimation of the costs of the project, lack of skilled manpower, insufficient experience. In all, the resultants of opinions of employers, contractors and consultants about delays in construction projects of Iran are listed in Table 2.

Table 2. Ranking of general delay causes in Iran.

Causes of construction project delays in Iran	Rank
Financial statement, adjustments and other payments	1
Mismanagement of workshop	2
Delays in preparing shop drawings	3
Improper understanding of the project scope	4
Contractors being less experienced and incompetency	5
Skillfulness and specialization of work-force	6
Incorrect estimation of the costs of projects	7

5. The nature of projects in construction industry

So far, we discussed the factors of delays and their relative importance. In order to present solutions for these problems, it is worth to mention the main specifics of projects in construction industry. According to Wideman (1997), construction projects are physical and tangible in nature and activities in this industry are mainly skillful works in which the activities are considered as repetitive of the former operations. But, they improve as a result of repetition and training. The main specifications of construction industry are expressed in Table 3.

Table 3. Characteristics of Construction projects from Youker (1999) perspective.

<i>Construction Projects</i>	
Cost	High
Technology	Low
Scope of activities	Specified
Time pressure	Low
Risk	Low

Youker (1999) believes that if the high cost of construction projects is considered as an inherent feature of this industry and if the scope of project activities is properly defined, the project risks, time pressure and temporal problems would reduce considerably.

5.1 Delay Problems

Delays in projects pose difficulties both for employers and contractors:

5.1.1. Difficulties for employers

The main difficulties which delays in projects bring about for the employers include:

- Losing the benefits accruing from the exploitation of the project.
- In adjustable contracts, delays cause increases in costs of employers as a result of paying adjusting fees.
- Decrease in expected effectiveness of the project which is called dead duck.

5.1.2. Difficulties for contractors

The main difficulties which delays bring about for contractors are as follows:

- Contractors are usually forced to pay overhead costs such as maintenance of facilities, protection of completed parts up to delivering time and paying such costs as salaries of permanent personnel, water, electricity, guards, renting fees, etc.
- The overhead coefficient is usually 1.30 which is according to schedule of prices independent from contraction duration. So, the more the contraction is delayed, the more the overhead costs are increased which the contractors are paid according to the list of completed operations.
- As a result of delays, such expenses as amortization of machinery, costs of machinery repairment and maintenance and decrease in economic efficiency of machinery are imposed to contractors.
- Personnel and workers engaged in delayed projects may become depressed and demoralized.

- The possibility for contractors to attend in new projects is decreased.
- Surety bond costs for the extension of the period of contracts as well as the engagement of a part of financial capability of contractors, because project imprest blocks a part of its capitals.
- Decrease in receipts of contractors which may cause problems for such payments as insurance, taxes, wages, official costs, etc.

According to Iranian association of construction companies (2008), mathematical analysis of overhead coefficient and permanent costs of employers due to 25% delays poses losses equivalent to about 8% profits from overhead coefficients whereas delays in projects usually exceed 25% of contract time.

In all, delay is considered as a main problem in construction industry. Although commonly the employers are the causes not the contractors, both of them are affected by delays. In Iran, in which governmental organizations are usually the employers, they usually can bear these losses. But, contractors lacking this privilege and as a result they encounter many problems and even may become bankrupt. The other problem in construction industry in Iran is usually poor quality of projects which usually is directly connected to delay losses imposed to contractors.

6. Discussion and Conclusion

According to this study, firstly, it reveals that some delay causes are common between different countries and some are not. The reason might be because the delay is a factor that has a close relationship with working culture, management style, methods of construction, geographical condition, stakeholders, the government policy, economic situation and availability of resources. These are concepts that often vary from one country to another. Hence, it is not so surprising that causes of delay in Iranian construction project may be more significant or more frequent in comparison to other developing countries.

Secondly, the main factors of delays in Iranian construction projects are identified as:

- Non-paying financial statements, adjustments, etc.
- Changes in the extent of projects and interferences of employers.
- Project delivery to contractors according to low tendering.
- Poor site management by contractors

All of the above-mentioned factors are in contrast to the needs of this industry which in turn is

due to unfamiliarity of major managers with the nature of construction projects.

Since the employers are the owners of projects, they tend to complete the projects with the lowest costs while having the greatest impact during the projects. However, if the employer knows that the construction projects are inherently costly and the scope of activities should be clarified from the beginning of the projects, they would reduce their interferences and would change their approach in bidding phase. They would also pay more attention to financing the projects.

The contractors due to lack of awareness concerning the skillfulness of project activities usually pay low attention to training. However, by training the work force and particularly senior managers, contractors can decrease the delay causes originating from this point.

Therefore, the main causes of delay in construction projects of Iran are insufficient familiarity of involved organizations with the nature of this industry. Hence, it is proposed that the senior managers of contractors and employers be trained in principles of construction management.

Corresponding Author:

Behzad Abbasnejad,
Department of Civil and Environmental Engineering,
Chalmers University of Technology, SE-412 96,
Gothenburg, Sweden.
E-mail: behzada@student.chalmers.se

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