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International Journal of Project Management 34 (2016) 1167–1182

International Journal of Project Management

www.elsevier.com/locate/ijproman

Measuring project management inputs throughout capital project delivery

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Received 19 January 2016; received in revised form 24 May 2016; accepted 2 June 2016

Abstract

Despite continuous efforts into benchmarking over the last decades, few have focused on management efforts of project organizations who are involved in managing the capital project. This study presents a phase-based framework and 10 input measures for measuring project management efforts in a capital project. The measures are planning, organizing, leading, controlling, design efficiency, human resources, quality, sustainability, supply chain, and safety. This study quantifies and assesses the inputs and further sorts the results by industry sectors and project phases. The analyses show that traditional functions tend to have more consistent implementation than construction-specific functions. The results indicate that infrastructure sector tends to exert fewer and less consistent efforts than building and industrial sectors. This study contributes a new benchmarking framework and is the first to quantify project management inputs of a capital project systematically. Additionally, phase-focused and phase-wide benchmarking applications of the input measures are also discussed and provided.

Keywords: Project management input; Phase-based benchmarking; Leading indicator; Project organization; 10-10 program

1. Introduction

Over the past two decades, benchmarking has played a significant role as a strategic process that enables construction firms to create competitiveness by continuously improving their performance (McCabe, 2008). Continuous research efforts in benchmarking studies have produced several effective measures to evaluate the performance outcomes of capital projects (Chan and Chan, 2004; Costa et al., 2006; Cox et al., 2003; Lee et al., 2005; Ramirez et al., 2004; Yeung et al., 2009, 2013). Most benchmarking methods adopt an approach that tracks ex-post lagging performance indicators focusing on cost, schedule, changes, safety, and productivity. Since these indicators are usually only obtained after project completion, they do not provide managers a chance to make changes to the performance or results of their projects while they are still ongoing (Beatham et al., 2004; Costa et al., 2006). In addition, benchmarking models have not paid much attention to evaluating organizational or human resources changes as performance indicators in firms executing a capital project.

However, the recent global economic recession has motivated construction firm owners and contractors to diagnose their ongoing projects at more detailed levels and proactively react to create better project outcomes. The traditional benchmarking approach, based on lagging indicators, has been found to be an unsatisfactory tool for management of capital projects in complex, uncertain project environments. Therefore, it was recognized that the industry needed a new benchmarking approach with leading indicators while projects are ongoing. Such a tool can provide early warnings, identify potential problems, and establish action plans to remedy and improve them (Yeung et al., 2013). The Construction Industry Institute (CII) has developed a phase-based benchmarking

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http://dx.doi.org/10.1016/j.ijproman.2016.06.004
0263-7863/00

framework, called the 10-10 program to address such issues. It evaluates processes and practices, as well as the organizations and their people participating in capital project delivery at the phase level, using multi-dimensional tracking aspects (Kang et al., 2014; Yun et al., 2016).

This paper presents a phase-based framework and indicators of project management inputs to evaluate project management efforts throughout capital project delivery. 10 project management inputs include planning, organizing, leading, controlling, design efficiency, human resources, quality, sustainability, supply chain, and safety. These inputs can be measured in the phase-based framework, which help project managers identify the project status and establish corrective action plans. This study thus aims: 1) to develop a phase-based framework and input measures for measuring project management efforts; 2) to assess project management inputs by industry sectors and project phases; and 3) to discuss applications of the input measures in capital project benchmarking. This approach enables construction executives and project managers to identify impending problems and to take proactive steps in subsequent phases of an ongoing project. Furthermore, the benchmarks allow a project manager to identify which project management inputs are vulnerable throughout capital project delivery.

2. Research background

Leading indicators are fundamental characteristics and/or events found throughout capital project delivery that reflect or predict project health. If recognized in a timely manner, leading indicators enable proactive management to influence project outcomes (Choi et al., 2006). Leading indicators can be defined as "the measurements of processes, activities, and conditions that define performance and can predict future results" (Hinze and Hallowel, 2013). Thus, they can play the following significant roles in project management: 1) predict the future performance of the measured process, 2) present opportunities to change practices accordingly, and 3) allow future decisions related to subsequent processes based on the outcomes of precedent processes (Choi et al., 2006).

Over the last decade, many research efforts have been made to identify leading indicators and their application for performance measurement throughout capital project delivery (Almahmoud et al., 2012; Amaratunga et al., 2002; Choi et al., 2006; Jaafari, 2007; Sarshar et al., 2004). Most attempted to identify leading indicators among critical success factors or key performance indicators that influence project outcomes. However, it is difficult for managers to use these traditional measures to gain insights that enable performance improvements on ongoing projects, as there is no systematic approach to applying leading indicators to proactive project management.

On the other hand, several proactive approaches have existed to link leading indicators with performance outcomes by measuring the state of the project to create better project outcomes (Almahmoud et al., 2012; Amaratunga et al., 2002; Choi et al., 2006; Jaafari, 2007; Sarshar et al., 2004). One such effort introduced a business process diagnostic tool for construction projects from the facilities management perspective. It developed a step-wise process for assessing construction process capability (Amaratunga et al., 2002; Sarshar et al., 2004). The framework identified key processes to measure that indicated capacity maturity levels. Another approach identified leading indicators as project health indicators (PHIs) and developed a tool to forecast potential risks affecting project outcomes (Choi et al., 2006). This approach initially identified 181 potential leading indicators through brainstorming, and then refined and finally confirmed 43 leading indicators that had statistical relationships to project outcomes. The leading indicators were categorized as CII practices, and they include alignment, change management, constructability, contracting, quality management, safety practices, project controls, and team building. Jaafari (2007) developed a diagnostic toolset designed to check the health of a project and program that focused on the capabilities and management approaches influencing project success. The toolset mainly consisted of business, strategic, and project implementation assessments. The business and strategic criteria focused on customers and markets, stakeholders, technology, facility design and operational requirements, supply chain systems, learning and innovation, finance, project delivery systems, risks, and due diligence. The project implementation criteria included governance and leadership, engineering, details and specifications, procurement, transportation and warehousing, planning and control, team performance, information and communications management, quality management, offsite management, and risk management. Based on the results from Jaafari's (2007) study, Almahmoud et al. (2012) adopted the concept of a project health check (PHC) and developed a framework identifying 67 leading indicators under 9 core management functions for capital project delivery. The core management functions to identify leading indicators consisted of 1) governance and leadership, 2) engineering, detailed designs, and specifications, 3) procurement, 4) planning and control, 5) team performance, 6) information and communication management, 7) quality management, 8) offsite management, and 9) risk management.

Despite these research efforts, the proposed frameworks share a common fundamental limitation in application to real capital project delivery. Although the existing benchmarking frameworks provided a holistic strategy to management at the project level, managers could not use the results for ongoing projects. Moreover, although the early stages of capital project delivery have a high impact on project outcomes, the frameworks in the previous studies tended to focus on project execution, particularly the construction phase. The industry has expressed a need for an alternative approach that provides timely information so that management efforts and the project's status can be evaluated at the phase level while the project is ongoing. To meet this demand, this study develops a phase-based framework and identifies leading indicators for measuring project management inputs throughout capital project delivery.

3. Research method

3.1. Conceptual framework

This study developed a conceptual framework to measure project management efforts throughout capital project delivery