

CAUSES OF CONSTRUCTION DELAYS IN IRAN: PROJECT MANAGEMENT, LOGISTICS, TECHNOLOGY AND ENVIRONMENT

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Delay is one of the most reoccurring problems in the construction industry and has negative impacts on project success in terms of time, cost, quality and safety. To minimise these impacts, identifying the most significant causes of delay is vital. The construction industry in Iran, with an annual turnover of US\$ 38.4 billion, is one of the most profitable sectors in the country. However, the process of construction is very slow and expensive in Iran. Recently, due to a sharp increase in the price of land, materials, equipment and the high rate of population growth more efforts are being made to bring efficiency to the industry and mitigate delays in construction projects. This paper presents the second part of an investigation into factors which cause construction delay. The first part was focused on the role of Stakeholders, Politics and Economy in causing delays in projects. The second part will focus on causes of delays associated with Project Management, Logistics, Technology and the Environment. Eleven in-depth interviews were conducted with construction managers and practitioners associated with the Iranian construction industry. Interviewees, with more than 10 years' experience, explained the factors that cause delay in the construction industry in Iran. Responses were analysed qualitatively and a comprehensive interpretation was developed. The results revealed that most construction projects in Iran are subject to delay. Traditional management style, poor scheduling, using old technology, purchasing problems, low level of commitment among supply chain members, storage issues, and poor weather conditions are the top causes of delays in the Iranian construction industry, all of which will be discussed in this paper.

Keywords: construction projects, delay, Iran, management, time.

INTRODUCTION

Successful execution of construction projects and keeping them on time and within budget depends on effective planning and scheduling. High levels of experience and accurate time and cost estimating are necessary to plan a project effectively (Keane and Caletka, 2008). Besides this, attention should also be paid to factors that may endanger the project schedule such as delay. Delay is 'the time overrun either beyond completion date specified in a contract, or beyond the date that the parties agreed upon for delivery of a project' (Assaf and Al-Hejji, 2006). In other words delay is an 'act or event which extends required time to perform or complete work of the contract manifests itself as additional days of work' (Zack, 2003). Despite recent developments in technology and project management techniques, construction projects continue to suffer from delays. In fact delay is an inherent risk in construction and should be treated in a similar fashion as other risks. It can be managed, shared, minimised, or

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accepted but must not be ignored (Keane and Caletka, 2008). Poor attention to the risk of delay may have negative consequences such as time overrun, cost overrun, increase in disputes, arbitration, litigation, and project abandonment (Sambasivan and Soon, 2007). To avoid these problems an appropriate strategy should be developed to minimise delays or mitigate their negative impacts on projects.

Delay is often the result of an unpredicted event that does not necessarily indicate that the management system is ineffective; but the level of agility that a management team displays in response to delays can expose its strength or weakness in relation to delay analysis and management. On most construction projects, there are common causes of delay that frequently happen. Identifying these causes may help practitioners to anticipate potential delays and plan to minimise their effects. Therefore, identifying delays and investigating their causes is an important part of the delay analysis process. The authors conducted an investigation in 2008 to identify the causes of delays in the Iranian construction projects by interviewing experienced practitioners involved in projects in this country. The results were divided into two parts. The first part revealed the causes of delays from the stakeholder, economic and political points of view. The second part (this paper) will focus on causes of delays associated with project management, logistics, technology and environment.

THE IRANIAN CONSTRUCTION INDUSTRY

The construction industry has a major role in the Iranian economy by generating employment and wealth. There is a huge demand in different sectors of the construction industry in Iran. In housing and residential sectors, there is a need for 800,000 additional units every year as young couples embark on married life (Ministry of Housing and Urban Development, 2009). 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). In the transportation sector, many projects such as road, airport and railway building are under construction. In road building alone more than 1000 kilometres of road were constructed in 2007 (Fars News Agency, 2008). There are also several projects in water, oil and gas, industrial and commercial sector that are under construction or in the design stage.

However, the process of construction in Iran is slow and expensive and delay is one of the most reoccurring problems in the Iranian construction projects. This, along with other issues such as increase in the price of land, materials and machines and unavailability of resources has led to a recession in the construction industry in Iran. Recognising this, the Iranian government has widely invested in national projects, specifically in the infrastructure sector (Eco News, 2009). The government has even become involved in the residential sector by introducing the "Maskane Mehr" scheme.

To feed the enormous demands in the different sectors of the construction industry, the Iranian government has attempted to encourage construction firms to improve productivity and efficiency of their projects. In July 2008, the Iranian President, Mahmoud Ahmadi Nejad, announced that his government was looking for different ways to reduce time and costs of construction, especially in residential projects, by insisting on industrialising the construction of buildings (ISNA, 2008). Before this announcement, the government spokesman had publicised that 30 prefabricated building factories will be opened by April 2009 (Fars News Agency, 2008). The government and practitioners are also looking for ways to reduce the time of construction by minimising delays in projects. As was explained before, identifying

different causes of delays is the first step to avoid time overrun and the other negative impacts of delays in construction projects. The aim of this research is to introduce the causes of delays in Iranian construction projects. In this paper project management, logistics, technology and environmental issues will be focused on. By recognising these causes, practitioners will be able to foresee delays in their projects and minimise their negative impacts or at least adapt themselves to their consequences.

PREVIOUS RESEARCH

A large and growing body of literature has investigated causes of construction delays in different countries. Mansfield *et al.* (1994), Ogunlana *et al.* (1996), Kumaraswamy *et al.* (1998), and Sambasivan and Soon (2007) surveyed the causes of construction delays in Nigeria, Thailand, Hong Kong, and Malaysia respectively. Several researchers studied the causes of delay in countries in the Middle East and Persian Gulf region. Mezher and Tawil (1998) explained that preparation and approval of drawings, slowness of the owner's decision-making process, obtaining permits or approval from different government authorities, non-availability of materials on time, and unskilled manpower are the major causes of delay in Lebanese construction projects. The results of a study in Jordan indicated that the main causes of delay in construction projects in this country are related to designers, user changes, weather, site conditions, late deliveries and economic conditions (Al-Momani, 2000). A study in 2006 in Saudi Arabia by Assaf and Al-Hejji revealed the highest frequent factors of delay in this country as: awarding contracts to the lowest bidder, changes in orders by owners during construction, delay in payments, ineffective planning and scheduling by contractors, poor site management by contractors, shortage of labour and difficulties in financing. In the UAE, preparation and approval of drawings, slowness of the owner's decision-making process and inadequate early planning of the project, shortage of manpower, conflict between contractors and the consultants are the major causes of delays (Faridi and El-Sayegh, 2006). In Egypt, El-Razek *et al.* (2008) identified the most important causes of delay as financing by contractors during construction, delays in contractors' payment by owners, design changes by owners or their agents during construction, and no utilisation of professional construction.

Clearly, some delay causes are common between different countries and some are not. The reason is that 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 some causes of delay may be more significant or more frequent in one country in comparison to another. Faridi and El-Sayegh (2006) had a similar interpretation when they compared the causes of delay in the UAE to Saudi Arabia. Therefore, for a better result, identifying causes of delay should be done in a specific country, which is Iran in this research. An important point to raise about the literature is that the majority of research in the area of delay has been conducted using quantitative methodologies and has attempted to rank causes of delay from three points of view: clients, consultants and contractors. There is a lack of qualitative research to interpret the causes of delays from different perspectives. This paper, in contrast with other studies with a similar topic, will use qualitative methodology to provide in-depth understanding of delay causes in construction projects in Iran.

METHOD

This research has a qualitative strategy to achieve an in-depth understanding of the reasons for delays in construction projects in Iran. In fact, it investigates why and how delays happen in construction projects. Hence, a small, but focused and carefully selected sample is chosen to identify delay causes in the Iranian construction industry. In the first stage, literature associated with delays in construction was reviewed. The aim of the literature review was to find different causes of delays in the other countries, specifically in the Persian Gulf region where Iran is also located. Fortunately, some research was conducted in countries such as Jordan, Lebanon, Saudi Arabia, UAE and Egypt.

To meet the aim of this study getting help from experienced people in the field of construction in Iran was essential. Hence, eleven open-ended interviews were conducted with practitioners who are involved with day-to-day issues of the construction industry in Iran. All participants have ten or more years of experience and are involved in residential, commercial, and road building projects in Iran. Data gathered from interviews was analysed by using a qualitative data analysis method. First, responses were classified under seven relevant categories as (1) Stakeholders; (2) Economy; (3) Politics; (4) Project Management; (5) Logistics; (6) Technology; and (7) Environment. Figure 1 illustrates the structure of the categories. Under these categories, new sub-categories were developed by progressing through the transcript of interviews. Then, a comprehensive interpretation was developed to produce well-grounded conclusions. Wherever it was suitable, the participants' direct quotes are cited anonymously to make the interpretation more meaningful.

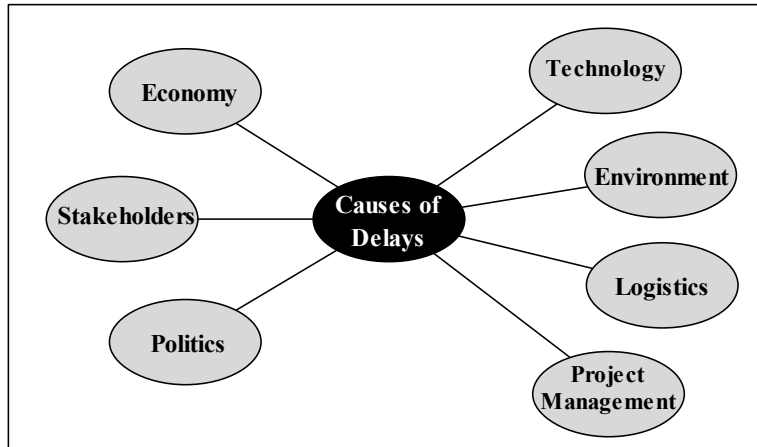


Figure 1: Categories that are developed based on qualitative data analysis.

It should be explained that the result of this study is restricted to the participants' experiences and their viewpoints and cannot be generalised in wider contexts. In addition, the result may not be the whole reality as in social studies like these there may be multiple realities. However, to achieve reliable data, interviewees were selected carefully among construction practitioners who have three specifications: a) to have worked as a senior manager in a construction specialist company, b) to have ten or more years of experience in construction, and c) to be completely familiar with the culture and environment of construction in Iran. Reliable level of data saturation was achieved within eleven interviews.

QUALITATIVE DATA ANALYSIS

Figure 2 illustrates categories and sub-categories that have been developed based on qualitative data analysis. Project management, logistics, technology and the environment are categories that are narrowed down to sub-categories like managing style and scheduling.

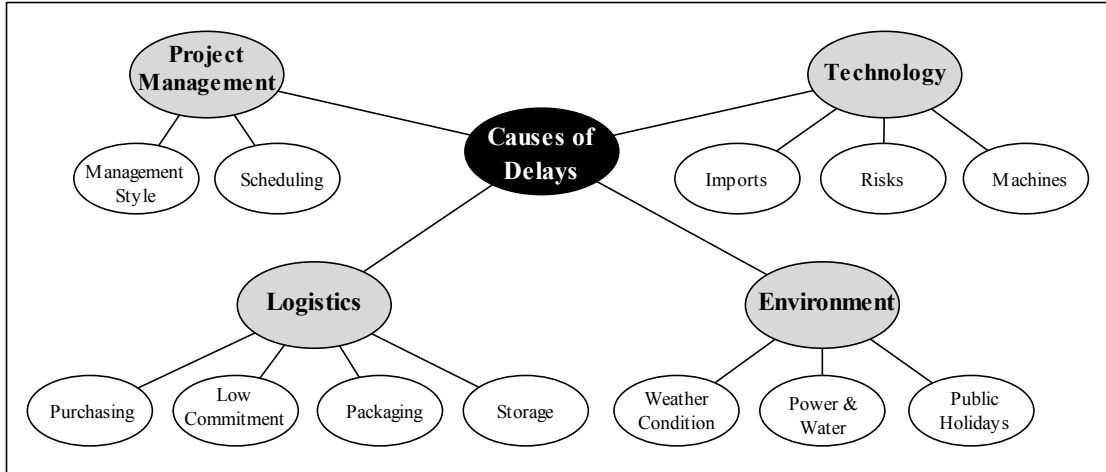


Figure 2: Sub-categories.

Project Management

Management style may mitigate or contribute to delays. As was explained before, the level of agility that a firm has in response to a crisis is important to avoid delays in construction projects. Most of the Iranian construction firms have tall hierarchical organisational structures with high levels of bureaucracy. This affects the speed of information flow through the organisation. It means that senior managers, who have the authority to make vital decisions, are not informed about projects' issues at the early stage when the problem arises. Therefore, they are not able to respond to problems as fast as necessary. Slow response to small problems will lead to crises that may cause delay to the projects. Another issue is the traditional style of management. In fact, traditional managers, who do not have enough knowledge about modern management concepts, want to take control of everything. They usually have problems with team making and distributing duties to the team members. Hence, they have to carry much responsibility themselves. This will put the projects in serious trouble in the manager's absence. In the event of a problem, if the manager is not available, nobody is able to make a decision because team members have neither enough information nor enough confidence to make decisions. This will reduce the agility competency of the firm that may lead to delays.

Famous scheduling methods like CPM and PERT networks have been rarely used in small construction projects in Iran. Hence, predicting the time of the project is impossible in these projects. It means that there is a starting date for the project but nobody can say when the project will be finished. Yet, in medium and large size projects, scheduling has been carried out by getting help from computer software such as Microsoft Project and PRIMAVERA. However, even in these projects, the schedule is not executed correctly. It means that although most firms schedule their activities before starting the project, parties involved do not commit themselves to comply with these schedules. There are two reasons for this phenomenon. First, people who schedule projects in Iran are not experienced in the construction field. Many of them

are Industrial Engineering graduates who are not familiar with the nature of construction industry. Hence, they schedule projects in a way that is not achievable.

"We schedule our projects using Microsoft Projects but we do not use them because they are not realistic. Especially activities durations are not based on realistic statistical data."

Lack of proper training is also an issue. In some projects, planners do not assign resources and costs to activities. This again makes the activities' bar charts and planning networks unusable and unrealistic. Another reason that practitioners feel schedules are not useful is the high uncertainty in the construction industry.

"It is impossible to forecast the behaviour of the human resources, cost of materials, weather condition and other unpredictable problems for the projects."

Without an effective schedule, managing time in the projects is hardly possible. In fact, without a schedule a firm is not able to identify delays in its projects. This is one of the reasons that time overrun has happened in the Iranian projects frequently.

Logistics and Supply Chain

Many interviewees expressed that logistics problems may cause delay for projects. In terms of purchasing material and components, the most serious problem is shortage of some critical material such as cement, steel and concrete. In complicated projects such as the petrochemical industry, many components should be imported from other countries. Some respondents explained that purchasing sensitive components and spare parts for construction machines is also a problem due to economic sanctions. The reason is that components cannot be ordered directly from the manufacturer and should be purchased from other channels of supply. Hence, in most cases predicting the exact date that a component would be available is almost impossible.

"Our company purchased two high-tech recycling machine from a Canadian company. They sent the machines to Dubai. However, in Dubai our machines were confiscated because they want to be sure that sending these machines to Iran is not against the sanction. This lasted about six months and caused a big delay for our project."

Another issue is low commitment among the supply chain members. Few respondents expressed that their companies had long-term relationships with suppliers. Yet, most respondents explained that firms usually have short-term relationships with suppliers because the supplier that offers the lowest price will be chosen. In a short-term relationship, parties are not aware about the capabilities of each other. Hence, they cannot trust each other. In many cases a supplier that offers the lowest price could not provide the site with enough materials due to lack of experience or credit. Also, there are many construction firms that could not pay their debts to suppliers due to shortage in cash or having a dispute with the clients. Even if the construction firms have long relationships with the suppliers, because of the properties of the chaotic market with high inflation rates, they cannot trust each other.

"Even if you purchase materials from a supplier for ten years or more, they do not accept to send you the material before payment."

When parties do not trust each other the sense of commitment to the contract will decrease. In this situation, it can be expected that the project will be delayed. One of the respondents had a problem with a cement supplier:

"I signed a contract to buy a large amount of cement for my project three months ago and paid for it completely. The supplier provided me with a quarter of the contract and after that, he argued because the price of cement had increased, I have to pay the difference between the current price and price of three months ago. It is not fair because I paid for that contract three months ago. So why should I pay more? Inflation forces suppliers to be not committed to their contracts."

Poor material packaging is also an issue that leads to time and material wastage. Logistics of materials and components with low quality packaging is difficult and time-consuming because the time of loading, unloading and handling increases. In addition, poor packaging amplifies the risk of depreciation of material and components. This would increase the amount of waste on site. It means that there is more waste than what is expected in the schedule. Removing extra waste needs allocation of resources and because this allocation is not planned in the schedule, it adds to the workload of manpower and machines. In other words, manpower and machines in addition to their main jobs that are planned in the schedule, should also remove extra wastes. Hence it is possible that resources cannot finish their main job on time because of the heavy workload. Moreover, depreciated materials need to be reordered and this may take a long time. Repetition of this cycle may cause serious delays for the projects.

While much research in the area of logistics management suggests a minimum inventory by utilising JIT techniques, Iranian construction firms prefer to store materials onsite as much as possible. The reason is that the prices of materials usually increase due to high rate of inflation. Hence, it is beneficial to purchase and store material onsite as soon as possible.

"If we have enough space onsite we will buy all materials that we need for completion of the projects ahead of the schedule."

Yet, buying ahead has several problems. In terms of storing sensitive material like cement or plaster, if a suitable storage area is not anticipated, they will be decayed. In addition, storing a large amount of material onsite needs effective warehousing management by using special software and hardware that are not easily accessible in Iran. In this situation, even finding materials would be a time-consuming job on busy sites. Hence, much time will be wasted in removing decayed materials and also reordering, handling, and positioning them.

Technology and Construction Methods

Utilising new technologies and methods of construction is a key issue in mitigating delays. For instance, by using IT, information can be shared among different parties. This may increase the speed of reaction to crises by the firms. Moreover, using new methods like prefabricated units will increase the speed of construction and reduce the total time of execution. Iranian construction firms rarely use high-tech technology in their projects. There are several reasons for that. First, importing new technology is a time-consuming task. In addition to political reasons (e.g. economic sanctions), tight custom regulations imposed by the Government are always a problem. Moreover, firms are always concerned about after sale support, specifically in terms of receiving spare parts. Construction practitioners also do not trust in new technologies or methods of construction. There are always several questions that practitioners may ask about new technologies: "Why we should buy a high-tech equipment while the old one is still working? Is it worthwhile to buy it? Will we be trained to use it? How much does the training cost? Do uneducated operators want to use it? How much does

the maintenance cost?" These are questions that cannot be answered easily and prevent firms utilising new technologies.

Construction firms look at new methods of construction as a risk, since there is no guarantee that new methods work well. Clients also are not eager to invest in methods that may cause problems for them in the future in terms of functionality. Moreover, because new technologies and methods are expensive, in some cases clients cannot afford to buy them. Most of contractors and subcontractors are experienced in traditional methods and they do not want to try a method when they do not have enough knowledge. However, some new methods have been utilised in the recent years. For instance, prefabricated walls and panels have been produced in Iran and have used in many projects. Yet, in some cases, firms are not happy with them.

"I prefer to use traditional methods as I am sure about their functions. In some of my projects, I used prefabricated walls. I was not happy with the result at all. There are few skilled labourers who are able to incorporate these walls into the buildings. Hence, the outcome had a very low quality and was disappointing."

In terms of machines and equipment, most respondents explained that basic construction machines are often available and there is no delay associated with them. However, delays may occur due to repair and maintenance of these machines. Construction firms have three choices when purchasing machines and equipment that they need: direct purchase from foreign manufacturers; buying from Iranian manufacturers; and buying second hand machines from other countries in the Persian Gulf region such as the UAE. Buying brand new machines from European or Japanese manufacturers is a difficult task due to economic sanctions and the unavailability of finance sources. Iranian-made machines and equipment do not have the standard of quality in comparison to German, Japanese and Italian machines. Hence, they become impaired frequently and cause delays for the projects. Second hand machines, that usually are around ten years old, often have problems in terms of availability of spare parts. Easy access to spare parts of construction machines is vital for practitioners. If the spare part cannot be bought in Iran, it should be imported and that takes a long time and may cause delay.

Environment

Iran is located in a special geographical location. The northern part of the country has cold winters and the southern part has hot summers. Poor weather conditions are not predictable in the planning stage and this is an issue that may cause delays. When the temperature rises to 50 degrees, the site is practically closed because labourers are not able to work effectively and some materials start melting. In cold seasons, when the temperature goes under 5 degrees, many construction materials like concrete will be frozen. These issues are more crucial in projects like road building. Working in the mountain areas, deserts or islands may cause delays. The reason is that dealing with natural events like sand storms or heavy snow needs experience and special equipment. Firms that work in these situations for the first time usually complain about tough working conditions in those areas. As some respondents confirmed, many unpredictable events may happen in special geographical locations that cause delays for the projects.

In a very few cases, in road building projects, some firms had problems with providing power and water for the site. This issue, especially in nonurban areas, is a dilemma for firms and causes delays for their projects. The many public holidays are also a problem. Although many firms have their own calendar and work on most

holidays, because other businesses are closed on those dates construction firms cannot work normally on public holidays. For example, a project may be in need of concrete but because all suppliers are closed they have to delay their concrete work.

CONCLUSIONS

Delays in construction projects may have different reasons that should be studied by taking different approaches. The purpose of the current study was to identify causes of delays in construction projects in Iran. Qualitative interpretation enhances understanding of delay causes associated with project management, logistics, technology and the environment.

Managers have a significant role in dealing with delays. Their management styles may contribute or mitigate delays in projects. The traditional management style, with a tall vertical organisational structure and ineffective teams, makes the firms too slow to respond to delays. Managers should distribute responsibilities evenly among team members and give them a level of authority to increase the agility of the firms against unpredicted matters that may cause delays. Planning an effective schedule based on actual data is a key in identifying delays and mitigating their impacts. Without a correct schedule, firms are not able to distinguish delays and this will lead to a long time-overrun in projects. There are several problems in the purchasing stage of materials, components and machines that may cause delays. Sensitive components that should be imported can cause long delays for the projects due to economic sanctions and custom regulations. Other logistics problems that may seriously affect the time of the projects in Iran are low commitment among supply chain, poor packaging and storage issues. This paper argues that, although utilising new technologies and methods of construction may help to reduce the overall time of construction, without adequate training, they can cause delays for projects. Customer service support and availability of the skilled labourers are key issues that should be considered before utilising new technologies and methods of construction. Diverse geographical regions in Iran may cause delays for construction projects. Too high and too low temperatures do not let firms work properly in all seasons of a year. Moreover, working in tough conditions (e.g. deserts) increases the rate of uncertainty and risk of delay. This paper suggests that special attention paid to factors identified in this study will help industry practitioners in minimising the risk of delays in projects. Conducting further research is necessary to find the best practice in managing delays in construction projects in Iran.

REFERENCES

- Al-Momani, A.H. (2000) Construction delay: a quantitative analysis *International Journal of Project Management* **18**, 51-59.
- Assaf, S. A., Al-Hejji, S. (2006). Causes of delay in large construction projects, *International Journal of Project Management* **24**(4), 349-357.
- Australian Government-Austrade, 2007 [online] Available at: <http://www.austrade.gov.au/Construction-to-Iran/default.aspx> [Accessed February 2008].
- Eco News, (2009) [online] available at: <http://www.econews.ir/fa/NewsContent.aspx?id=101700> [Accessed May 2009] (in Farsi).

- El-Razek M. E., Bassioni, H. A., Mobarak, A. M. (2008) Causes of Delay in Building Construction Projects in Egypt, *Journal of Construction Engineering and Management*, 831-841.
- Faridi, A. S., El-Sayegh, S. M. (2006). Significant factors causing delay in the UAE construction industry *Construction Management and Economics* **24**, 1167-1176.
- Fars News Agency, 2008 [online] Available at:
<http://www.farsnews.com/newstext.php?nn=8703110422> [Accessed May 2008] (in Farsi).
<http://www.farsnews.net/newstext.php?nn=8703020180> [Accessed May 2009] (in Farsi).
- Iranian Students News Agency, 2008 [online] Available at:
<http://isna.ir/ISNA/NewsView.aspx?ID=News-1156465&Lang=P> [Accessed October 2008] (in Farsi).
- Keane, P. J., Caletka, A. F. (2008) *Delay Analysis in Construction Contracts*, Wiley-Blackwell, UK.
- Mezher, T.M., Tawil, W. (1998). Causes of delays in the construction industry in Lebanon *Engineering, Construction and Architectural Management* **5**(3), 252-60.
- Kumaraswamy, M. M., Chan, W. M. (1998) Contributors to construction delays *Construction Management and Economics*, **16**, 17-29.
- Mansfield, N. R., Ugwu, O. O., Doran, T., Causes of delay and cost overruns in Nigerian construction projects, *International Journal of Project Management*, **12**(2), 254-60.
- Ministry of Housing and Urban Development, (2009) [online] available at:
<http://www.mhud.gov.ir/Portal/Home/ShowPage.aspx?Object=News&ID=2f1a88a7-ea3c-4526-9861-863ae1dd5703&LayoutID=33a3dd9a-0227-4378-8ced-0cc611ebd486&CategoryID=5b688c7d-87e8-4a5b-ba27-575871faa6e9> [Accessed May 2009] (in Farsi).
- Ogunlana, S. O., Promkuntong, K. (1996) Construction delays in a fast growing economy: comparing Thailand with other economies, *International Journal of Project Management*, **14**(1), 37-45.
- Sambasivan, M., Soon, Y. W. (2007). Causes and effects of delays in Malaysian construction industry *International Journal of Project Management* **25**(5), 517-526.
- Zack, J. G. (2003). Schedule delay analysis; is there agreement? Proceedings of PMI-CPM College of Performance Spring Conference, Project Management Institute, New Orleans, USA.