



International Journal of Engineering Research and Science & Technology

ISSN : 2319-5991
Vol. 6, No. 2
May 2017



www.ijerst.com

Email: editorijerst@gmail.com or editor@ijerst.com

Research Paper

ANALYSING THE ROLE OF CLIENTS IN THE JORDANIAN CONSTRUCTION SUPPLY CHAIN DELAYS

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Construction projects main goal is the completion of projects on time without any cost overruns and time delays. Project delays are undesirable due to their consequences on project budget and schedule. To reduce the risk of project disruptions to occur, cooperation of all Construction Supply Chain (CSC) partners, client, contractor, suppliers and architecture, is required. This paper quantifies the extent of impact of information flow on construction projects' performance through site observations, main survey and development of simulation scenario in order to analyse the extent of impact of the information flow from the client to the contractor. The results demonstrated a delay of 6.5% on the projects duration with a 20% average probability of a delay occurring. The main issues were payment from the client to the main contractor for design changes with a probability of occurrence of 36%, a 1-day delay on the duration.

Keywords: Supply chain management, Construction information flow, Construction supply chain, Project performance, Residential housing construction projects in Jordan, Client role in delays

INTRODUCTION

Modern construction contractor's encounter many challenges in delivering a project successfully due to the increasing complexity of projects (Doloi, 2009). The Construction Supply Chain (CSC) performance lags behind supply chain in other sectors (Harty, 2008; Segerstedt, 2010; and Bankvall, 2010). Many construction processes lack efficiencies and are inadequate due to many problems including, i.e., waste, time delays, budget overruns, quality and control

(Vrijhoef, 2000; Langford, 2012; and Ochieng, 2013).

Cox and Ireland (2002) contributed that the main flows of the construction supply chain are equipment, labours and materials. That been said, (Dave, 2010; and Sacks, 2010) contributed that information impacts all resource flows and should be efficiently and effectively managed as another flow in the CSC.

Due to the supply chain complexity, it can be complex to manage information flow issues (Zhai,

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2009). More unified manner of working and more effective collaboration in the SC with the SC partners can help in achieving the main goal of the construction process (Barlow, 2005; and Zhu, 2010). There is a continuous need to improve information sharing in the SC (Bowersox, 2000; Lambert, 2008; Yu, 2010; and Barratt, 2011). Some research has focused on the advantages of information sharing (Li, 2006; and Zhou, 2007), debatably this research is one of the first attempts to quantify the impact of information flow from clients on projects performance and to what extent it may delay residential housing projects in Jordan.

Table 1 illustrates research findings about factors that impact the information flow between supply chain partners.

PROBLEM STATEMENT AND RESEARCH OBJECTIVES

The Jordanian construction industry represents 5.8% to the GDP (Central Bank of Jordan, 2015). Nevertheless, the construction industry suffers from project disruptions and delays (Sweis *et al.*, 2008; Mattarneh, 2015; and Bekr, 2016).

The construction supply chain in Jordan encounters many disruptions that are resulted from several factors. Project delays can result in cost and time overruns. Ineffective communication and problems associated with the information flow between clients and contractors. Disruptions from the contractor's side have an impact on projects performance. The main aim of this research is to quantify to what extent may information delays from clients have an impact on construction projects performance in terms of time delays, providing good practices and potential solutions to improve the information flow and therefore

Table 1: Factors that Impact Information Flow Between Supply Chain Partners	
Factor	Researcher
Collaborative communication	Fynes <i>et al.</i> (2005), Forslund and Jonsson (2009) and Cao and Zhang (2011)
Legal protection	Jin and Hong (2007) and Cai <i>et al.</i> (2010)
Goal congruence	Tan <i>et al.</i> (2006) Jin and Hong (2007), Forslund and Jonsson (2009) and Cao and Zhang (2011)
Innovative supply chain process	Simatupang and Sridharan (2005), Angerhofer and Angelides (2006) and Simatupang and Sridharan (2008)
Collaboration level	Angerhofer and Angelides (2006) and Zacharia <i>et al.</i> (2009)
Commitment	Walter (2003), Kwon and Suh (2004), Fynes <i>et al.</i> (2005), Zacharia <i>et al.</i> (2009), Nyaga <i>et al.</i> (2010) and Chen <i>et al.</i> (2011)
Technology application	Angerhofer and Angelides (2006), Crook <i>et al.</i> (2008) and Lee <i>et al.</i> (2011)
Topology	Angerhofer and Angelides (2006)
Stakeholders	Angerhofer and Angelides (2006)
Co-operation	Fynes <i>et al.</i> (2005) and Liu and Wang (2011)
Promoter of the customer	Walter (2003)
Trust	Kwon and Suh (2004), Simatupang <i>et al.</i> (2004), Crook <i>et al.</i> (2008), Fawcett <i>et al.</i> (2008), Zacharia <i>et al.</i> (2009), Forslund and Jonsson (2009), Nyaga <i>et al.</i> (2010), Chen <i>et al.</i> (2011) and Fawcett <i>et al.</i> (2011)

further efficient control and management of the construction supply chain. The information flow investigated in this research refers to all information flow from clients to contractors regarding the project.

RESEARCH DESIGN AND METHODOLOGY

The adopted research methods in this research incorporated site observations, questionnaire and simulation scenario.

Preliminary investigations

Regular sites visits were conducted to 2 residential housing projects over 90 days in Amman, Jordan. observing client’s involvement whilst the construction process helped in identifying client’s role in project delays. change in design, financial difficulties, accepting work and slow decision making process were the main sources of delays from the client’s side.

Questionnaires

This stage helped in recognising areas of delays resulted from the client’s interaction with the project. The questionnaire, whose respondents are displayed in Figure 1, requested CEO’s, consultants, engineers, suppliers and architects to answer the following question: Do you face any problems during the project from the client? If so, please specify the problem, the potential delay it may cause to the whole project in days and the probability of that occurring.

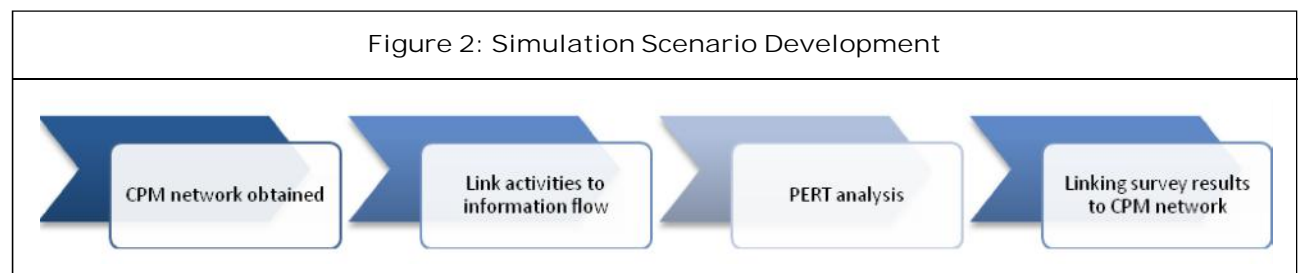
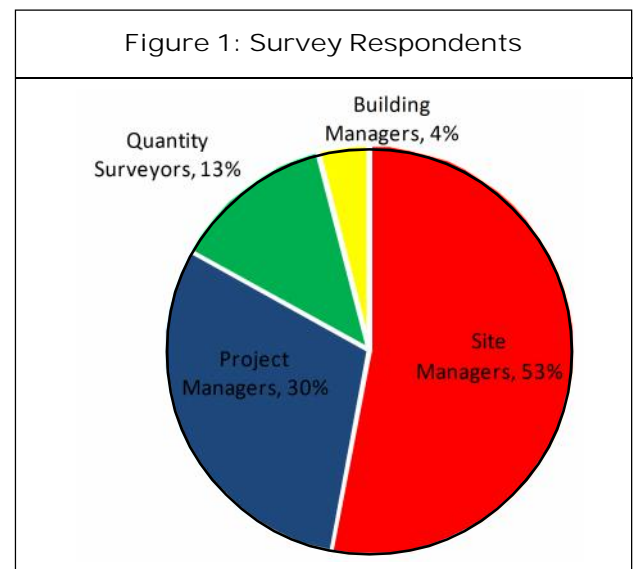
The results identified changes in design, slow decision making process and other financial problems as factors that plays a major role in project delays caused by client’s involvement in the project.

Formation of Simulation Scenario

The simulation scenario was formed using a CPM network gathered from a Jordanian residential housing construction project and delays identified from the questionnaires. In order to calculate the maximal effect of client information flow on the project, the highest pessimistic value of delays related to the client information flow was incorporated with the pessimistic duration of the activity. Figure 2, illustrates the process of formulating the simulation scenario.

ANALYSIS AND DISCUSSION

As described earlier, the information delays in this research refer to the client and main contractor’s communications and information flow between them. Table 2 demonstrates that the information delay simulation scenario resulted in a 9-day delay which represented 6.5% of the total duration



Scenario	Duration in Days	Delay in Days	Delay Percentage
Actual	138	0	0
Information delays	147	9	0.065

of the actual project. Based on the main survey findings, the average probability of information flow delay occurrence is 20%.

The results of the main survey suggested that the interactions between the client and the main contractor can be the main source of information delays. Clients change in orders interrupt the construction process as it can create a new job or break the work. Figure 3 presents an example of the simulation results.

Moreover, sometimes obtaining the clients approval is essential before starting the next activity in the project; this can cause a delay for many reasons such as: the clients poor planning regarding job specifications, limited time by the client to review and accept the work or a financial constraint from the client’s side.

Design changes, payments and weekly reports may disrupt the information flow between the client and the main contractor. Clients play a major role in the information flow as obtaining clients acceptance of works on a weekly basis is essential for the work to continue in a timely

manner. Client’s unavailability may disrupt the work by delaying some activities which require consent by the client or indeed payment from the client to continue the project.

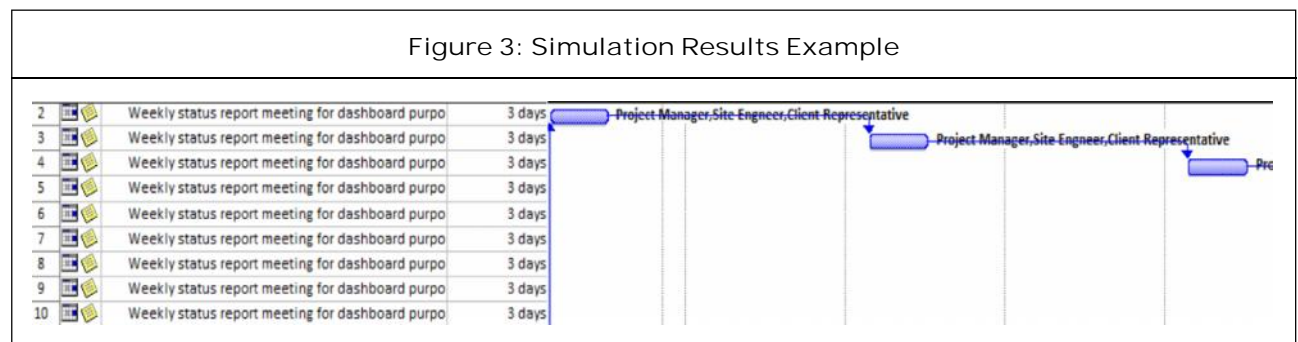
Solving information flow problems is the duty of both the contractor and the client. Information delays can happen in any project, ways in which contractors may help in reducing the risk of information delays occurring are as follows:

Getting the Client More Familiar with the Different Aspects of the Project

The contractor can help the client by educating him/her in the construction process, expectations, quality of work, time, etc. As the client may have limited knowledge about the construction process and managing projects in general, some projects documentation, graphs, tables and pictures may help the client understand the construction process. Additionally, they may help the client in understanding the plan, design, quality and other issues related to the construction process.

Including the Client in Project Meetings

Taking part, where applicable, in project meetings may help the client to become more involved during the construction process which can lead to increase the awareness of the client regarding the different aspects of the construction process, and the implications of any change in the project plan in terms of cost and time.



On the other hand, ways in which the client may help in reducing the risk of information delays occurring such as:

Be Considerate, Accessible, Kind, Approachable and Follow the Work Schedule

Following works schedule and meeting financial and consensual obligations on time, as stated in the contract, may help in avoiding work disruptions due to lack of contractors' funds or inability to carry out work without client consent.

Clear Project Specification

Clear and concise information relating to the project scope and specifications both at the initial stages and throughout the project may help in avoiding disputes. Defining a process to deal with project changes helps to reduce the risk on having a dispute or conflict should a design change occur.

CONCLUSION

As discussed in this paper, client involvement with the construction supply chain may lead to project delays. Clients often 'change their minds', and request a design alteration which interrupt or break works. Furthermore, clients require time to make a decision which is another cause of delay. Client's approval is necessary in order to continue to the next stage of a project but clients are not always capable due to lack of proper knowledge and/or insufficient funding to approve. Risks relating to information delays may be reduced by familiarising the client with various aspects of the project. Including the client when project meetings take place would enable client awareness of the construction processes involved in the project. This inclusion may help the client to realise the implications of design

changes regarding time delays and how that would influence the overall cost.

Establishing and maintaining efficient information flow between clients and contractors ensures that the contractor understands the client's needs, specifications and concerns relating to the project. Ultimately, it is the client's responsibility to avoid causing any work disruptions.

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