Effect of lean tools to control external environment risks of construction projects

Richard Hannis Ansah, Shahryar Sorooshian*

Faculty of Industrial Management, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Kuantan, Pahang, Malaysia

ARTICLE INFO

Keywords:
Analytic Hierarchy Process (AHP)  Construction projects  Environmental-based delays  Framework  Lean tools  Prioritization

ABSTRACT

Among the existing management concepts and methods implemented for solving construction project delays is the integration of lean tools in the construction project cycle. While these lean tools are said to minimize delays and improve project delivery processes, most have been conceptualized to assess aspects of the lean tools. However, to ensure suitability and applicability, and thus, the success of lean tools implementation, there is the need for identification and appropriate prioritization of the lean tools. This paper proposes a novel delay control framework based on AHP method for the evaluation of lean tools application in the external environment (political, economic, social, technological, legal, and environmental aspects) of construction projects. To extend the qualitative data, six main delay sources and forty lean tools were extracted from the existing literature for further empirical inquiry. The results of the framework indicated that the most effective lean tools were concurrent engineering, last planner system and daily huddle meetings with priorities 0.425235, 0.379652 and 0.371172 respectively. Meanwhile, the least influenced lean tool was found to be SMART Goals with priority 0.026566. This framework, would provide a decision tool for practitioners to determine appropriate lean tools to control specific delay sources.

1. Introduction

The lack of robustness in the existing managements concepts and conventional project management approaches in solving construction project delays over the past decade (Aziz & Hafez, 2013; Koskela, Belvikken, & Rooke, 2013; Koskela, 2000; Norzima, Sorooshian, & Chow, 2011; Rahman, Wang, & Lim, 2012), are driving companies to seek for time efficient and cost effective improvement methods in their project development process. Among such improvement approaches that are trending in recent years within the construction industry, are the use of Off-site fabrication (OSF), or Off-site manufacturing (OSM), Industrialised Building Systems (IBS), Prefabrication, Computer Integrated Manufacturing (CIM), Building Information Modeling (BIM), Business Process Re-engineering (BPR), Business Process Modeling (BPM), Total Quality Management (TQM), Lean and Six Sigma, among others (Andújar-Montoya et al., 2015; Andújar-Montoya, Gilart-Iglesias, Montoyo, & Marcos-Jorquera, 2015; Ang & Kasim, 2013; Anvari & Sorooshian, 2014; Bashford, Walsh, & Sawhney, 2005; Gibb, 2001; Koay & Sorooshian, 2013; Laplante, 2005; Mohamad, Mardhiah, & Nekooie, 2009; Rahman et al., 2012; Ansh et al., 2016; Sacks, Eastman, Lee, & Orndorff, 2005; Schweikhart & Dembe, 2009; Waldner, 1992).

Explicitly, the application of lean tools and lean thinking practices in construction projects is increasingly becoming a must for any construction company to succeed in the current industry (Abdelhamid, El-Gafy, & Salem, 2008; Aziz & Hafez, 2013; Bashford et al., 2005; Marhani et al., 2013; Marhani, Jaapar, Nor-Azmi, & Zawawi, 2013; Mohammad, Ismail, & Hashim, 2013; Sacks, Radosavljevic, & Barak, 2010; Salimi, Hadjadi, & Sorooshian, 2012; Sarhan & Fox, 2013). The intensity of the pursuit for the operational application of lean tools in the construction projects is on the increase; this is due to the realization by construction companies of the potentials of an effective lean project development process in reducing project completion time, engineering hours, design and supply chain management integration, ease in constructability, environmental sustainability, flexibility, process control, and increased in the quality of new projects (Abdelhamid et al., 2008; Aziz & Hafez, 2013; Bashford et al., 2005; Marhani et al., 2013; Muhammad et al., 2013; Nikakhtar, Hosseini, Wong, & Zavichi, 2015; Rahman et al., 2012; Sacks et al., 2010; Sarhan & Fox, 2013).

Nonetheless, for most companies, there are still some uncertainties and unresolved issues concerning the lean application and its suitability. According Schweikhart and Dembe (2009) and Li (2011), proper prioritization and the choice of appropriate lean tool(s) are