

Guidelines of Using Project Management Tools and Techniques to Mitigate Factors Causing Delays in Public Construction Projects in Kingdom of Saudi Arabia

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Abstract: Delays can be considered a common problem within public and private construction projects around the world but the problem is endemic in Kingdom of Saudi Arabia (KSA) where massive public funds are lost every year as a result. Delays may have significant negative impact not only to the KSA public construction projects but also on its economic and social status. Although several studies have examined the factors influencing delays in public construction projects in KSA, little attention has been paid to how project management tools and methods have made any impact to the incidence of project delays. This paper aims to develop the mapping and the guidelines using the principles of Project Management, after reviewing the critical factors for delays in public construction projects in the KSA. A careful attention was given to investigate the critical factors that are causing delays in building projects within public sector in KSA and the current practices of project management applications in order to develop guidelines to effectively mitigate construction delays in KSA. This review paper reports the top critical factors associated with delays in construction projects in KSA. It also identify project management tools and techniques that if implemented properly have the potentials to address the main factors contributing to the occurrence of delays. Following this, a new guideline to utilize Project Management tools and techniques in addressing the identified delay factors is also provided here with the view to help practitioners to minimize the potentials of construction delays in the KSA public projects.

Keywords: Construction, building projects, delays, project management, Kingdom of Saudi Arabia.

1. Introduction

Construction delays have been identified as endemic in the construction industry around the world. Multiple studies have identified incident of schedule delay as a major problem facing construction projects in the world (Sweis et al., 2008; Kaliba et al., 2009; Kazaz et al., 2012). According to Assaf and Al-Hejji (2006), delays were referred to as the “time overrun either beyond completion date specified in a contract, or beyond the date that parties agree upon for delivery of a project.” Construction projects that were completed late are typically at risk of cost overrun due to the likely loss of revenue that could be generated by timely operation of the facility (Kazaz et al., 2012).

In the Kingdom of Saudi Arabia delays in construction projects is not a recent phenomenon. As far back as 1983, it was reported that delayed projects accounted for 70% of projects undertaken by the Ministry of Housing and Public Works (Zain Al-Abidien, 1983). Al-Sultan (1987) conducted a survey on time performance of different types

of projects in KSA and pointed out that 70% of public projects experienced time overrun (Al-Sultan, 1987). In another study conducted by the Water and Sewage Authority in the Eastern Province in KSA, it was concluded that 45 (59%) out of a total of 76 projects completed during the period 1985–94 were delayed (Al-Khalil and Al-Ghafly, 1999, p. 101). In another survey, Falqi (2004) reported that 952 (40%) out of 2379 projects in KSA have been delayed, suggesting that some improvements have been achieved over the past decade (Al-Kharashi and Skitmore, 2009). In terms of cost and consequences, project delay is considered to be one of the most serious and frequent problems in the KSA construction industry (Faridi and El-Sayegh, 2006). As a matter of fact many academic studies have recognised the growing pattern of delays experiences in construction projects in the Kingdom, observed as early as 1983 up until now (Deloitte, 2013). While most of the studies have provided basic insights into the causes of delays in KSA construction projects over the years, it appears that there is limited publicly available study that has examined the

project management tools and techniques practices within the construction industry (Alotaibi et al., 2015).

Generally, government of KSA has contributed mostly to the construction sector growth in the Gulf nation. A previous study has long put percentage of government's contribution to the volume of construction activities in the country at 67% (Bubshait and Al - Musaid, 1992). According to the recent report of Deloitte, government of KSA still remains the major contributor to the construction industry growth index in the country (Deloitte, 2013). For instance, an examination of country's 2015 budget released by the Ministry of Finance indicates that The Kingdom has been allocating huge funds towards building construction projects with (USD 57.9 billion in 2015) as part of its nation plan. The projects include building schools, new colleges (500 projects in 2015), hospitals under construction (117 projects and 8 medical cities in 2015), labour offices, and social security infrastructure and sports facilities across the kingdom. Also the budget indicates the GDP growth form construction sector estimated by 6.7 percent in 2015 compared to 8.11 in 2014.

With the growing cases of delays in publicly owned construction projects in KSA, there certainly is a need for further and significant investigation of this phenomenon. Over the years, studies investigating factors contributing to delays in KSA construction projects have not been able to offer any empirical theories on how this problem can be managed (Kim et al., 2008). However, evidence from other regions have emphasized the significance of project management knowledge, tools and techniques in promoting the effectiveness of project management (Frame, 2002).

In light of the above, the aim of this paper to highlight the critical factors that are associated with delays in the construction building projects within public sector in KSA and develop ways for mitigating construction delays within the sector. The objectives of this paper are:

- To review the critical factors causing delays in public construction projects in KSA.
- To develop a Project Management process model that could be used to better understand the occurrence of delays and support the effective time management of in public construction projects in KSA.
- To develop project management guidelines that could provide assistance in anticipating the incidence of construction delays in the KSA public building projects.

2. Literature Review

2.1. Delays

Delays have been defined in several studies. One common definition of a delay is an incident that leads to an extension in the time agreed to complete tasks or ultimately deliver the project (Assaf and Al-Hejji, 2006; Stumpf, 2000). Enshassi et al. (2009) defined a delay as an event that hinders the progress of the project. In their study, Sanders and Eagles (2001) described delays events that lead to extension in time required for part of a project or the entire project (Sanders and Eagles, 2001), while yet another study defined delays as situations in which the contractor and the project owner jointly or severally

contribute to the non-completion of the project within the original, stipulated or agreed contract period (Aibinu and Jagboro, 2002). According to Assaf and Al-Hejji (2006), delays could also be referred to as the "time overrun either beyond completion date specified in a contract, or beyond the date that parties agree upon for delivery of a project."

2.2. Effects of Delays

Without doubt, late completion of projects can have dire consequences on not just the project performance but all stakeholders. For example delays in the completion of road maintenance projects can cause further discomfort for the road users (Gao and Zhang, 2013). Delays may contribute to project cost overruns in some forms. One of the means that delays may lead to cost overruns is through increase in overhead costs and other expenses that contractors have to incur as the project drags on for longer than anticipated period (Mansfield et al., 1994). Also, contractors may accrue huge interests on borrowed investment money as a result of contractors' capital being trapped in the project due to delays (Odeh and Battaineh, 2002). Another example of how delays lead to cost overruns is that when projects are delayed, there is high chance of the need to add more resources and hence increased spending in order to facilitate speedy completion of the project (Aibinu and Odeyinka, 2006). Moreover, cost of materials may increase during the period of delays, thereby significantly increasing the project costs (Koushki et al., 2005).

Apart from potentially causing cost overruns, delays may incur loss of income that could have been generated from the operation of the constructed building facility (Kazaz et al., 2012). Moreover, delays could result into disputes between parties involved in the projects and possible litigations and then financial loss in the process (Semple et al., 1994). For instance, contractors and project owners could be locked in disputes and consequently legal actions when contractors fail to deliver the projects within the time stipulated in the contract (Al-Khalil and Al-Ghafly, 1999). Legal action could be time-wasting and energy sapping, needless to emphasize its cost burden for parties involved, so it is an option that can create prolonged acrimony between the parties and loss of future opportunities for contractors (Yates and Epstein, 2006).

Al-Kharashi and Skitmore (2009) also refer to the impact of delays on projects from a different perspective. In the case of public sector construction, they identified negative influences of delays to include: confusion in relation to the public development; disturbance in the budget execution; public inconveniences with possible political implications. Delays are generally costly for both stakeholders that involved.

2.3. Types of Construction Delays

Delays in construction projects could be generally classified into excusable or non-excusable delays (Menesi, 2007). Excusable delays are caused by circumstances which are beyond the control of the contractors (Fugar and Agyakwah-Baah, 2010). Trauner et al. (2009), state that generally any unanticipated event which is not within the contractor's control is deemed as excusable delay. Further they give examples of excusable delays such as flood, fire, act of God, labour strife, and changes in design made by owners, omissions and errors in plan and specifications, hidden conditions, government or legal interventions, non-

co-operation by government agencies and weather. However, non-excusable delays are caused by circumstances which are within the control of the contractors (Majid and McCaffer, 1998). Further, the excusable delays could be compensable or non-compensable (Wei, 2010). Compensable excusable delays are caused by project owners or their agents, and hence the contractors are entitled to claim damages (Fugar and Agyakwa-Baah, 2010). An example of this would be the delayed delivery of engineering designs by the engineers in direct employment of the owners. On the other hand, non-compensable excusable delays are typically caused by third parties or incidents which are beyond the control of either contractors or owners. The example of these would be changes in government regulations or extreme weather.

2.4. Construction Delays Globally

Delays in construction projects have been considered a common dilemma in the construction industry globally. In Nigeria for instance, Odeyinka and Yusif showed that seven out of ten construction projects suffered delays in their execution (Odeyinka and Yusuf, 1997). Common causes of construction delays in Nigeria were identified in a survey study as inclement weather, shortages of resources, financial difficulties faced by public agencies and contractors, poor contract management (Aibinu and Odeyinka, 2006). Study by Aibinu and Odeyinka (2006) which analysed questionnaires posted to construction managers also reported that common causes of construction delays in Nigeria include unfavourable weather, inadequate project resources, improper contract management, and problems of finance that public agencies and contractors are confronted with.

According to a study that employed datasets derived from an interview survey involving some 450 project owners and developers of private residential houses covering 27 urban districts in Kuwait, the three main contributing factors to the frequent incident of construction delays in the country were identified as number of change orders, financial constraints, and owners' lack of experience in construction (Koushki et al., 2005). In Hong Kong, construction practitioners agreed that construction delays in the country are caused by "unforeseen ground conditions, poor site management and supervision by consultants, environmental restrictions, exceptional low bids, and client variations" (Lo et al., 2006).

A study in Malaysia in 2005, showed that nearly 17.3% of government construction projects experienced delays of more than three months (Sambasivan and Soon, 2007). The most common grounds for delays in construction projects were recognised as inadequate training of contractors, poor site management by contractors, insufficient contractor experience, unsatisfactory management of finance by the client and poor scheduling of payments for work completed, issues with sub-contractors, labour and material shortage, unavailability of construction equipment, poor communication between stakeholders, and errors during the construction stage (Sambasivan and Soon, 2007).

A recent study was conducted by (Albogamy et al., 2013) on construction public sector in the KSA. Their

study involved a survey of clients, consultants and contractors, across the public sector construction projects in the KSA and Kingdom of Jordan. The study revealed that the top five factors contributed to delays in construction projects were low performance of the lowest-bidder system; delays in sub-contractors' work; poor qualifications, skills and experience of the contractor's technical staff; poor planning and scheduling of the project by the contractor; and delays in progress payments by the owner (Albogamy et al., 2013).

Delays in construction projects are not just restricted to developing countries, but are also seen in the so called developed countries. A report by the National Audit Office in the United Kingdom says that nearly 70% of the construction projects undertaken by various public departments had experienced some form of delays (Bourn, 2001). Further, according to the Building Cost Information Service in the UK nearly 40% of construction projects investigated in the UK had experienced some form of delays and had failed to meet their originally planned completion time (Bourn, 2003). A study by Nkado (1995), identified some of the common causes of construction delays in the UK, which were linked to the completion sequence as specified by the client, contractor's scheduling of the construction activities, client's and designer's priority on construction activities, construction type, project complexity, building location, build ability of design, and completeness and timeliness of project data (Nkado, 1995).

In Australia, Wong et al. (2012) identified 48 possible causes of construction delays in Western Australia through a review of literature. Based on the 48 causes, a survey was conducted on 32 construction professionals in Western Australia to identify top most causes of construction delays in the state. The five most prevalent causes of construction delays according to the respondents were: shortage of skills; financial difficulties; shortage of labour; unrealistic deadlines for project completion and unforeseen ground conditions (Wong and Vimonsatit, 2012).

In another study conducted in the United States, Chang (2002) investigated causes of delays in construction engineering design projects using 4 environmental and engineering design projects for roadway construction projects in California. The study grouped the reasons for delays into three categories namely: causes within the owner's control; causes within the consultant's control; and causes beyond either the owner's or consultant's control (Chang, 2002). Also, a study by Syed et al. (2003) in Florida indicated that both construction project owners and consultants were responsible for the widespread incident of construction delays in this state. They identified the primary causes of delays in the State to be lack of proper monitoring and control by project owners and consultants, project design flaws and lack of compliance with building codes.

From the foregoing, it is apparent that while construction delays is a significant problem globally, the most important causes of this delay can exist under a wide range of different conditions, depending on the local circumstances, such as the regulatory environment in-

country, level of expertise and experience, level of awareness and familiarity with international project management standards, techniques and tools like. These factors have significant impact on management of construction projects and the potential for delays.

2.5. Construction Delays in KSA

The construction industry in KSA is considered to be one of the most important economic drivers in the Kingdom. It plays a vital part in the progress of the various regions and contributes to the overall development of the Kingdom. Delays in construction projects are not really recent phenomena in KSA. As early as 1983, Zain Al-Abidien (1983) found that nearly 70% of projects undertaken by the Ministry of Housing and Public Works experienced delays (Zain Al-Abidien, 1983). Further, Al-Sultan (1987) studied the performance of different types of projects in the Kingdom and concluded that 70% of public projects had experienced time delays. A preliminary survey by the Water and Sewage Authority in the Eastern Province in KSA found that 45 (59%) out of a total of 76 projects completed during the period 1985–94 experienced delays (Al-Khalil and Al-Ghafly, 1999, p. 101). Another study, by Falqi (2004) stated that 952 (40%) out of 2379 projects in KSA had experienced delays, with suggestions that some improvement have been observed over the past decade (Al-Kharashi and Skitmore, 2009). In terms of cost and consequences, delays in projects is considered to be one of the most serious and frequent problems of the construction industry in the Kingdom (Faridi and El-Sayegh, 2006).

2.5.1. Sources of Construction Delays in KSA.

During the last decades several studies have researched the reasons for delays in construction projects in the Kingdom. With most studies focusing on public sector construction projects such as Albogamy et al. (2013), Al-Hammad (1993), Al-Khalil and Al-Ghafly (1999), Falqi (2004), Assaf and Al-Hejji (2006), Al-Kharashi and Skitmore (2009) and Al Mobarak et al. (2013). Generally their studies takes into account the perspectives of construction clients, contractors and consultants. Following a comprehensive review of literature which focuses on reasons causing delays in construction projects in the KSA, the top factors contributing to delays in construction building projects in the Kingdom are captured in Table 1. Most of these studies were conducted by using the questionnaire survey. Mostly the data analysis methodologies employed were Frequency Index, Severity Index and Importance Index. However, the table shows that there is a convergence of views between authors on the different sources that contributing to delays in construction projects in the Kingdom.

Ineffective planning and scheduling of the project by contractors is caused by poor experience and qualifications, results in inaccurate estimation of tasks and other aspects of the construction project and also results in conflict between the stakeholders and project delays (Albogamy et al., 2013), (Agumba and Fester, 2011), (Al-Kharashi and Skitmore, 2009). Also the tendering system is used to award contracts, the contractor winning the bid tried to lower his cost by hiring less experienced personnel (Falqi, 2004). Delays in progress payment, resulting from

bureaucratic procedures of the various government agencies, results in work being stopped as contractors are unable to meet daily expenditure which are high. (Frimpong et al., 2003; Al-Najjar, 2008; Koushki et al., 2005; Asnaashari et al., 2009; Mahamid et al., 2012; Odeh and Battaineh, 2002; Alghbari et al., 2007; Al-Momani, 2000). (Al-Kharashi and Skitmore, 2009) (Al-Mudlej, 1984; Al-Hazmi, 1987; Al-Subaie, 1987; Al-Khalil and Al-Ghafly, 1999; Al-Sedairy, 2001). Further, changes in scope and design while the construction is in progress is very common in projects in the Middle East, leading to delays caused by re-design, task repetitions and extra financial burden (Kasimu, 2012), (Albogamy et al., 2013), (Al-Kharashi and Skitmore, 2009), (Assaf and Al-Hejji, 2006). Poor communication and coordination between the stakeholders is common in the Middle East, especially when imported labor speaking different languages (Al-Kharashi and Skitmore, 2009), (Falqi, 2004), (Mahamid, 2013). All these results in project delays for public construction projects in the KSA. The issues which cause the delays is sometimes unique to the Middle East and may not occur in developed countries.

2.5.2. Project Management Theory

Project management methods is essentially designed for the application of knowledge, skills, tool, and techniques to manage activities so as to meet the project objectives (PMI, 2013). The importance of project management techniques and tools in achieving the project objectives and expectations has been widely reported in literature (Milosevic, 2003; Murphy and Ledwith, 2007). For instance, the application of the principles of project management have been considered to be very efficient in the management and control of project activities (Murphy and Ledwith, 2007).

Most research on project management emphasize the importance of successful implementation of techniques in projects. Project management is an essential part which contributes to project success (Munns and Bjeirmi, 1996). Project management principles is mainly applied to improve the performance of the project (Ko, 2011). Duncan and Gorsha were able to identify three areas which affected the project success, which were over-expenditure, under-costing and delayed delivery, and state that project management is essential to overcome these issues (Duncan and Gorsha, 1983). Further Lackman has described some project management tools that contributed to project success such as project plans, work breakdown structure (WBS) and client information sheets (Lackman, 1987).

Project management recognizes the existence of several inter-related tasks working towards a definite objective. The objective here is the project which has definite objectives in terms of time, economics and technology. Project management also places responsibility on one person for supervision of these inter-related human tasks, which is known as project management. In relation to construction projects project management would require delivery of quality buildings at optimal cost and time (Bennett, 1983).

Table 1. Top factors contributing to delays in KSA

Delays Causes	Authors
Ineffective planning and scheduling of the project by the contractors	Al-Ojaimi, 1989; Assaf et al., 1995; Alkalil and Al-Ghafly, 1999; Falqi, 2004; Assaf and Al-Hejji, 2006; Al-Kharashi and Skitmore, 2009; (Albogamy et al., 2013)
Poor qualification, skills and experience of the contractors' staff	Al-Ojaimi, 1989; Assaf et al., 1995; Alkalil and Al-Ghafly, 1999; Falqi, 2004; Assaf and Al-Hejji, 2006; Al-Kharashi and Skitmore, 2009 (Albogamy et al., 2013)
Delay in progress payment by the client	Al-Mudlj, 1984; Al-Hzmi, 1987; Al-Subaie, 1987; Alkalil and Al-Ghafly, 1999; Falqi, 2004; Assaf and Al-Hejji, 2006; Al-Kharashi and Skitmore, 2009 (Albogamy et al., 2013)
Changes during construction by client	Alkalil and Al-Ghafly 1999; Assaf and Al-Hejji, 2006; Al-Kharashi and Skitmore, 2009 (Albogamy et al., 2013)
Slowness in decision making by client	(Al-Kharashi and Skitmore, 2009), (Assaf and Al-Hejji, 2006), (Falqi, 2004)
Poor communication and coordination between construction parties	Alkalil and Al-Ghafly, 1999; Falqi, 2004; Assaf and Al-Hejji, 2006; Al-Kharashi and Skitmore, 2009
Assigning contracts to the lowest bidder without regards to qualification	Alkalil and Al-Ghafly, 1999; Assaf and Al-Hejji, 2006; Al-Kharashi and Skitmore, 2009, (Albogamy et al., 2013)
Delay in approving major changes in the scope of work by consultant	Alkalil and Al-Ghafly, 1999; Assaf and Al-Hejji, 2006; Al-Kharashi and Skitmore, 2009 (Albogamy et al., 2013)

Application of project management methodologies in the construction industry is unique as it deals with geographical variations, involves design and engineering professionals, requires huge amount of material, tools and physical labor to build and modify, and involves several stakeholders such as community groups and environmental agencies in addition clients and owners (PMI, 2003).

Even though, the theory of project management imply that the delays in construction projects could be minimized using project management tools and method, it has been argued that the underlying principles of project management theories are obsolete and must be reviewed (Koskela, 2002). Hence, it is pertinent to examine the project management theory, especially in the light of the problems faced by public building projects in KSA. Such in-depth review of project management theory and concepts could be of vital significance to developing customized guidelines based on project management tools and techniques that could help mitigate the incidents of delays experienced within the public construction sector in KSA.

3. Research Methodology

Deductive reasoning, which is based on the development of specific statements or from observations, general principals and experience (Gay et al., 2011) is used here, representing the early stage of a mixed approach research strategy. Hence the deductive research methodology starts with analysis of relevant literature and prior studies in the field of interest, and identifies the disconnect between prevailing evidence and theories, the contradictions to be examined and new instances of application of previous

research (Sutrisna, 2009). However, the objective of this paper is to present the outcome of a detailed literature review on public construction project delays, with special emphasis on public building projects in the KSA, in order to explore and identify the major sources of delays in its construction projects. Also to develop a process model that could be utilized for better management of the occurrence of delays in the KSA public building projects. In addition to that, an established guidelines that captured the potential factors which contribute to delays, potential approaches for their management has also been developed and presented. It could be considered that the analysis and arguments presented in this paper provide values in promoting a better understanding of the nature of the public construction industry in the Kingdom and provide a robust platform to motivate further research efforts on this subject.

4. Managing Factors Contributing to Delays

Suggestion on how to manage construction delays grounded on empirical evidence are usually scanty within the body of knowledge. Nevertheless, some measures have been suggested to minimize the issues of delays in construction projects. One of the recommended measures for reduction in delays during the implementation phase of the building construction project is to have a detailed and strong project management plan in place (Abdelnaser et al., 2005).

In a relevant study, Nguyen et al. (2004) suggested that five factors were necessary for the reduction of the possibility of delays in construction projects. These factors are the availability of resources; multi-disciplinary / competent project team; competent project manager;

accurate estimation of initial costs and initial time schedules. In yet another study, Koushki et al. (2005) recommended that reducing construction delays would require adequacy and availability of funds until the project completion. In addition, the study also stresses the importance of selecting a competent consultant and a reliable contractor to carry out the work (Koushki et al., 2005).

In their own study, Odeh and Battaineh (2002) suggest that reducing issues such as delays in construction projects requires enforcement of liquidation damage clauses and offering incentives to contractors and other project teams for project's early completion. They also recommended effective human resources development across the construction industry through proper training to help with building capacity (Odeh and Battaineh, 2002). Other approaches supported by the study are: adoption of a new approach to contract award procedures by giving less weight to prices and more weight to capacities and past performances of contractors; and application of new approaches for contracts, such as design-build and construction management-type contracts.

According to Aibinu and Jagboro (2002), delays had significant effects on the completion cost and time of 61 Nigerian building projects considered in their study. However, they recommended acceleration of site activities; improved client's project management procedure; and inclusion of appropriate contingency allowance in pre-contract estimate as the solutions to the high incidents of construction delays in Nigeria (Aibinu and Jagboro, 2002).

Although previous suggestions on how to minimize construction delays are invaluable and have provided basis on which further advancement can be made in addressing the problems of delays in construction projects, they have not provided holistic approaches for curbing the syndrome. The limitations of the suggestions made by the previous authors can be understandably based on the basic knowledge of project management methodologies at the time they published their articles. Nonetheless, most of the suggestions proposed by the authors are rooted in the modern project management processes and principles. As project management principles are becoming widely accepted across the globe in the recent years, it would be interesting to examine how building projects in public construction sector in the KSA could leverage on this to manage frequent incidents of delays in government owned building construction projects.

4.1. Project Management Approach to Managing Construction Delay in KSA

Recommendations from previous studies suggests that the critical factors which contribute to delays in building

construction projects in the KSA could be managed using principles of project management. The major critical factors which contributes to delays in construction projects have been identified across the literature, as ineffective project planning and scheduling by contractors; slow decision-making process; poor qualifications, skillsets and experience of the staff of the contractors; delays in progressive payments by the client; awarding contracts to the lowest bidder system; change orders by the client; delays in approval of major scope changes in the by the consultant;. Inadequate capacity to manage these factors may be connected to the poor implementation of the principles of project management across public sector construction projects in the KSA (AlMobarak et al., 2013). According to these researchers, the field of project management is still fairly new in KSA and there was unwillingness from most of the industry professionals to adopt it. There is a requirement for further research for identifying how knowledge of project management tools and techniques can be implemented to minimize incidents of delays in public sector construction projects in KSA. Hence, the current research attempts to improve the efficiency of management of the critical factors which contribute to delays in construction projects, by clearly demonstrating the potential benefits of using project management tools and techniques to address the problem.

Nevertheless, in the KSA, the usage of the principles of project management to drive successful projects is still at its infancy stage (AlMobarak et al., 2013). Although it is anticipated that adopting of project management principles and tools would contribute towards alleviating delays in construction projects, prior research reviewed in this paper have not methodically studied the current practices in order to determine gaps that have to be filled through adoption of said tools and principles. As such, this study intends to establish the gaps in practice in order to satisfy the second objective of this study.

However, there are several project management tools and techniques that can be applied for addressing the various issues plaguing projects, such as those related to project planning, cost management, human resources management and time management.

Nevertheless, in order to emphasize the potential of project management principles in mitigating delays in the public building projects in the KSA, Figure1 below lists the major sources of project delays as identified through the literature review which is specific to the public construction projects in the KSA. These factors have been mapped against project management process during the project lifecycle and tools that have the potential to minimize the impact of these sources of delay.

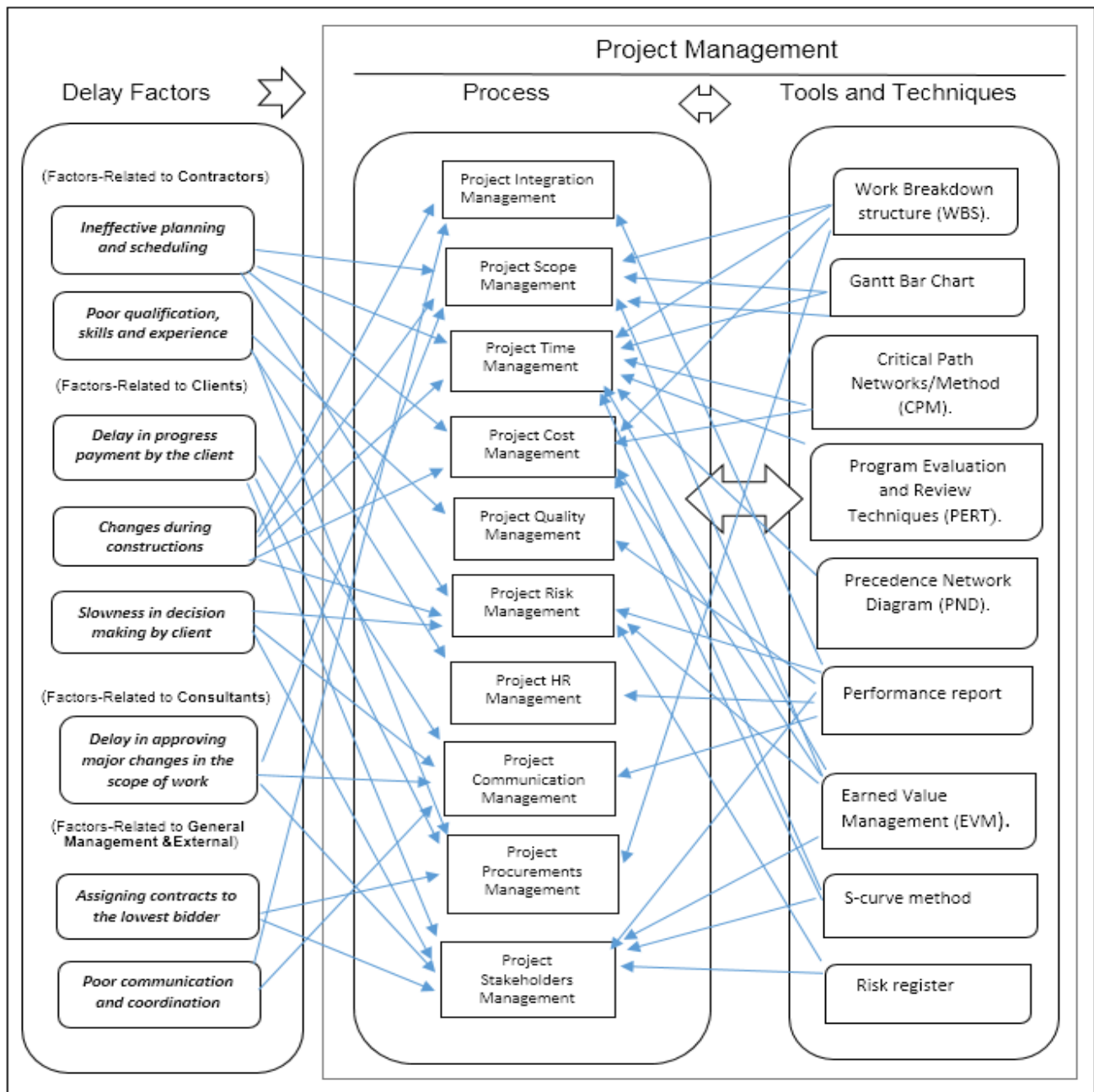


Fig. 1. The mapping of sources of delays in KSA against PM process and tools

4.2. Managing Factors related to the Contractors

There are certain project management tools and techniques that can be utilized to warrant efficient planning and scheduling of public building projects in the KSA. They include critical path method (CPM), work breakdown structures (WBS), critical chain method (CCM), Precedence Diagram Method (PDM), Gantt charts and Program Evaluation Review Technique (PERT) (PMI, 2013). Similarly, in order to control the activities of the project against the plan and schedule, tools and techniques such as EVM, performance reviews, analytical techniques, schedule compression and project management information system have been recommended (APM, 2006). Work breakdown structure (WBS) is a deliverable-oriented de-composition of the elements of the project into phases, work packages and deliverables with each lower level representing an increasingly comprehensive

description of the project work (Haugan, 2002). WBS is described as a common focal point for presentation of the project in total from the uppermost hierarchy to the lowest (Haugan, 2002). WBS helps in the efficient allocation of time to the various tasks which are embedded within the project (Burke, 2013). As such, WBS promotes the timely completion and manageability of the project activities. Normally, WBS enables easy planning and scheduling of the project and its activities (Lanford and McCann, 1983).

Other than WBS, critical path method (CPM) has been acknowledged as another tool or technique of project management. CPM is considered an efficient time management tool for complex projects (PMI, 2013). It supports the logical sequencing and timing of every project activity (Yamín and Harmelink, 2001). Furthermore, CPM communicates the inter-dependencies between the activities and therefore offers a more efficient

time management toolset for complex and large projects (Kallantzis et al., 2007). The process of critical path methodology involves breaking down the project into a logical sequence of activities that has to be completed and estimation of the time duration of every activity (PMI, 2013). According to PMI (2013), CPM can improve communication and planning, leading to effective time management; assist in estimating and calculating the time required to complete the project; highlighting critical activities which may influence the duration of the project; highlight the “float times” for all activities. Other project management tools and techniques such as Precedence Diagram Method (PDM), Program Evaluation Review Technique (PERT) and Gantt chart have also been found to be efficient in managing the project time (PMI, 2013).

4.3. Managing Factors related to the Client

Change orders or variations have been considered as any additions or deletions from the original project scope which may cause time or cost over or under runs (Park and Peña-Mora, 2003). It is quite common in construction projects for the owners to issue change orders during the project construction, by either adding or deleting some deliverables or activities (Ibbs et al., 2007). Taking into consideration the importance of change order in project management, it is very important that the clients of the building construction projects in KSA (mostly the government) should be made aware of the consequences of change order and its possible effects on the progress of the project. Change order needs to be evaluated and its effects established during the project management work and execution of integrated change control (PMI, 2013). To bring about reduction in this issue which causes unwanted delay in public sector construction building projects in the KSA, change orders proposed by the client should be effectively managed using the principles of project management such as expert judgement, meetings, and change control toolsets based on the project organization and environmental constraints (PMI, 2013).

In order to manage delays in the progressive payments by the client (basically the government) in KSA, the principals of project management principles can be applied. For instance, an effective cost management plan could be utilised to address the issues of delays in progressive payments by the client. Using efficient cost management policies, procedures, plan and documentation for the planning, management, and control of project costs would involve establishing the required project cash flows at the outset of the project (PMI, 2013). Such plans would support in the correct estimation of the amount, location, and timing of progressive payments for projects, from the perspective of the clients (Dayanand and Padman, 2001). It is vital that data related to project expenditures should be presented clearly, such that the client can comprehend. Effective cost management plans can bring about the reduction in the chances of progressive payments being delayed by the client, because it will warn against the consequences of not making the payments when its due (Ulusoy and Cebelli, 2000).

4.5. Managing Factors related to the Consultant

The importance of involving the expertise of experienced consultants in any major project cannot be over-

emphasised. Consultants typically help in setting up a stage for emergent activities within a project, and hence their role is more concerned with the ‘foundation laying’ (Kadefors, 2004). Considering the consultant roles, it is suggested that prior experience of any potential project consultants should be thoroughly evaluated before engaging their services (Berggren et al., 2001). In many instances, proficiency of consultants are essential for the development of the project charter, direction and management of project work, performance of integrated change control, defining of the project scope and many other activities undertaken as part of the project (PMI, 2013). For reducing the issue of inexperienced consultants in the KSA, experience of the potential candidates should undergo thorough scrutiny to determine the consultant’s suitability for the successful execution of the project (Kadefors, 2004).

Rapid approval of major changes in the scope of project work by consultant may also be very critical to prevent overall delays in the project. The reason being such changes may affect the project management plan, project documents and deliverables (PMI, 2013). One method of preventing delays in the approving of major project scope changes by the consultant is to recruit an experienced and qualified consultant who understands the consequences of certain actions on the project performance as well as the ability to utilize project management tools and techniques (Berggren et al., 2001; Albogamy et al., 2013).

5. The Proposed Guideline

The following guidelines illustrated in Table 2 provide proactive initiatives to be considered in minimizing the likelihood of delays and potentially improving the situation within the public building projects in the KSA.

As the above guidelines are based on project management principles as outlined by PMBOK methodology as a generic guideline that can be applied in construction industry of any country. However, the delays factors being addressed here are more specific to construction projects based in KSA. The guidelines would be especially useful in addressing delays in construction projects in construction industries with similar characteristics to the ones of KSA which may include (but not limited to) Middle East, Africa and other developing regions. Especially in reference to the gulf region, the issues which cause delays are similar as those discussed here in the context of KSA, hence these guidelines should be more useful for public building projects in the Gulf region. Also, most Middle East countries have embarked on large scale public sector construction projects, with large investment. Hence the guidelines would help in promoting more effective management in construction projects, resulting in on quality, on time and within budget delivery of these projects.

This paper has given a new viewpoint of how problems of delays in public construction projects could be addressed, using the example of the KSA. This study has identified the top factors causing recurrent incidents of delays in building construction projects in the KSA are in-efficient project scheduling and planning by the contractors; inadequate qualification, skillsets and experience of the

contractor workers; delays in making progress payments by the owners; changes in project scope by the owners and assigning contracts to the lowest bidder without regards to qualification. However, it has been argued that those factors could be better managed using applicable by applying appropriate project management techniques, tools and principles. The paper presents an argument pointing towards new directions in addressing the issues of persistent delays in public construction projects in KSA. This was followed by identifying potential project management tools and techniques that could be utilized to support the effective management of project time mapped against the top sources of project delays in KSA. Bringing these two together, this paper presents guidelines that could be considered to minimize incidents of delays within the building construction projects in the KSA public sector.

The guidelines discussed based on PM principles and specific to the construction industry are typically constrained in terms of size, time, scope, quality and budget (PMI, 2008). Whilst the guidelines have been developed based on study of historical projects which are mainly to increase the likelihood of success for future projects. For instance, these successes in the reported historical projects could have been influenced by management styles, traits or competencies. Hence these guidelines are limited by leadership quality (Toth, 2011). The guidelines simply lays out the processes and how they connect with the techniques and tools that can be used (Wideman, 2002; Bell, 2009) and not designed to improve the intrinsic and existing leadership quality.

Table 2. The proposed guidelines

Delays Factors	Guidelines
<i>Contractor - related factors</i>	
Ineffective planning and scheduling of project	This factor can be more effectively managed by using a robust Project Management Plan at early stages of construction project. Scheduling could better managed through the application of Project Time Management process, involving tools such as WBS which will help project managers and project team to develop schedule, budgeting and easily execute project activities; defines the different tasks and responsibilities to be undertaken to complete the project and improve the effectiveness of how time is allocated. Another planning tool and technique is PERT helps give better time estimation for a project. CPM is an effective time management tool for complex projects. It can display the sequence and timing of each activity more logically, and hence communicate the interdependencies and is a more effective time management tool for large and complex projects (PMI, 2013). Ensure modern PM software are used for project planning, scheduling. Equally important, ensure proper project controlling and monitoring during the project lifecycle. These would potentially overcome these issues in the KSA public building projects.
Poor qualification, skills and experience of the staff	The KSA construction building project participants could employ Project Human Resources Management applications that involve estimation of the resources required for activities, consideration of enterprise environmental factors and organizational process assets. Tools used are Organization Charts, Responsibility Matrices, and Role Description, (PMI, 2013). These would meet the challenge of poor qualification, skills and experience. The personnel could be trained to follow the standard Project Human Resources Management guidelines.
Poor site management and supervision	Involving Project Management with the construction projects in KSA would reduce the delays caused by poor site management as the processes get standardized and monitored regularly; tools and techniques such as project performance reports, (EVM), monitoring controlling tools, periodic review of the progress could help to avoid numerous problems confronting projects (PMI, 2013).
Difficulties in financing the project	Project Cost Management would ensure that work in progress can be estimated and payments be released according to schedule to ensure the smooth progress of the project.
Delay in sub-contractors' work	Project Integration Management would ensure that each stakeholder is keeping up with his assigned schedule.
<i>Client - related factors</i>	
Unrealistic estimates for project duration	PMOs within KSA public agencies should ensure PM practices is done by experienced professionals that using tools such as CPM which can improve communication and planning, leading to effective time management; assist in estimating and calculating the time required to complete the project; highlighting critical activities which may influence the duration of the project; highlight the "float times" for all activities. Also expert judgment, analogous estimation, parametric estimation, bottom-up estimation, 3 point estimation, reserve analysis, quality cost, project management software, vendor bid analysis and group decisions (PMI, 2013). Thus would ensure that there is no under- or over-estimation of time and having a more realistic schedule of tasks.
Change orders	Delays caused by changes requested for the project could better managed in KSA through the application of Project Scope Management that involves planning scope management and controlling the scope. Using tools such as (EVM) to identify and predicts project variances by comparing what work completed to plan. Also by involving project, integrated change control, management plan, project charter, enterprise environmental factors such as organization culture, infrastructure, market conditions and administration of personnel (EVM) to measure scope performance (PMI, 2013).
Slowness in decision-making process	

Table 2. The proposed guidelines (continued)

Delays Factors	Guidelines
Delay to furnish and deliver the site to contractor	This issue could potentially mitigate through Project Stakeholder Management, Project Communications Management and Project Risk management; The output of these processes would ensure timely decisions are taken and cut through bureaucratic red tape in KSA.
Delay in progress payment	This could better manage through Project Time Management process and Project Communications Management. Project cost management Plan and Control. Also Project Communications Management could be involved to ensure payment schedules are agreed upon in the contract.
Consultant - related factors	
Delay in approving shop drawings and sample materials	Bring professionalism and experience into project management, as such Project Time Management approaches could overcome these factors.
Unclear and inadequate details in drawings	Project Management processes including Product-oriented processes, initiating, planning, execution, monitoring and controlling of process groups .Using tools and techniques such as project performance reports, (EVA), monitoring controlling tools, periodic review of the progress could help to potentially avoid numerous problems confronting projects (PMI, 2013).
Ineffective control progress of project	
Poor qualifications of supervisory staff of the consultant staff	Adopting Project Human Resources Management approaches in the KSA public construction industry; using tools such as Organization Charts, Responsibility Matrices, and Role Description, (PMI, 2013), would ensure that minimum qualification and experience are fixed for the workforce, ensuring quality work.
General management and external - related factors	
Lack of communication between all projects parties	A robust PMP could manage these factors through Communications Management Plan and Controlling Communications strategy. Tools used Involve Communications Matrix. Hence, the KSA public construction could employ these approaches in order to better mitigate the impact caused by this factor.
Shortage of qualified manpower	Project Human Resources Management.
Contracts to the lowest bidder system	Contractors selection criteria in KSA could improve to better overcome this matter. Suggested approaches are past performance, prequalification.
Changes in material and resources prices during construction	Changes in material and resources prices during construction in KSA could be reduced through the adoption of Project Risk Management application and Project Procurement Management. These applications include procedure and strategies that could address this matter. Using tools such as contingency and cost change control bidder conferences, techniques of evaluating proposals, independent estimation, expert judgment, advertising, analytical techniques and procurement negotiations (PMI, 2013). These potentially could overcome these factors.
Weather effect (hot, rain, etc.)	Project risk management plan. Prepare contingency plans for extreme climatic conditions.

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