A Structured Approach for Questionnaire Survey of Construction Delay

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Construction delay is a common problem costing the industry billions of dollars every year. The first step to reduce this unnecessary loss is to identify the major delay factors. More than 200 studies on major construction delays have been reported using self-administered questionnaire surveys of views of project participants. The present approach adopted is reviewed by a case study of Egypt. Thirty-two delay factors were identified as major construction delay factors. A thorough review of these eight studies revealed many shortcomings in the present approach. A structured approach is proposed for questionnaire survey to study major construction delay factors.

Keywords: Egypt, schedule performance, construction delay factors, structured approach, questionnaire survey.

Introduction

Construction delay is a common problem costing the industry billions of dollars every year. Identifying the major construction delay factors is the first step in understanding poor schedule performance. Appropriate measures can then be implemented to address issues related to the major construction delay factors to achieve good schedule performance. More than 200 studies on construction delays reported used self-administered questionnaire surveys of owners, contractors and consultants. The questionnaire was developed based on either construction delay factors reported in the literature or by open ended interviews with selected panels of contractors, consultants and owners. The major construction delay factors were established by statistical analysis of the survey data. There were several short comings in the present approach for such studies resulting in a diverse and inconsistent range of the top major construction delay factors identified for a country. Obviously, some of the top major construction delay factors were inappropriate. This is important because it is confusing to practitioners in devising appropriate measures to achieve better schedule performance. The purpose of this paper is to use a case study to identify the short comings of the present approach for questionnaire survey to study major construction delay factors. A structured approach will be proposed to address such short comings so that the most appropriate top construction delay factors can be identified.

Egypt is chosen for the case study. There are eight studies to identify major delay factors for construction projects in Egypt reported in the literature. All these studies were based on self-administered questionnaire surveys of views of project participants. Thirty two of the forty two construction delay factors reported in the literature had been identified as one of the major construction delay factors. Egypt is not a large country in its physical size. The wide diversity of major construction delay factors identified was illogical. To clarify this confusion, a review of the eight studies was undertaken to identify the top major construction delay factors for Egypt.

Egypt's Construction Industry

Egypt has a population of 92 million in 2016 and is one of the most populous countries in Africa and the Middle East. Egypt is the largest oil refinery center in Africa. The largest market in the Egyptian construction industry was infrastructure construction accounting for slightly more than a quarter of the total volume. The second largest market was industrial construction accounting for slightly less than a quarter of the total volume, followed by commercial construction accounting for about 20% of the total volume. The residential and institutional constructions account for the remaining about 20% of the total volume.

In the past, the Egyptian construction industry stemmed from a lack of resources and technological expertise. More recently it was the management and administration of construction projects. The construction industry was facing a skills deficit that extended to engineers and there was a need to create a more institutionalized and structured system for training skilled labor and engineers. Specific training programs could potentially help contractors. A shortage of raw materials, an uncertain political environment, price controls and excessive government interference in the operation of construction industry were among the main obstacles affecting the construction industry. There were not many contractors in Egypt relative to its population. Its capability was also limited. It had been estimated that the new capital city needs at least 500 contractors, whereas there were not more than 300 qualified. If Arabtec's one million homes were built, at least 200 more contractors were needed. Before the revolution, there were 49,000 contractors registered with the Egyptian Federation for Construction and Building Contractors. It had reduced to 11,000 now. Most of them did not have the requisite classification to take on sizeable projects. There were only 280 contractors classified as level 1 to level 3, with the capability to execute projects worth US$2.7 million and above. Only around 20 contractors were in level 1 classification. According to the Egyptian Federation for Construction and Building Contractors, 12,000 of the 15,000 registered small and medium-sized construction companies were experiencing problems in 2014-2015. The main challenge for smaller contractors lied in funding and financing their projects. The banking sector lacked confidence in financial and administrative management of small and medium-sized contractors. For larger contractors, the challenge was to avoid stretching their resources too thin. Many construction projects faced delays. Financing large construction projects was also an issue. It was not a preferred area for banks given the risks and delays in the past. Banks would only finance fast-track projects and not longer-term projects. When financing and debt was available, it was expensive. Overdraft fee facilities could reach as high as 16% for contractors. This was not an issue for international contractors because most of them accessed funding abroad. For local contractors, the lack and cost of financing posed a stern challenge to their operability.

Major Construction Delay Factors in Egypt

Standardization of Delay Factor

One of the major difficulties in the present study is the lack of standardization of delay factors. Some of the delay factors have to be revised to those that are commonly found in the literatures. The standardization of delay factors is summarized in Table 1. It is not clear what is meant by

'sudden failures actions' of Aziz (2013). It is certain that sudden failures were not referring to equipment because another factor 'frequent equipment breakdowns' was ranked thirteen among the major construction delay factors identified. Therefore, it is not possible to include 'sudden failures actions' in the present study.

Table 1: Standardization of Delay Factors

Reference	Delay factor in reference	Standardized delay factor
Abd El-Razah et al. (2008)	• 'delays in contractor's payment by owner' and 'partial payments during construction' • 'the relationship between different subcontractors' schedules' • 'preparation of shop drawings and material samples' • 'non-utilization of professional construction/contractual management'	• 'finance and payments of completed work by owner' • 'ineffective planning and scheduling' • 'poor site management and supervision' • 'poor contract management by consultants/substandard contract'
Marzouk and El-Rasas (2014)	• 'effects of subsurface conditions (e.g., soil, high water table, etc.)'	• 'inadequate site investigation/unforeseen subsurface conditions'
Aziz (2013)	• 'selecting inappropriate contractors' • 'poor financial control on site' • 'inadequate planning' by owner • 'global financial crisis'	• 'inadequate contractor experience/incompetence contractor' • 'poor site management and supervision' • 'owner's lack of experience/ incompetent project team' • 'economic conditions'
Shibani and Salah (2015)	• 'change orders during work' and 'changes of design by owner or his agent during work' • 'poor communication and coordination of contractor' • 'inappropriate government policy'	• 'variation orders/changes of scope by owner during construction' • 'poor site coordination' • 'government regulation and permit approval'
Nawar (2017)	• 'the amount of changes and owner behavior towards changes' • 'level of constructability and extent of design review' • 'owner management capability and ability to take timely decisions' • 'scope definition and clarity' • 'time allowed for project planning' and 'schedule accuracy' • 'market conditions' • 'project complexity' • 'investigation of existing site conditions'	• 'variation orders/changes of scope by owner during construction' • 'lack of constructability reviews in design' • 'owner's lack of experience/ incompetent project team' 'slow decisions from owner' • 'lack of clarity in project scope' • 'ineffective planning and scheduling' • 'economic conditions' • 'inadequate contractor experience/incompetence contractor' • 'inadequate site investigation/ unforeseen subsurface conditions'

Reference	Delay factor in reference (cont'd)	Standardized delay factor
Hafez et al. (2016)	• 'change orders by owner during construction (variation)', 'variation order in extra quantities', 'change in drawings & specifications' and 'materials changes in types and specifications during construction'	• 'variation orders/changes of scope by owner during construction'
Kholif et al. (2013)	• 'financial difficulties of contractor' and 'high insurance and high interest rates' • 'high cost of skilled labor' • 'inaccurate bill of quantities'	• 'financing by contractor' • 'inaccurate estimating of construction materials quantities/price' • 'poor contract management by consultants/substandard contract'

Major Delay Factors of Egypt

The methodology for the present study is to count the number of times each delay factors had been identified by the eight studies. The top major construction delay factors are factors identified by the most number of studies. The rational is obvious. Most of the respondents in the eight studies on Egypt had identified that delay factor. This methodology had been adopted by the studies reported by Kog (2017a, 2017b, 2017c, 2017d, 2018a, 2018b, 2018c, 2018d, and 2019) for Ghana, Nigeria, Jordan, UAE, Pakistan, Sri Lanka, Iran, Portugal, UK, US, Saudi Arabia, Kenya, India, Indonesia, Malaysia, Thailand, and Vietnam respectively.
Table 2 tabulates the major construction delay factors identified by the eight studies for Egypt under project participants related factor, owner related factors, contractor related factors, consultant-related factors, and other factors. Each construction delay factor is placed in the category linked to the party which can exert the most influence on that factor. Delay factors that are beyond the control of project participants are grouped under 'other factors'.

Table 2: Summary of Construction Delay Factors from Existing Literature on Egypt

Reference	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Methodology of study	S	S	S	S	S	S	S	S
Number of respondents in the questionnaire survey/projects	74	33	@	2,500	63	40	52	15
Response rate (%)	NA	NA	@	83.3	@	40	65	60
Consistency check of questionnaire	No	No	@	No	No	No	No	No
Type of construction projects studied	B	A	A	A	A	A	B	B
All project participants related factor								
Communication problems/lack of adequate project coordination	X				X	X		
Owner-related factors								
Finance and payments of completed work by owner	X	X	X	X	X	X	X	X
Variation orders/changes of scope by owner during construction	X	X	X		X	X		X
Contractor selection methods (negotiation, lowest bidder)		X					X	
Slow decisions from owner								X
Owner interference					X			
Owner's lack of experience/incompetent project team								X
Excessive bureaucracy in project-owner organization							X	
Contractor-related factors								
Inadequate contractor experience/incompetence contractor	X			X			X	X
Ineffective planning and scheduling	X	X	X	X			X	X
Inaccurate estimating of construction materials quantities/price							X	
Poor site management and supervision	X		X	X		X		

Reference (cont'd)	1	2	3	4	5	6	7	8
Poor site coordination					X			
Late delivery/shortage of construction materials		X	X					
Financing by contractor	X	X		X		X	X	
Subcontractor problems/mechanical and electrical construction						X		
Rework due to mistakes in construction/construction defects				X				
Low productivity level of labors		X			X			
Shortage of labors					X			
Unqualified workforce/low skilled labors		X		X	X			
Labor disputes/strikes/personal conflict among labors						X		
Equipment (or operator) availability and failure				X				
Consultants related factors								
Inadequate site investigation/unforeseen subsurface conditions		X				X		X
Lack of clarity in project scope								X
Poor contract management by consultants/substandard contract	X					X	X	
Mistakes and discrepancies in design documents by consultant						X		
Delay in revising design documents		X						
Lack of constructability reviews in design								X
Other factors								
Rise in prices of materials					X		X	
Economic conditions				X			X	X
Security/political situations	X			X			X	
Corruption				X	X			
Government regulation and permit approval					X		X	

S= study is based on a survey of views of owners, contractors and consultants; A= Building, road, water and sewer etc. projects; B= Building projects; @=not able to check; NA=not applicable
References: 1= Abd El-Razek et al. (2008); 2= Marzouk and El-Rasas (2014); 3= Amer (1994a) and Amer (1994b); 4= Aziz (2013); 5= Shibani and Salah (2015); 6=Hafez et al. (2016); 7= Kholif et al. (2013); 8= Nawar (2017)

Views are not reality and may not be correct. Views are not based on facts that have been critically reviewed and validated by an independent party. The quality of the survey data determines the accuracy of findings of studies based on self-administered questionnaire surveys. Respondents' views are derived from working experience and the number of years of working experience is crucial. Kog & Loh (2012) reported that views of respondents with less than 15 years were found to be not consistent with respondents with more than 15 years. This seems to be an objective criterion on the suitability of survey respondents. The construction period for a reasonably sized project will be around 3 years. A respondent with 15 years working experience will have completed a number of projects equivalent to about 5 reasonably sized construction projects. Such experience enables a broader and more incisive understanding of construction delay factors affecting construction projects. A respondent with less than 6 years of experience will only have completed one project. Some of the construction delay factors this respondent identified are unique to the completed project only and not typical for the construction industry. It is not surprising that the major delay factors identified by these studies with large proportion of 'inexperienced' respondents are not among the major delay factors identified by the present study.

Of the eight studies using self-administered questionnaire survey, no information on the profile of working experience of respondents was reported in Abd El-Razek et al. (2008), Hafez et al. (2016) and Shibani & Salah (2015). There was also no consistency check of the views of the survey respondents as demonstrated in Kog & Loh (2012). In Marzouk & El-Rasas (2014), "all

respondents hold senior positions with related working experience and the majority of them had practiced in the field for 20-30 years." It is not clear what is meant by 'majority of them'. Is it more than 50%, 60%, 70%, 80% or 90%? There were three out of the eight studies using questionnaire survey that provided information of the profile of working experience of respondents. Out of the 2,500 respondents of Aziz (2013), there were 903 respondents (36.12%) with more than 15 years working experience. In Kholif et al. (2013), 30 out of 52 respondents (57.6%) had more than 15 years working experience. In Nawar (2017), 3 out of 15 respondents (20%) had more than 15 years working experience. This shows the importance of working experience to the validity of the major construction delay factors identified is not fully appreciated.

The evidence from existing literature is that the views of respondents of the top delay factors depended on their occupations (owner, contractor, or consultant). There was no breakdown of the number of the occupations of respondents reported in Amer (1994a, 1994b), Marzouk & El-Rasas (2014) and Shibani & Salah (2015). The views of consultants were not sought by Marzouk & El-Rasas (2014). The views of contractors were over-represented in Abd El-Razek et al. (2008), Aziz (2013), Nawar (2017), and Kholif et al. (2013). The views of consultants were over-represented in Hafez et al. (2016). The number of owners, contractors and consultants of the eight studies were not equal. This meant that the views of one or two of these occupation groups were over-represented in such studies.

The response rate of Abd El-Razek et al. (2008), Marzouk & El-Rasas (2014), Amer (1994a, 1994b), and Shibani & Salah (2015) could not be calculated because the needed information was not given. As shown in Table 1, the response rate of Hafez et al. (2016) was less than 50% while that for Kholif et al. (2013), Aziz (2013), and Nawar (2017) were more than 50%.

None of these studies had carried out a consistency check with a pilot survey after finalizing the survey questionnaire. Despite these criticisms, the eight studies are not without values. The major construction delay factors identified by combining the findings of the eight studies are more credible than the individual studies.

The number of times each major delay factor identified by the eight studies summarized in Table 1 was calculated. Table 3 shows the top seven construction delay factors most cited in the eight studies. It is noted that the top construction delay factor was identified by 100% of the eight studies and the seventh construction delay factors were identified by 37.5% of the eight studies. This clearly illustrates the wide diversity of the views of the respondents. The wide diversity can be attributed to the inclusion of a significant proportion of respondents with less than 15 years working experience in the eight studies and the very small number of respondents in Nawar (2017).

Table 3: Top Seven Construction Delay Factors for Egypt

Rank	Construction delay factor	Identified in studies	
		No.	Proportion (%)
1	Finance and payments of completed work by owner	8	100
2	Variation orders/changes of scope by owner during construction	6	75
2	Ineffective planning and scheduling	6	75
4	Financing by contractor	5	62.5
5	Inadequate contractor experience/incompetence contractor	4	50
5	Poor site management and supervision	4	50
7	Communication problems/inadequate project coordination by all participants	3	37.5
7	Unqualified workforce/low skilled labor	3	37.5
7	Inadequate site investigation/unforeseen subsurface conditions	3	37.5
7	Poor contract management by consultants/substandard contract	3	37.5
7	Economic conditions	3	37.5
7	Security/political situations	3	37.5

The major delay factors identified by various studies were apparent causes. Some of these factors might not be the root causes of delay as defined by Ellis & Thomas (2002). Ellis & Thomas (2002) found that the root cause for a highway project was insufficient resources even though 'utility relocations' was identified as an apparent delay factor. Generally root causes were fewer; apparent causes were many in number. The approach to identify root cause was to trace the process beyond the point of the apparent cause to find the root cause and appropriate corrective action (Ellis & Thomas 2002). During interviews with all project participants, root causes of delay will emerge from repeatedly hearing similar problems and statements. The root cause may be different in different countries for the same apparent delay factor because of differing practices in the construction sector, economic and political conditions, and cultural background. The construction delay factors 'finance and payments of completed work by owner' and 'variation orders/changes of scope by owner during construction' are under the owner category. The construction delay factors under the contractor category accounting for five of the top construction delay factors are: 'inadequate contractor experience/incompetence contractor', 'ineffective planning and scheduling', 'poor site management and supervision', 'financing by contractor' and 'unqualified workforce/low skilled labor'. The construction delay factors 'inadequate site investigation/unforeseen subsurface conditions' and 'poor contract management by consultants/substandard contract' are under the consultants-category.

It must be pointed out that the shortcomings discussed for the case study of Egypt are common in the 123 studies for other countries reviewed by Kog (2017a, 2017b, 2017c, 2017d, 2018a, 2018b, 2018c, 2018d, and 2019). This amply demonstrates that the present approach adopted for the study of major construction delay factors is not satisfactory.

Proposed Structured Approach Using Questionnaire Survey to Study Major Delay Factors

A review of the eight studies to identify major construction delay factors for Egypt performed in the present study reveals several short comings in the present approach for such studies. These short comings include the lack of standardization of delay factors; consistency check of the questionnaire design; the number of respondents in the questionnaire survey; the response rate (also known as completion rate or return rate); number of each occupational group, and the

number of years of working experience for respondents. These desirable conditions are not new in social science and business research. Judging from the large numbers of works using questionnaire survey to identify major construction delay factors reported in construction management journals (including the top journals) that do not comply with these conditions, this shows the inadequacy of such knowledge among the reviewers, researchers, and construction professionals is glaring.

Standardization of Construction Delay Factors

The advantage of standardization of construction delay factors is that no further explanation of the meaning of the delay factor is necessary. In many of the studies reported in the literature, some of the construction delay factors, such as 'sudden failures actions' of Aziz (2013) pointed out earlier, were not defined. It is not possible to understand what these construction delay factor mean. In addition, standardized construction delay factors facilitate comparison between different countries. It follows that the delay factors listed in the survey questionnaire must be those standardized delay factors. If non-standardized delay factor must be used, then it must be fully defined in the questionnaire.

Design of Questionnaire

After finalization of the questionnaire for the survey, a consistency check of the questionnaire is required before it is used for the survey. The consistency check is normally performed with a pilot survey. In statistics, procedures such as computing confidence intervals and conducting hypothesis tests are normally performed. A desired property of procedures is consistency as the number of items in the data set increases indefinitely. More importantly, consistency requires that the outcome of the procedure with unlimited data should identify the underlying truth. As shown in Table 1, none of the studies on Egypt has conducted such a consistency check of the questionnaire design. Internal consistency is usually measured with Cronbach's alpha (α), a statistic calculated from the pairwise correlations between items. Internal consistency ranges between negative infinity and one. Coefficient alpha will be negative whenever there is greater within-subject variability than between-subject variability. Cronbach's alpha coefficients of internal consistency reliability tests for each of the responses to the questionnaire must be at least 0.7. Higher values of alpha are seemed to be more desirable. A commonly accepted rule for describing internal consistency using Cronbach's alpha is as follows: excellent: $0.9 \leq \alpha$; good: $0.8 \leq \alpha < 0.9$; acceptable: $0.7 \leq \alpha < 0.8$; questionable: $0.6 \leq \alpha < 0.7$; poor: $0.5 \leq \alpha < 0.6$; unacceptable: $\alpha < 0.5$ (George & Mallery 2003). Revision to the questionnaire will be required when Cronbach's alpha coefficients are less than 0.7.

Number of Respondents of Questionnaire Survey

The number of respondents of the eight studies ranges from 15 to 2,500. It is clear that these studies do not follow any specific guideline on the minimum sample size. In most of the studies using questionnaire survey, the population of the respondents is not fully known to the researchers. Therefore, it is not possible to adopt random or probability sampling as a sampling frame. Normally, a self-administered survey questionnaire is sent to contractors, consultants and owners (including civil servants in charge of construction projects) who are members of the trade

associations and professional bodies. Most of the times, the mailing address of the respondents is obtained from trade associations and professional bodies. This means that those project participants who are not members of such organizations are left out. Mailing addresses of project participants who are not members of such organizations should be secured whenever possible so that questionnaire can also be sent to them.

Respondents are requested to assess the frequency of occurrence and severity for each construction delay factors listed in the questionnaire. A Likert scale of 1 to 5 is adopted for evaluating the frequency of occurrence and severity of each delay factor. Numerical values of 1 = very low, 2 = low, 3 = medium, 4 = high, and 5 = very high for frequency are assigned to the respondents rating. A similar scale is adopted for severity.

The sample proportion, p, is given by $p=x/n$ where x is the count of each rating for each delay factors in the sample collected and n is the size of the sample obtained from the population (Fleiss et al. 2003). When the ratings are independent, p has a binomial distribution. For sufficiently large n, the distribution of p will be closely approximated by a normal distribution. Using this approximation, it can be shown that this distribution's probability lies within 1.64 standard deviations of the mean at 95% confidence level. Using the Wald method for the binomial distribution, an interval of $p\pm2\sqrt{(0.25/n)}$ derived from Central Limit Theorem for proportions will form a 95% confidence interval for p, i.e. the estimate of p is within $p\pm e$, where e is the error. This means that e of the estimate of p is $2\sqrt{(0.25/n)}$. It follows that $n=1/e^2$ (NIST/SEMATECH 2013). For e = 10%, n = 100, and for e = 5%, n = 400. These numbers are often quoted in news reports of opinion surveys. Except for Aziz (2013), the errors of the rating of the studies for Egypt listed in Table 1 ranged from 11.6% to 31.6%. This meant that the sample sizes in these studies were too small.

Response Rate

Only a fraction of questionnaires sent is completed and returned. A survey's response rate is obtained by dividing the number of people who returned the completed survey questionnaires by the total number of survey questionnaires sent. A survey's response rate is viewed as an important indicator of survey quality. The range of the response rate of the eight studies for Egypt listed in Table 1 is 40% to 83.3%. A low response rate gives rise to sampling bias. The only way to ensure that a survey sample is unbiased is to obtain a 100% response rate, but this is very difficult and almost impossible in practice. Many researchers believed that higher response rates assured more accurate survey results (Aday 1996; Babbie 1990; Backstrom & Hursh 1963; Rea & Parker 1997). According to Evans (1991), a high response rate (>80%) from a small, random sample was preferable to a low response rate from a large sample. According to Moser & Kalton (1993), the response rate should be more than 40% in order for data to be acceptable for analysis. Data failed to be representative if the response rate was lower than 30% and result of the analysis was of little value for further interpretation. Babbie (1973) and Kidder (1981) regarded a response rate of 50% as an acceptable response rate in social research postal surveys. Baruch (1999) researched the response rates reported by 141 published studies and 175 surveys in five top management journals published in 1975, 1985 and 1995. He found that the overall average response rate was 55.6%. It seems that there was no consensus on the minimum response rate required. In view of the above discussion, it will be reasonable to conclude that a

minimum response rate of 50% is desirable. All the studies with known response rates listed in Table 1 complied with this requirement except Hafez et al. (2016).

Numbers of Owners, Contractors and Consultants

It is noted that the number of owners, contractors and consultants of all these studies with known information were not equal. The evidence from existing literature was that the views of respondents of the major delay factor depended on their occupations (owner, contractor, or consultant) of the respondents because they always blamed other project participants were responsible for most of the major delay factors (Abdul-Rahman et al. 2006, Akinsiku & Akinsulire 2012, Asiedu & Alfen 2016). Of the eight studies on Egypt, the views of one or two of these occupation groups were over-represented for studies where such information was given. There is a need to ensure that the numbers of each occupational groups; i.e. owners, contractors and consultants; are as close to equal as possible. This is to ensure that none of the occupational group is over-represented that will lead to a biased set of top major construction delay factors.

Minimum Working Experience of Survey Respondents

The present study has shown that respondents of questionnaire surveys should have a minimum working experience of 15 years. Alternatively, it will be necessary to conduct a consistency check of the views of respondents using statistical technique demonstrated in Kog & Loh (2013) for those respondents with less than 15 years working experience. If the consistency check shows that they share similar views of the top major construction delay factors with respondents with more than 15 years working experience, their views can be included in the sample for further analysis.

Proposed Approach for Questionnaire Surveys

Based on the preceding discussion, the proposed approach for questionnaire surveys is as follows. Consistency check of the questionnaire designed must be conducted with a pilot study to achieve a Cronbach's alpha coefficient of at least 0.7. The minimum working experience of respondents must be 15 years. The views of respondents with less than 15 years working experience can be included after consistency check as discussed earlier. It is important to achieve more than 400 completed questionnaires and a response rate of at least 50%. The number of respondents who are owners, contractors and consultants must be as close to equal as possible so that the views of each occupation group are not over-represented. When there is over-representation, or the required number of completed questionnaires and response rate is not met, those potential respondents of the required occupational group and working experience who do not return their questionnaires should be contacted for direct interview to complete the questionnaires to make up any shortfalls. Once all the above requirements are complied with, analysis of the data collected from the completed questionnaires can proceed to identify the major construction delay factors. The major delay factors identified by questionnaire survey are apparent causes. Root causes of delay can be determined during interviews or panel discussions of selected groups of owners, contractors, and consultants after identifying the major delay factors by questionnaire survey.

Conclusion

A review of the eight studies to identify major construction delay factors for Egypt is performed in the present study. Major construction delay factors for construction projects in Egypt identified by the present study include: 'communication problems/inadequate project coordination', 'finance and payments of completed work by owner', 'variation orders/changes of scope by owner during construction', 'inadequate contractor experience/incompetence contractor', 'ineffective planning and scheduling', 'poor site management and supervision', 'financing by contractor', 'unqualified workforce/low skilled labor', 'inadequate site investigation/unforeseen subsurface conditions', 'poor contract management by consultants/substandard contract', 'economic conditions', and 'security/political situations'.

The review has identified several short comings in the present approach adopted for studies using questionnaire survey to identify major construction delay factors. These short comings are pertaining to standardization of delay factor; minimum number of respondents; response rate; numbers of owners, contractors and consultants; and minimum working experience of respondents. A structured approach is proposed addressing these short comings of the present approach.

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