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ScienceDirect

International Journal of Project Management 35 (2017) 1253–1271

International Journal of Project Management

www.elsevier.com/locate/ijproman

Collaborative model: Managing design changes with reusable project experiences through project learning and effective communication

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Received 18 October 2016; received in revised form 21 March 2017; accepted 27 April 2017
Available online 8 July 2017

Abstract

This paper empirically studies the importance of managing design changes in dealing with time delay and cost overruns in construction projects. The main objective of this paper is to identify the causes of design changes and the implications on the Malaysian construction projects measured in terms of cost and time. It also aims to determine how rework induced from the design changes is detrimental to project performance and to suggest recommendations on how to overcome the related problem with project learning and effective communication in building construction. To investigate the factors giving rise to design changes, a total of 43 causes were first identified through a comprehensive literature review. The factors are categorised into client, consultant, contractor, site and external-related themes. This is followed by a qualitative research study involving semi-structured interviews with 12 experienced industry practitioners comprising of clients, consultants, and contractors. Critical incident technique employing content analysis is used to analyse the interviews transcripts in detail to provide a rich picture of the causes of design changes, the implications for project delivery performance, enablers of effective communication, enablers of project learning and types of reusable project knowledge. The research findings were further integrated to develop a collaborative model to manage design changes using effective communication and project learning approach. This model highlights the importance of effective communication and project learning towards improving the level of competency and cohesiveness of project team in managing future projects. Capturing and sharing of reusable project experiences is essential towards maximising the benefits of past experiences (lessons learned), shortening the learning curve and adding value to future projects in design change management.

Keywords: Communication management; Construction; Design change; Overruns; Project learning

1. Introduction

In developing economies such as Malaysia, the construction industry drives economic growth and social development through employment opportunities. It is one of Malaysia's key economic drivers and a major enabler of the Economic Transformation Programme (ETP) (Performance Management and Delivery Unit (Pemandu), 2013) with RM 260 billion of development expenditure under the 11th Malaysia Plan (2016–2020) (RAM Ratings, 2016). Building construction is considered to be an essential sub-sector which forms 63% of total project value in 2015 (Construction Industry Development Board (CIDB), 2016). However, this subsector continues to be plagued with schedule delays (Alaghbari et al., 2007) and cost overruns (Shehu et al., 2014). These overruns result in loss of money and

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http://dx.doi.org/10.1016/j.ijproman.2017.04.010
0263-7863/00/

time to contracting parties (Kazaz et al., 2012) and retard the development of the industry (Odeh and Battaineh, 2002); consequently detrimental to Malaysia's construction industry in particular and the national economy in general. Hence, successful and timely delivery of construction projects is vital for the construction sector to continue to contribute towards the sustainable growth of the economy. Utilising effective project management methods can help the construction industry reduce the risk of project failures and also helps in ensuring timely delivery of projects.

Design changes have been seen as synonymous with the construction sector (Mohamad et al., 2012). The performance of construction projects is much impacted by design changes (Olawale and Sun, 2010) which increase the risk of overruns (Rosenfeld, 2013). These changes, again and again, lead to rework (Love et al., 2002) which can degrade the project performance (Palaneeswaran et al., 2014). In recent years, a plethora of studies has identified design change as one of the leading causes of schedule delays and cost overruns resulting in various effects such as excessive claims and disputes (Abdul-Rahman et al., 2016). Deviation of project objectives results in claims and disputes among the contracting parties in the construction project (Motawa et al., 2007). Delays and disruptions have adverse effects (Yang et al., 2013; Williams et al., 1995) leading to litigation, or in extreme cases; projects were abandoned.

A recent industry-wide survey conducted by Shehu et al. (2014) revealed that an alarming 55% of Malaysian construction projects suffer from cost overruns; some recording as high as >80% increase from initial contract sum. The most prominent concern relating to this situation is the construction of Kuala Lumpur International Airport 2 (commonly known as KLIA2). The original target date for opening is September 2011 but rescheduled several times and finally completed in May 2014 (31 months delay). The increase in the construction cost from the initial RM 1.7 billion to RM 4 billion (135% cost overruns) was primarily due to the changes made to the design concept for KLIA2 (Ng, 2015; Ghazali, 2015). Given this, schedule delay and cost overruns caused by design changes are a serious problem in the Malaysian construction industry. Nevertheless, several studies on causes of delay in Malaysian context failed to recognise design changes as a major contributing factor (see Alaghbari et al., 2007; Azis et al., 2013; Hamzah et al., 2012; Sambasivan and Yau, 2007). Hence, amplify the need of scholarly attention, looking into improving the project delivery process through efficient management of design changes (Yap et al., 2016). There is also a scarcity of literature looking at mitigation of overruns using project learning approach (Abdul-Rahman et al., 2008) and limited use of knowledge management systems in construction (Carrillo et al., 2013). Yong and Mustaffa (2013) identified human-related factors such as effective communication as a critical success factor in Malaysian construction projects. These observations provide the underlying motivation for future studies to understand this phenomenon better and fill the gap. The purpose of this study is to develop a collaborative model on the enhancement of design change management through a qualitative research study involving in-depth interviews with experienced practitioners to obtain a rich picture of their project experiences and the influence of effective communication and project learning in building construction projects. This study can assist researchers and practitioners in gaining an in-depth understanding of the causes influencing design changes, impacts of the design changes to project time and cost performance, effective communication strategies and factors stimulating project learning to improve project delivery performance.

2. Literature review

2.1. Design changes and rework

Almost all building projects undergo various degrees of design change through the project lifecycle. Changes are inevitable in most construction projects to correct or modify original design or scope of work (Alnuaimi et al., 2010). Park (2003) defines that construction changes refer to "work state, processes or methods that differ from the original construction plan or specification and usually resulted from different in work quality and conditions, scope changes or uncertainties that make construction dynamic and unstable." Even though design change is widely accepted by the practitioners in the construction industry, however, its effect on project performance is undesirable. Any uncontrolled changes short of reviews to schedule and budget will lead to scope creep (Project Management Institute, 2013). According to Knight and Fayek (2002) and Shane et al. (2009), scope creep is a significant risk event contributing to design cost overruns on construction projects. Hence, identification of the causes of design changes is a critical risk identification process in project risk management (Chapman, 2001). Changes usually occur at any stage of a project due to various causes from different sources and have considerable impacts (Motawa et al., 2007). To understand design change dynamics, Yap et al. (2016) categorised the causing factors of design changes into client-related, consultant-related, contractor-related, site-related and external-related.

These changes in a project can cause a substantial adjustment to the contract duration, time, total direct and indirect cost or both (Ibbs et al., 1998). The undesired design changes will result in unexpected rework which leads to delays and disruptions (Howick et al., 2009). The sooner the changes are identified and resolved, the lesser impact it will have on the project. According to Hwang and Low (2012), conflict over project changes can be minimised when the problem is found in the earlier phase of the project. Therefore, one of project management best practices is to apply or implement lessons learned (experiences or knowledge) from past projects (Duffield and Whitty, 2016).

Design changes are the top inhibiting factor of cost and time control in construction projects in the UK (Olawale and Sun, 2010). In the US, one of the most common reasons for change orders is design changes (Hanna et al., 2004). Several studies on causes of delays and cost overruns in construction projects have highlighted design changes as a major contributing factor (Table 1).