Journal of Construction Project Management and Innovation Vol. 3 (2): 608-619, 2013
ISSN 2223-7852

CONTRIBUTORS TO SCHEDULE DELAYS IN PUBLIC CONSTRUCTION PROJECTS IN SAUDI ARABIA: OWNERS' PERSPECTIVE

Ibrahim Mahamid

Hail University, Civil Engineering Department,
Hail, 2440, Kingdom of Saudi Arabia
Email: imahamid@ymail.com

Abstract
This study aims at identifying the contributors to delays in public construction projects in Saudi Arabia from owners' viewpoint. To do so, 22 public owners of construction projects completed a structured questionnaire survey. 35 factors were identified through literature review. The results indicated that the top delay contributors are: bid award for lowest price, poor site management, poor communication and coordination between construction parties, payments delay, poor labor productivity, and rework. These findings can support the Government in improving the regulations to meet the construction market needs, owners in planning and designing and evaluating policy, contractors and managers in planning and taking external and internal risks when costing and scheduling contracts, consultants in applying comprehensive contract information, and workers in conducting their day-to-day activities. Results will fill an important research and practice gap and help in improving time performance in public construction projects in Saudi Arabia and other developing countries.

Keywords: Delays, construction, public owners, contributors, risk map

INTRODUCTION

The construction industry is large, complex and diverse and covers a wide range of business interests and activities, united by their common usage and development of land (Chan, 2007). It gives rise to many other related industries such as steel, concrete, lumber, carpet, furniture, paint, paving, mining, shipping and other industries. It is one of the largest dollar generating segments of the world economy, construction is a big business, totaling more than $3.9 trillion annually worldwide, and there is no slowdown in sight (Jackson, 2010). However, it is at or near the top in the annual rate of business failures and resulting liabilities compared to other industries (Chapman et al., 2001).

This is because it is a risky business with too many uncertainties that management has to deal with (Enshassi and Abu Mosa, 2008). One of the most recurring problems in construction industry is schedule delay. The history of the construction industry worldwide is full of projects that were completed with significant time and cost overruns (Amhel et al., 2010)

Saudi Arabia has experienced a construction boom during the past three decades, attracting construction professionals from all over the world. According to the Saudi Ministry of Planning, the construction industry contributed between 30% to 40% of the non-oil productive sectors at the end of each National Development Plan from 1980 to 2000 (Al-kharashi and Skitmore, 2009). However, project delay is considered to be one of the most serious and frequent problems in the Saudi Arabian construction industry (Faridi and Al-Sayegh, 2006). Assaf and Al-Hejji (2006) conducted a survey on time performance of different types of construction projects in Saudi Arabia. The survey concluded that 70% of projects experienced time overrun and found that 45 out of 76 projects considered were delayed. They found that the average time overrun was between 10% and 30% of the original contract duration. From the aforementioned, it appears that the problem of delay in construction projects is critical and should be studied more to overcome this problem and to improve the sector of construction industry. This paper presents the findings of a survey that aims at identifying the contributors to schedule delay in public construction projects in Saudi Arabia from the owners' perspective. It is hoped that these findings will guide efforts to enhance the performance of the construction industry in Saudi Arabia and other developing countries.

CONSTRUCTION DELAY - LITERATURE REVIEW

A number of studies have been conducted to examine delay contributors in construction projects. Mahamid et al. (2012) conducted a study to identify and rank delay causes in road construction projects in the West Bank in Palestine. Contractors indicated that the top five delay causes are: segmentation of the West Bank and limited movement between areas, political situation, progress payments delay by owner, delays in decision making by owner, and low productivity of labors. While the consultants indicated that the top five affecting causes are: political situation, segmentation of the West Bank and limited movement between areas, awarding project to lowest bid price, shortage in equipment's, and ineffective scheduling of

project by contractor. Al-Khalil and Al-Ghafly (1999) investigated three components of delay in the construction of water and sewage works in Saudi Arabia. The components are: the frequency of delayed projects, the extent of delay, and the responsibility for delay. The results indicated that a high proportion of projects were subjected to delay. The frequency of delayed projects seems to be associated with the contractor classification grade. They also found that the project owners and consultants assigned the major responsibility for delay to the contractors while contractors believed that the owner is mostly responsible.

Odeh and Battaineh (2002) found that contractors and consultants agreed that the most important causes of construction delay in Jordan are: owner interference, inadequate contractor experience, financing and payments, labor productivity, slow decision making, improper planning, and incompetence of subcontractors. Alghbari et al. (2007) examined delay causes in construction projects in Malaysia. 31 variables examined in the study. They concluded that the major delay causes in construction projects are: financial causes, coordination problems, and material problems. Al-Momani (2000) investigated contributors to delay in 130 public building projects constructed in Jordan during the period of 1990-1997. He presented regression models of the relationship between actual and planned project duration for different types of building facilities. He concluded that the main causes of delay are: related to designer, user changes, weather, site conditions, late deliveries, economic conditions and increase in quantity.

Frimpong et al. (2003) conducted a survey to identify and evaluate the relative importance of significant causes contributing to delay and cost overruns in Ghana groundwater construction projects. A questionnaire with 26 causes was designed. The questionnaire was directed towards three groups in both public and private organizations: owners of the groundwater projects, consulting offices, and contractors working in the groundwater works. Results revealed that the main contributors to delay and cost overruns in construction of groundwater projects are: monthly payment difficulties from agencies; poor contractor management; material procurement; poor technical performance, and escalation of material prices. Koushki et al. (2005) conducted a study in Kuwait to investigate the contributors to time and cost overrun in construction projects. A person-interview survey of 450 randomly selected private residential project owners and developers have been done.

They concluded that the main contributors to delays are: changing orders, owners' financial constraints, and owners' lack of experience. Al-Najjar (2008) concluded that the top affecting causes of time overrun in building construction projects in Gaza Strip as perceived by contractors are: strikes, Israeli attacks and border closures, lack of materials in markets, shortage of construction materials at site, delay of material delivery to site, cash problem during construction, poor site management, poor economic conditions (currency, inflation rate, etc), shortage of equipment at site, equipment's and tool shortage on site, and owner delay in freeing the contractor financial payments.

RESEARCH METHOD

From the detailed review of literature, 35 delay contributors in public construction projects were defined. The delay contributors were tabulated into a questionnaire form. Then the draft questionnaire was discussed with three experts in the construction industry to evaluate the content of the questionnaire. Modifications and changes have been done. The questionnaire is divided into two main parts. Part I is related to general information for the agency. The surveyed owners were requested to answer questions pertaining to their experience in public construction. Part II includes the list of the identified contributors to schedule delay in public construction projects.

Data collection and analysis

Twenty-two public owners from the Northern Province of Saudi Arabia were successfully questioned. The questionnaire gave each respondent an opportunity to identify variables that they perceived as likely to contribute to delays by responding on a scale from 5 (very severe) to 1 (not severe). Participants then rated the frequency of occurrence for each contributor on project that they have experienced on an ordinal scale: very high (5), high (4), medium (3), low (2), or very low (1). For each contributor, the mean value of the respondents' severity rating was named the severity index. Secondly, the mean value from respondents' frequency rating was named the frequency index. Accordingly, the severity and frequency levels are categorized using Table 1. Finally, the contributors' matrix map was identified using Figure 1 (Mahamid, 2011).

Table1: Categories of the severity and frequency of occurrence

Index value	Severity level	Frequency level
≤ 20%	very low (VL)	very low (VL)
20% - 40%	low (L)	low (L)
40% - 60%	moderate (M)	moderate (M)
60% - 80%	high (H)	high (H)
80% - 100%	very high (VH)	very high (VH)

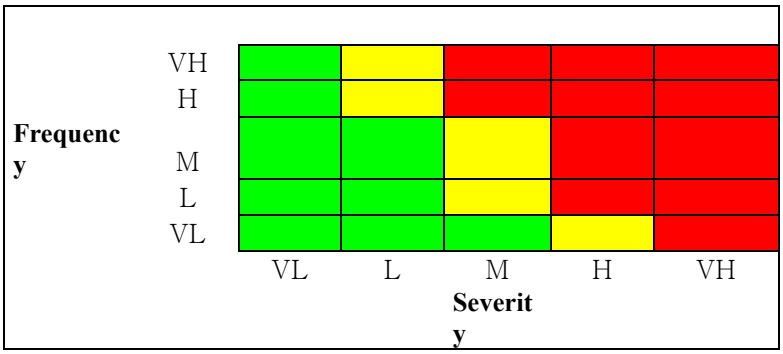

Figure 1: The risk map

The risk map includes three zones: red, yellow, and green; such that:

- **Green zone**: risks in this zone are low level, and can be ignored.
- **Yellow zone:** risks in this zone are of moderate importance, and should be controlled.
- **Red zone**: risks in this zone are of critical importance. These are the top priorities, and close attention should be paid to them.

Statistical analysis

The statistical analyses for delay contributors as assessed by owners were performed. The tests include the computation of the weighted mean, standard deviation, and coefficient of variation. These tests are used to check the compactness and consistency of the responses.

RESULTS AND DISCUSSION

Participants

The target populations in this study are the public owners of construction projects in the Northern Province of Saudi Arabia. Simple random sampling was used.

The questionnaire was sent out to a total of 22 public owners asking their perception in ranking the identified 35 contributors in terms of severity and frequency using an ordinal scale. A total of 22 owners filled the questionnaire. The response rate by the owners is 100%. On average, the respondents have experience of more than 15 years in public construction projects.

Contributors' risk map

Table 2 shows the results of risk map for contributors to schedule delays in public construction projects in Saudi Arabia from owners' perspective. It shows that 6 contributors are located in the red zone (critical contributors), 26 contributors are located in the yellow zone (moderate importance), and 3 contributors are located in the green zone (low level).

Table 2: Risk map for delay contributors from owners' perspective

Contributor	S.I*	Level	F.I*	Level	Map zone
additional work	48.48	M	42.66	M	yellow
bid award for lowest price	67.46	H	90.01	VH	red
changes in material types and specifications during construction	57.03	M	52.33	M	yellow
contract management	50.51	M	40.27	M	yellow
contractual procedure	45.29	M	40.99	M	yellow
disputes on site	50.51	M	44.83	M	yellow
duration of contract period	57.90	M	54.83	M	yellow
economic instability	53.55	M	47.33	M	yellow
effects of weather	47.03	M	49.83	M	yellow
fluctuation of prices of materials	57.9	M	53.14	M	yellow
frequent changes in design	54.42	M	51.75	M	yellow
government policies	33.99	L	34.83	L	green
high interest rates by bankers	36.16	L	36.49	L	green
inadequate production of raw materials by the country	54.86	M	52.33	M	yellow
labor cost	51.81	M	41.49	M	yellow
lack of adequate manpower	53.55	M	41.31	M	yellow
lack of contractor experience	55.73	M	49.83	M	yellow
late design work	53.12	M	55.66	M	yellow
level of competitors	59.20	M	45.66	M	yellow
long period between design and time of implementation	55.29	M	50.88	M	yellow
manipulation of suppliers	53.12	M	47.33	M	yellow
mistakes in design	54.42	M	49.83	M	yellow
number of competitors	55.73	M	43.99	M	yellow
number of projects going at the same time	56.59	M	46.49	M	yellow

payments delay	75.03	H	61.23	H	red
Poor communication and coordination between construction parties	69.64	H	78.88	H	red
poor financial control on site	58.33	M	51.49	M	yellow
poor labor productivity	67.90	H	62.18	H	red
poor relationship between managers and labors	58.68	M	50.66	M	yellow
poor resource management	53.99	M	42.33	M	yellow
Poor site management	62.68	H	56.96	M	red
project location	56.59	M	35.66	L	yellow
rework	61.81	H	59.14	M	red
social and cultural impacts	36.59	L	39.83	L	green
unreasonable project time frame	56.59	M	53.99	M	yellow

**S.I = Severity index, F.I = Frequency index.*

Top delay contributors

Table 3 shows the top contributors to delays in public construction projects in Saudi Arabia from owners' perspective, they are:

1. Bid award for lowest price: in general, the clients award bids to the lowest bidder to execute their projects. However, the lowest bidders might be low qualified contractors. Consequently, poor performance will occur that will affect the project schedule. This result is supported by Mahamid et al. (2012) in that award project to the lowest bid price is one of the main delay contributor.
2. Poor communication and coordination between construction parties: since there are many parties involved in any construction project (i.e. client, consultant, contractor, supplier, subcontractor), the communication between the parties is very important for the success of the project. Proper communication channels between the various parties should be established during the early project phases and should be continued during all project phases. Lack of coordination and communication between parties could lead to many negative causes that affect the project schedule such as: delay in decision making, frequent design changes, rework, etc. This result was not pointed out by any of the investigated studies as a critical contributor to schedule delay.
3. Poor site management: site management includes resources management, coordination with construction parties, procurement management, labor management, and construction activities management. In many cases and due to the contractor to the lack of experience, the construction site faces obstacles that lead to poor site management.

Poor site management mainly affect the projects schedule in addition to many other negative impacts on construction projects such as: rework, bad labor morale, poor productivity, bad relation between labors and management team, misuse of time schedule, interrupting construction activities, and bad relation between construction parties. This result was concluded by Al-Najjar (2008) and Frimpong et al. (2003).

5. Payments delay: construction works involve high daily expenses and most of the contractors cannot fulfill these expenses when the payments are delayed. Work progress can be delayed because of payment delay; this is because of inadequate cash flow to support the construction expenses by contractor. The problem is more acute for those contractors who are not financially sound. This result is in line with many of the investigated studies (Frimpong et al., 2003; Al-Najjar, 2008; Koushki et al., 2005; Mahamid et al., 2012; Odeh and Battaineh, 2002; Alghbari et al. 2007; Almomani, 2000)
6. Poor labor productivity: labor productivity is one of the most important keys of project success. It affects the activity duration and consequently the total project duration. Poor productivity will increase the actual time for a specific activity to be completed. Accordingly, the project will delay. This result is in line with Mahamid et al. (2012) and Odeh and Battaineh (2002).
7. Rework: it can be simply defined as redoing the same activity for more than one time. It can be as a result of many reasons such as poor workmanship, poor material quality, late changes, scope changes, and mistakes in design. Redoing the same duty again and again will lead to time overrun. This result is in line with Frimpong et al. (2003).

Table 3: Top delay contributors from owners' perspective

Contributor	S.I	Level	F.I	Level	Map zone
bid award for lowest price	67.46	H	90.01	VH	red
Poor communication and coordination between construction parties	69.64	H	78.88	H	red
Poor site management	62.68	H	56.96	M	red
payments delay	75.03	H	61.23	H	red
poor labor productivity	67.9	H	62.18	H	red
rework	61.81	H	59.14	M	red

Statistical analyses

Table 4 presents the statistical analyses for delay contributors as assessed by the surveyed owners. The table contains the computation of the weighted mean, standard deviation, and coefficient of variation. The results show good data compactness and reasonable values, indicating a good data consistency and agreement between the respondents on the severity and the frequency of the identified contributors.

Table 4: Statistical analyses for delay contributors as assessed by public owners

Contributor	Severity			Frequency		
	X'*	Sn*	C.V (%)*	X'	Sn	C.V (%)
additional work	2.42	0.82	28.97	2.13	0.81	34.10
bid award for lowest price	3.37	0.82	27.36	4.50	0.70	15.69
changes in material types and specifications during construction	2.85	0.77	18.66	2.62	0.34	7.19
contract management	2.53	0.83	18.67	2.01	0.36	2.27
contractual procedure	2.26	0.41	19.73	2.05	0.39	16.46
disputes on site	2.53	0.74	30.68	2.24	0.97	36.45
duration of contract period	2.90	0.94	23.83	2.74	0.74	19.85
economic instability	2.68	0.95	27.37	2.37	0.73	34.07
effects of weather	2.35	0.68	31.42	2.49	0.76	32.82
fluctuation of prices of materials	2.90	0.90	22.62	2.66	0.55	6.50
frequent changes in design	2.72	0.74	19.38	2.59	0.72	15.53
government policies	1.70	0.78	28.66	1.74	0.77	39.06
high interest rates by bankers	1.81	0.65	31.33	1.82	0.62	29.72
inadequate production of raw materials by the country	2.74	0.73	16.09	2.62	0.30	3.97
labor cost	2.59	0.78	28.01	2.07	0.63	17.43
lack of adequate manpower	2.68	0.89	25.87	2.07	0.40	1.96
lack of contractor experience	2.79	0.88	24.77	2.49	0.81	14.87
late design work	2.66	0.86	30.57	2.78	0.85	27.28
level of competitors	2.96	0.74	21.13	2.28	0.78	23.48
long period between design and time of implementation	2.76	0.53	19.08	2.54	0.71	18.46
manipulation of suppliers	2.66	0.58	17.02	2.37	0.86	30.97
mistakes in design	2.72	0.72	18.21	2.49	0.71	15.64
number of competitors	2.79	0.81	31.03	2.20	0.99	34.78
number of projects going at the same time	2.83	0.74	19.38	2.32	0.93	30.10
payments delay	3.75	0.78	27.31	3.06	0.86	32.78
Poor communication and coordination between construction parties	3.48	0.60	19.27	3.94	0.68	23.31
poor financial control on site	2.92	0.89	22.64	2.57	0.74	12.11

poor labor productivity	3.40	0.78	24.91	3.11	0.62	34.06
poor relationship between managers and labors	2.93	0.70	15.93	2.53	0.49	5.32
poor resource management	2.70	0.85	24.50	2.12	0.95	30.28
Poor site management	3.13	0.78	28.66	2.85	0.78	30.95
project location	2.83	0.82	28.19	1.78	0.49	24.31
rework	3.09	0.71	32.07	2.96	0.77	18.46
social and cultural impacts	1.83	0.69	28.66	1.99	0.83	17.67
unreasonable project time frame	2.83	0.86	29.77	2.70	0.85	24.00

**X' = Mean, Sn = Standard deviation, C.V = Coefficient of variation.*

CONCLUSION

Time performance of a project is usually a particularly important consideration for the construction parties. Often, the most troublesome construction disputes involve delay and failure to complete the work in the specified time frame. Many variables have an impact upon construction delay in Saudi Arabia. A questionnaire survey was undertaken of 22 public owners of construction projects in the Northern Province of Saudi Arabia. 35 delay contributors were identified through literature review. The risk map for the considered contributors was identified according to their perceived severity and frequency of occurrence. Three zones were considered in the risk map: red, yellow, and green. The results showed that 6 contributors are located in the red zone, 26 contributors are located in the yellow zone, and 3 contributors are located in the green zone of the risk map.

The study concluded that the top delay contributors in public construction projects in Saudi Arabia from owners' perspective are: : bid award for lowest price, poor site management, poor communication and coordination between construction parties, payments delay, poor labor productivity, and rework. The statistical analyses showed that the data has good compactness, indicating a good data consistency and agreement between the respondents on the severity and frequency of occurrence of the identified delay contributors.

Based on the findings of this study, the following points are suggested in order to reduce and control delay in public construction projects:

1. The Government and Contractors' Association should conduct workshops and training courses to improve the managerial skills of the construction parties, especially the contractors to improve their site management skills.

3. Construction parties should have more communication and coordination during planning, design, and execution phases of the project.
4. Bids must be awarded to the bidder with reasonably estimated cost and not necessarily to the lowest bidder.
5. Contractors should manage their financial resources and plan cash flow by utilizing progress payment.
6. Owner should pay progress payment to contractors on time because it affects the contractors' ability to finance the work.
7. Construction parties should conduct a detailed and comprehensive site investigation at the design phase in order to avoid variations and late changes during the construction phase that will control rework.
8. The Government should improve the regulations and laws in terms of increasing labor wages and benefits; this will obviously improve their motivation to work and increase their productivity.

REFERENCES

Alghbari, W., Razali, M., Salim, A., and Ernawati (2007). The significant factors causing delay of building construction projects in Malaysia. Journal of Engineering, Construction and Architectural Management, 14(2), 192-206.

Al-Khalil, M. and Al-Ghafly, M. (1999). Important causes of delay in public utility projects in Saudi Arabia. Construction Management and Economics, 17(5), 647–55.

Al-Momani, A. (2000). Construction delay: a quantitative analysis. International Journal of Project Management, 18(1), 51–9.

Al-Najjar, J. (2008). Factors influencing time and cost overruns on construction projects in the Gaza Strip. Master thesis, Islamic University, Gaza.

Al-Kharashi, A. and Skitmore, M. (2009). Causes of delays in Saudi Arabian public sector construction projects. Construction Management and Economics, 27(1): 3 – 23.

Amehl, O., Soyingbe, A., and Odusami, K. (2010). Significant factors causing cost overruns in telecommunication projects in Nigeria. Journal of Construction in Developing Countries, Vol. 15.

Assaf, S. and Al-Hejji, S. (2006). Causes of Delay in large construction projects. International Journal of Project Management, 24, 349-357.

Chan, E. (2007). Corporate portals as extranet support for the construction industry in Hong Kong and nearby regions of China. ITcon; Special Issue Construction information technology in emerging economies, 12, 181-192.

Chapman, R. (2001). The controlling influences on effective risk identification and assessment for construction design management. International Journal of Project Management, 19, 147-160.

Enshassi, A. and Abu Mosa, J. (2008). Risk Management in Building Projects: Owners' Perspective. The Islamic University Journal, 16(1), 95-123.

Faridi, A. and El-Sayegh, S. (2006). Significant contributors causing delay in the UAE construction industry. Construction Management and Economics, 14, 1167-76.

Frimpong, Y., Oluwoye, J., and Crawford, L. (2003). Causes of delay and cost overruns in construction of groundwater projects in a developing countries; Ghana as a case study. International Journal of Project Management, 21, 321 – 326.

Jackson, B. (2010). Construction Management Jump Start. Second Edition. Indianapolis, Indiana: Wiley Publishing, Inc.; 386 p.

Koushki, P., Al-Rashid, K., and Kartam, N. (2005). Delays and cost increases in the construction of private residential projects in Kuwait. Construction Management and Economics, 23(3), 285-294.

Mahamid, I. (2011). Risk Matrix for Factors Affecting Time Delay in Road Construction Projects: Owners' Perspective. Engineering, Construction and Architectural Management, 18 (6), 609 – 617.

Mahamid, I., Bruland, A., and Dmaidi, N. (2012). Delay causes in road construction projects. ASCE Journal of Management in Engineering, 28(3), 300–310.

Odeh, A. and Battaineh, H. (2002). Causes of construction delay: traditional contracts. International Journal of Project Management, 20(1), 67-73.