

A Comparison of Effective Factors in Creating Delays from the Contractors' and the Employers' Point of View in Construction of Schools in Tehran

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Abstract

Time is one of the most fundamental factors in investment projects which are directly or indirectly affecting other factors. Since the reconstruction of Iran's schools as one of the Executive agencies, dedicates a large portion of Iran's annual credit to itself, paying attention to the effective factors in the delay in timely delivery of the organization's projects can result in increasing productivity and its performance. The purpose of this study is to identify factors in the delay of the organization's projects in Tehran province from the employer and the contractor's perspective. In the meantime, the qualitative information by using face-to-face interview with the experts and experts of both parties were collected as well as quantitative information which has been prepared through a questionnaire. The results of two groups have identified factors like high inflation in Iran, low affordability of the contractors, delay in financial demands of the contractors by an employer, offering lower prices by contractors, weaknesses in the management of financial resources and lack of familiarity of the contractors with the principles of engineering and workshop management. Also, each group has pointed out factors as effective reasons which are at a low priority of the other group. Identifying these categories of factors can help every researcher to find the claim causing factors in doing the projects by this organization.

Keywords: delay factors, school renovation, claims, time

Introduction

Generally, the word "delay" is a heterogeneous and unbalanced word considering the goals of a project. Although in Iran's current common projects, this interpretation is being treated normally and conventionally, if this phenomenon is not being treated scientifically and practically, it can become a node in the process of implementing a project as well as harming Iran's economy. The simplest interpretation of delay is "a difference in real contracting end and end time of the project which includes authorized and non-authorized delays". It can also be named a sanction or event which prolongs schedule of the project (Deputy of Technical Affairs, 2006).

Based on the above definition, the delays can be divided into two parts including justified delays" and "unjustified delays". Justified delays are those in which the performance of the contractor has nothing to do with it and it is just the employer who would be held responsible. Unjustified delays are those that are directly or indirectly caused by the performance of the contractor, and these delays are generally rooted in the structure of administrative and executive weakness which in the first stage affects the contractor. Identifying the importance of the subject and the way to treat delays is so important that in all countries, a lot of researchers have investigated the matter and have always tried to identify the various factors causing such delays as well as getting rid of them. Based on the researches that have been conducted in several developed countries, the amount of the average delay in the United States' projects was around 2.5 weeks and in England about 1 month (Chan, 2002). While the whole average weight of a project to be finished is estimated

to be approximately 8.9 years in Iran, an important point in conducted studies which should be considered is that, in more developed countries, even a slight amount of delay is not caused by improper structure of contracting agents, weak financial resources or un-standard management, it is mostly because of factors such as unfavorable weather condition or adverse performance of manpower (Chan, 2002). The separation point between the performance of executive directors in more developed countries and developing countries is their pragmatic attitude in handling them, after doing researches and scientific findings. What is important in doing such research, is not to rely on understanding the factors influencing the delays, but finding the right solutions to resolve them. For example, the Presidential Strategic Affairs in its report has merely divided the reasons for delayed construction projects into 9 sections including credits, the Executive agencies, contractors, consultants' design, consultants' studies, logistics supervisor, machineries tools, etc and has reviewed each one's impacts (Iran Budget and Planning Organization). One of the most fundamental factors in the analysis of the delay is to take the type of identifying each of the factors into consideration. Because each of the factors cannot be the main factor influencing the delays alone, each factor during the project affects others and different factors are affected directly or indirectly. Therefore, in addition to the identification of factors, interaction and the intensity of each factor should also be taken into consideration.

Literature Review

As mentioned before, the importance of identifying delays is having a long history for researchers. In this research, the researchers have tried to identify and investigate effective factors in delays of construction projects in Asian countries which are sharing the same cultural background with Iran. For example, "Asif" has pointed out five reasons for delays in Saudi Arabia such as slow preparation and approval of the administrative maps, the delay in paying the contractors, the changes in the design or the wrong design, workforce shortages as well as not skilled workforce (Sweis, Sweis, Abu hammad, 2008). Almoemeni has introduced the main factors for delays in Jordan which are weakness in the design, the employer's shortcomings, the changes of the design, economic conditions, an increase in the quantity and the lack of proper planning (Momeni, 2000). Koshaki, based on a study in Kuwait, has pointed the factors like change in orders, financial limitations of the employer as well as the lack of the experience of the employer in construction business. Fridel and Sayeg have introduced effective factors in delay in the United Arab Emirates and pointed out the factors like slow preparation and approval of the maps, an inappropriate primary planning, slow decision-making process on part of an employer, lack of workforce poor supervision and management in site and low efficiency of manpower (Sweis, Sweis, and Abu Hammad, 2008). In another research, which was conducted by Sambasivan in Malaysia factors such as poor planning of the contractor, poor management of the site on behalf of the contractor, the contractors' lack of experience, insufficient and inadequate payments, problems with sub-contractors, material shortages, work force impact, unavailability of the equipment, lack of communication between the groups and mistakes in construction phase have been identified (Sambasivan, et al, 2007)

Investigating factors affecting delays in Iran have a record of about three decades which is generally on the basis of the former budget and management reports. Furthermore, a lot studies have also been conducted in Iran. For example, Amidi (1994) divides the reasons behind projects' delay into two categories of direct and indirect factors. He categorizes financial and contractors' problem on a direct problem category and problems of study, structure and rules, employers' problems and inflation on indirect problems. Vatankhah (2003) considers factors like lack of the desired work force, the structure weakness, useless information system, planning and budgeting, and

a lack of careful design and evaluation as some of the basic effective factors but he points out the allocation of enough budgets as the most basic factor in increased period of project implementation. But, this factor is also affected by mismanagement and technical and executive systems of the country. "Shirojan" on his study at Amirkabir university has divided the effective factors in dam construction projects into 5 groups including rules, employer, consultant, contractor, ect., which are being summarized in table 1, but an important point which needs to be taken into account is the immense similarities of conducted research's resulting in the developing country and their comparison with the known factors in Iran. For example, in a study done by Chan and Komarosovami (2002), in 11 developing countries, the shared reasons for the delay in various projects were the improper design and poor project management, and the materials shortages.

Table 1. Findings of effective factors on delay of dam projects in Amirkabir University

Effects	Affecting scope
Delay in declaring reduction indexes and their differences	Laws
not a comprehensive list of references	
The lack of sufficient and timely credit assignment	Employer
managers and decision-makers replacement	
Simultaneous designing and implementation in dam construction designs which has led to un-clarity of the work district	
Technical weaknesses in accountability issues	Consultant
Disconnect supervision of Design Department during the project	
The lack of continuous presence or the programs of the designers at the workshop	
Consultant Change during the project	
Short financial capability of the contractor	Contractor
Geographical position of the project	Others

The impact of delays

What has been expressed as the effects of the delay can be briefly introduced in Presidential Strategic Affairs' report. In this report, the effects of the delay have, at least, been named as a doubt on technical and economic justification reports, failure in meeting the technical standards of the project, an increase on the ultimate price of a design, imposition of inflation rate on economy, loss caused by the delay in the operation and services delivery, the cost of lost opportunities in implementation of other projects, failure in running the scheduled programs of the government, the financial, physical and human resources waste in the form of semi-finished projects, creating a lack of confidence to economic programs, etc. Sambasivan (2005) on his study about delay identification on Malaysian projects introduces the impacts of delays as increasing the time, cost, conflict, arbitration and litigation, and ultimately surrendering and leaving the project. Besides the mentioned factors, factors such as delay in return of capital, low purchasing power of project budget due to rising in inflation, people's dissatisfaction as well as customers and beneficiaries' dissatisfaction can be mentioned as destructive effects of delay.

Objectives of the study

This study, like any other conducted studies is looking for the causes of the delay in the project of schools' construction in the province of Tehran. In spite of the conducted similar studies in this field, the structural difference and performance of this organization, as well as direct effects of

schools' construction process in the community and also the importance of the position of Tehran province in Iran 's growth have been a factor in conducting the present study. The difference between the current study and previous ones is that in most of the conducted studies the finding by participant had been presented generally and the participants' categories are ignored as well as not investigating the behavior of each group separately. We have tried to investigate the difference in behavioral and recognition scope of the participant from employer and contractors point of view in order to identify each distinctive view toward this phenomenon. In comparison made between these two views, we can point to some reasons and analyze them better.

Participants

The participants of this study are the contractors and employers who are busy with school construction projects in the city of Tehran. All participants were selected based on the following criteria: work force on the part of the employers having at least B.A degree as well as having at least ten years of experience in this field and for contractors having at least BA degrees as well as ten years of related work experience and the experience of working on three projects in relation with school construction. After collecting the data, the collected data were analyzed through using SPSS software.

Methodology

One of the most common ways of receiving and categorizing information is through face-to-face interview and providing questionnaire, which based on a subject matter both of them can be applied. Based on the information from both selected groups and in order to set the acquired values of items, we have used relative importance index. In this process, a questionnaire which included 58 recognized effective factors in 4 scopes including employers, contractors, laws and environmental conditions have been provided. In order to evaluate the above mentioned items, we have used Likert index and answer is valued in five scopes of very little, little, average, more, a lot more.

It is worth mentioning that the relative importance index is to show the importance of each factor in comparison with other factors in the questionnaire. To calculate it, the following formula is used.

$$R = \frac{\sum_{k=1}^5 W_i . X_i}{\sum_{k=1}^5 X_i}$$

i: item answer(1-2-,...,5)

wi: the allocated weight to the i answer(W1=1,W2=2,W3=3,W4=4,W5=5)

xi: the number of the given answers to the i item

As some of the drawn conclusion in this study is being extracted from questionnaire, quality control of the results is of high importance. A good questionnaire is easy to perform, piratical, easy to interpret, validate and make it reliable. By validity, it means that if the content of the tools or questions on the questionnaire are truly measuring the variables or not. In other words, what we are trying to measure is really being measured or not. This is usually done through experts' opinion. By reliability, it means if it is conducted under the same conditions, would it lead to the same results or not.one of the most common method to check the reliability of the questionnaire is through Cronbach which is explained below.

The general formula of Cronbach Alpha would be presented as below:.

$$\frac{k}{k-1} \left(1 - \frac{\sum pq}{s^2} \right) = \alpha$$

K is the number of the questions, p is the number of right responses, and q is the number of incorrect or wrong responses and s^2 is the total variance of the questions.

If the questions of the study are valued,, the following formula is used to calculate coefficient

$$\left(1 - \frac{\sum_{i=1}^k s_i^2}{s_{sum}^2}\right) \frac{k}{k-1} = \alpha$$

K is number of the questions, s_i^2 is the variance of each question and s_{sum}^2 is the total variance of the questions.

The obtained number in this coefficient is always a number between 1 and 0. The more closer this number is to 0, it shows lack of reliability and the more closer it is to 1, it shows more reliability of the questions. Generally, researchers approve a questionnaire having a reliability of 0.7 at least.

Instruments of the study

As mentioned before, Likert scale was used in order to value each of the criteria as well as asking each participant to rank their answers based on the effect intensity from very little, little, average, more, and a lot more. In this questionnaire, the reasons behind delays have been categorized into four parts as given below.

The employers' scope: management changes in different levels during implantation of the project, delay in timely delivery of the land, delays on management decision making, lack of the necessary maps to start the work, the employer; emphasis in using the new and non-experienced contractors, the way of holding auction and choosing the contractor, delay in timely approval of the contractor agenda, delay in pre-payment paying, delay in timely payment of the contractor, insufficient attention of the employer to audit agencies, hurried decision making about holding auctions, lack of working spirit among employer and audit agencies, not holding meetings with contractors, not financial encouragement for in time delivery of the projects by contractors, lack of enough workforce in designing, lack of workforce in auditing, management and technical weakness in audit agencies, issuing a lot of agendas and changes of the plans, delay in issuing agenda as well as delay in delivery of the needed maps, delay in approving the agendas of done work, ambiguous details in maps, weakness of audit agencies in working with contractors and employers.

Scope of the contractor: suggestion of low price for winning auctions, the lack of familiarity with the principles of engineering and contractor management workshop- lack of familiarity of the contractor to work in renovation of schools, a change in workshop management, insufficient knowledge of contractor and financial contracting company's manager- low financial capabilities of the contractors, the lack of technical, financial and administrative office systems in project, project control expert absence in workshops to control the amount of progress, the lack of the working spirit in the workshop personnel, weakness in executive management- financial resources management weakness, weakness in the lack of proper inventory management, contractors delay in payment of wages and salaries of personnel, not using a project engineer at the workshop, weakness in a number of technical and administrative personnel or contractor, a history of lack of attention to monitoring agency hints regarding the observance of the general terms of the treaty, lack of attention to the hints regarding the implementation of the executive principles, compliance with the terms of the notification in a timely manner, monitoring the agency and client to resolve this problem in a timely manner and lack of preparation for the financial status and submit to monitoring agency

Scope of rules: the rules include weakness in the rules and regulations referring to the work of the contractor which leads to a lack of fit between the technical and executive ability of the

selected contractor, lack of notification of the directive required by the strategic planning and organization related to the indices and coefficients, etc., low amount of penalties for delay, codified rules and administrative weaknesses in the field of fine delay, existing weakness in three factor contracts including contractor, consultant, client, and unclear conditions of article 53 for general conditions of the Treaty Dispute resolution.

Scope of environmental factors: it includes social problems in society, disasters like flood and earthquake, unfavorable weather conditions such as hot weather, lack of some required materials on the market, lack of working force in the area, high inflation in Iran, and an increase in commodity prices

Data analysis

In order to estimate the reliability of the questionnaire a pilot study was conducted. The questionnaire was administered to a similar group of ten. The reliability of the test was estimated through Cronbach Alpha formula which turned to be .93, which proves the high reliability of the questions. By filling all questionnaires and putting them into the software, the analysis of each participant is provided in the following tables.

Table 2: Effective factors in delay based on the contractor' point of view

Mean index value	The identified delay factor from contractors point of view	No
4.93	High inflation and prices increase	1
4.67	The contractor low financial capability	2
4.67	Executive in-capabilities of the contractors and the type of the project	3
4.53	Delay in timely payment of the contractors	4
4.4	Weak financial resources management	5
4.33	Not paying attention to the oversight audits about executive conditions and basics	6
4.2	Low offer of the contractor to win the auction	7
4.2	Contractors lack of knowledge about engineering basics and management	8
4.2	Inadequate knowledge of the contractor and contracting companies managers	9
4.2	Weaknesses in executive management	10

Table 3: Effective factors in delay based on the employers' point of view

Mean index value	Effective factors in delay based on the employers' point of view	No
4.57	High inflation and prices increase	1
4.57	The contractor low financial capability	2
4.57	Delay in timely payment of the contractors	3
4.43	Low offer of the contractor to win the auction	4
4.43	Weak financial resources management	5
4.14	Delay in timely delivery of the land	6
4	Delay in controlling the contractors' agendas	7
4	Contractors lack of knowledge about engineering basics and management	8
4	Weaknesses in regulations regarding referring the work to the contractor	9
3.86	Delay in pre-payment payment	10

Results and Discussion

As it is shown in table 2, the employers' factors in ten basic identified factors are related eight items to the contractor, one to the employer and one more to the environmental factors. However, according to table 3, four factors are related to the employers, four more to the contractors, one factor to the environmental factors and one is related to the weakness in laws and regulations. Among them, as table 4 indicates, six factors have been the common and critical factors, including high inflation and prices increase, the contractors' low financial capability, delay in timely payment of the contractors, low offer of the contractor to win the auction, contractors' lack of knowledge about engineering basics, and weakness in contractors management. Employers have identified factors which all related to contractors who have not paid enough attention including executive incapacities of the contractors and the type of the project, not paying attention to the oversight audits about executive conditions and basics, inadequate knowledge of the contractor and contracting companies managers and weaknesses in executive management. Instead, contractors have introduced factors which employers have paid enough attention to such as delay in timely delivery of the land, delay in controlling the contractors' agendas, weaknesses in regulations and delay in pre-payment payment. Among factors which were identified by the contractors, three factors were observed, which are directly related to the employer. An important point which should be taken into account is that 40% of not-common factors is being related to the contractors by the employers and only 30% of that not- common 40% is related to the employers by the contractors.

Table 4: Common identified factors

Common identified factors	No
High inflation and prices increase	1
The contractor's low financial capability	2
Delay in timely payment of the contractors	3
Low offer of the contractor to win the auction	4
Weak financial resources management	5
Contractors' lack of knowledge about engineering basics and management	6

Table 5 contains the common and not-common identified factors as well as each factor acquired values mean.

The results of the face-to-face interviews show that the employer considers the delay in paying the contractors payment besides the inflation factor as one of the priorities. The inadequate knowledge of the contractor in estimating his right financial capabilities is a set of factors which has been referred to in next phase. Employers, emphasized the delay in land delivery and referred to it as one of the important factors out. One of the most important factors in employers' point of view is extreme delay in auditing as well as checking the agenda which is generally ignored due to date registering problems.

Conclusion

Results of questionnaires analysis shows that high inflation and an increase in prices, the contractor's low financial capability, delay in timely payment of the contractors and contractors' lack of knowledge about engineering basics and management are the main reasons for delays in school construction projects. On the other hand, the findings from face-to-face interviews show high inflation and price increase, the contractor low financial capability, delay in timely payment of the contractors, and offering inappropriate prices. In the primary consideration, it is reviewed that from

the three primary factors, two introduced factors are associated with financial factors with State and the employer's financial policies and also another factor shows the low financial capability of the contractor, that is indirectly related to the two previous factors. Keeping track of client credentials in the absorption, distribution, appropriate allocation of funds between projects, realistic estimates by the employer is set of factors which can be effective in reducing the effects of the above mentioned factors. On the other hand, it is necessary for an employer to use the criterion and arguable financial criteria in accordance with the size of each project in the selection of the contractors. In order to solve the problem, a low bid is offered to win the auction, in addition to the necessary revisions in the regulations and the regulations of the employer's work, and it is necessary for the employer to ask for the documentation and the reasons for offering the price from the technical representatives of the companies and check the accuracy of each one. Weakness in financial management of the contractors, lack of familiarity with the principles of engineering and management workshop are the common basic factors, which have been among other factors announced by the employer.

Table 5: A mixture of both groups identified factors

Mean index sum	Mean index value(contractor)	Mean index value(employer)	Identified factors effecting delay	
9.5	4.57	4.93	High inflation and prices increase	1
9.24	4.57	4.67	The contractor low financial capability	2
9.1	4.57	4.53	Delay in timely payment of the contractors	3
8.83	4.43	4.4	Weak financial resources management	4
8.63	4.43	4.2	Low offer of the contractor to win the auction	5
8.38	3.71	4.67	Executive in-capabilities of the contractors and the type of the project	6
8.2	4	4.2	Contractors' lack of knowledge about engineering basics and management	7
7.91	3.71	4.2	Weaknesses in executive management	8
7.86	4	3.86	Weaknesses in regulations regarding referring the work to the contractor	9
7.8	4.14	3.66	Delay in timely delivery of the land	10
7.77	3.57	4.2	Inadequate knowledge of the contractor and contracting companies managers	11
7.46	4.14	3.66	Delay in pre-payment payment	12
7.27	4	3.27	Delay in controlling the contractors' agendas	13
7.04	2.71	4.33	Not paying attention to the oversight audits about executive conditions and basics	14

The employer is strictly weakening his contraction because people may not trust him. This issue is observed among the announced factors by employers which include the lack of fit with the type of contractor executive power and workload, lack of attention to monitoring agency in compliance with the principles of executive hints, insufficient knowledge of contractors and weakness in executive management. In this context, an employer is required to assess the quality,

identification and detection of the Executive capability of the contractors in order to provide them with projects. Modifying the structure of the rating and valuation of construction companies in Tehran is also another factor that could lead to a reduction of the effect of this factor. The obligation of continuous presence of engineers on the Board of Directors as well as the emphasis on knowledge and education of senior managers of the contracting companies could reduce or eliminate the impacts of these factors. In comparison with the mentioned factors, factors such as delays in the delivery of the land, the delay in handling the case of the financial situation and the delays in the pre-payment are the effective factors in the delay of the project, which is related to the employer. In this regard, it is necessary for the employer to make sure of the land ownership documents before holding auction.

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