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EVALUATING PPP PROJECTS USING A LEAN FRAMEWORK

ZEINA MALAEB and FAROOK HAMZEH

Dept of Civil and Environmental Eng., American University of Beirut, Beirut, Lebanon

A Public Private Partnership (PPP) describes an arrangement between the public and the private sectors for providing a public asset or service. PPPs are characterized by their long-term nature, complex contractual agreements, and distinct risk allocation formulas, all which distinguish them from traditional procurement routes. Performance evaluation is a prerequisite of performance improvement and is vital to the realization of project success, particularly in PPP projects. In fact, the absence of an effective performance evaluation framework in PPPs serves as a trigger for generating below optimum service quality. Although several performance evaluation frameworks exist, they prove more suitable for traditional projects, which highlights the need to account for the unique features of PPPs. This paper first introduces the various perspectives, from the literature, used to classify project success and evaluate performance. The paper then addresses the aforementioned need by introducing a new framework for evaluating project success, using the lean concepts of transformation, flow, and value. Key Performance Indicators (KPIs) are suggested as part of the framework to serve as performance measures on PPP projects. The introduced lean framework is the first of its kind and fills the gap in PPP research by being one of the few performance evaluation tools customized for PPPs.

Keywords: Key performance indicators (KPIs), Lean construction, Performance evaluation, Public private partnerships (PPPs), Special purpose vehicle (SPV), TFV.

1 INTRODUCTION

A Public Private Partnerships (PPP) describes an arrangement between the public and the private sectors for providing a public service. PPPs are characterized by their long-term nature, bundling of project functions, complex contractual agreements, and distinct risk allocation formulas (Grimsey and Lewis 2004), all of which set them apart from traditional procurement routes. The public sector's reasons for adopting PPPs are twofold: (1) they allow the public sector to benefit from private financing which relieves the stress on limited public budgets, and (2) they allow the public sector to utilize the private sector's skill and management expertise in project delivery (Osei-Kyei and Chan 2015). In fact, PPPs are claimed to offer a range of benefits such as accelerated infrastructure provision, timely project implementation, reduced whole life cycle costs, reduced pubic risk, and improved service quality and innovation (Leiringer 2006).

Performance evaluation is the prerequisite of performance improvement and is vital to the realization of project success, particularly in PPP projects. In fact, the absence of an effective performance evaluation framework in PPPs serves as a trigger for generating below optimum service quality (Liu *et al*. 2014a). Several frameworks and perspectives for measuring project success have been developed over the years. However, the unique characteristics of PPP projects,

in addition to the complex nature of their stakeholder interfaces, separate them from traditionally procured projects and prove the existing frameworks that serve the latter insufficient (Liu *et al*. 2014b). Additionally, changes in project structures obligate respective changes in performance metrics, driven by the altered characteristics (Tranfield *et al*. 2005).

Comprehensive evaluation of project success necessitates investigating several fronts: the transformation of inputs to outputs in a process, the flow within the process, and the value generation to the customer at the end of the process. This transformation-flow-value (TFV) theory is sourced from the lean philosophy, which attempts to generate a rounded outlook of a project and its processes. Of the few frameworks that attempt to evaluate PPP project success in specific, none focus on measuring success from these three aforementioned fronts. The above highlights the need for a holistic performance evaluation framework, specifically designed for PPP projects, which takes into account the transformation, flow, and value perspectives of project processes. This research attempts to address this need by introducing such a framework and suggesting a number of Key Performance Indicators (KPIs) that can be used to measure PPP project success. The introduced lean framework is the first of its kind and fills the gap in PPP research by being one of the few performance evaluation tools customized for PPPs.

This paper first describes the main characteristics of PPP projects. Then, it introduces different ways of classifying project success, as found in the literature. The shortcoming of these perspectives is highlighted next, which signifies the need for a new holistic framework for measuring PPP success. Finally, the TFV framework developed for this research is introduced, and a set of KPIs generated for evaluating the success of PPP projects.

2 CHARACTERISTICS OF PPP PROJECTS

The PPP project structure involves two main project stakeholders: the public authority and the private entity. The private sector is represented by a project company called the Special Purpose Vehicle (SPV). This SPV enters into a contractual agreement with the public authority for the financing, designing, building, management and operating of a public facility. This contract is of a long term nature, usually for 30 or more years (Sarmento and Renneboog 2016). Being a distinct procurement route, PPPs are characterized by several features that differentiate them from traditionally procured projects. Some of these are: uncertainties and risks stemming from the long-term agreements, major rearrangements in the roles of the multiple project stakeholders, increased responsibilities and risks for the private sector, and complex contractual arrangements between different stakeholders (Zhang 2005). Another major characteristic is the bundling of project functions, from design to construction to operation, in one and handing them over to one private entity (the SPV), which assumes the responsibility of the whole bundle. The structure of the SPV is also distinct, as this project company combines the designer, contractor, and service provider under one umbrella. This aligns stakeholder goals and interests and generates a whole-life cycle approach for the project. PPPs involve stakeholders early on in the process, which leads to the formation of collaborative environments. Furthermore, their use of output specifications in the design is claimed to drive the potential for innovation on the project (Grimsey and Lewis 2004, Leiringer 2006, Tawiah and Russell 2008, World Bank 2009).

3 CLASSIFICATIONS OF PROJECT SUCCESS

Performance evaluation of projects encompasses two parts: defining success and measuring success. As perceived in Table 1 below, there exists numerous ways and perspectives of describing success on projects. There might not be one correct way to define success and delineate its measures; however, it is certain that this definition should be in consistency with the

subject project and its distinct characteristics. To elaborate, evaluating the success of a project should take into consideration the different features stemming from its procurement route, stakeholder structure, commercial and contractual frameworks, and operating systems and processes (Thomsen et al. 2009). None of the various perspectives defined in Table 1 below are customized to account for the unique features of PPP projects, which reflects the need for a new holistic framework for evaluating such projects.

Table 1. Different classifications of project success.

No	Classification of Success Dimensions	Source
1	Project characteristics; contractual arrangements; project participants; interactive processes	Elattar (2009); Kwofie *et al*. (2016)
2	Project management perspective; stakeholder perspective; contract management perspective	Liyanage and Villalba-Romero (2015)
3	Technical KPIs; operational and functional KPIs; financial KPIs	Mladenovic *et al*. (2013)
4	Project management success; project success; consistent project success	Cooke-Davies (2002)
5	Macro viewpoint vs. micro viewpoint	Lim and Mohamed (1999)
6	Process domain and performance domain	Toor and Ogunlana (2010)
7	Quantitative KPIs vs. qualitative KPIs	Cox *et al*. (2003)
8	Project efficiency; impact on the customer; business and direct success; preparing for the future	Shenhar *et al*. (1997)
9	Process: doing it right; system: getting it right; benefits: getting them right	Atkinson (1999)
10	Meeting design goals; benefits to the end user; benefits to the developing organization; benefits to the economy	Sadeh *et al*. (2000)
11	Success efficiency and success effectiveness	Pinto and Slevin (1988)
12	Stakeholder satisfaction; strategies; processes; capabilities; stakeholder contribution	Liu *et al*. (2014a)
13	Physical characteristics of projects; requirements of stakeholders including financing and marketing, innovation and learning, and stakeholders; project process	Yuan *et al*. (2009)

4 DEVELOPED LEAN PERFORMANCE EVALUATION FRAMEWORK

4.1 TFV Theory

The optimal perspective for evaluating PPP project success would be one that takes into account a holistic description of the different elements of a project and its processes. To elaborate, it is not sufficient to merely evaluate the external outputs of a process, while ignoring the occurrences within the processes, and the creation of value at different steps. This line of thought is compatible with the Transformation-Flow-Value (TFV) theory of the lean philosophy. In short, the TFV theory introduces the concept of studying the transformation, flow, and value views of a process. It considers that traditional theories, which encompass only the "transformation" view, are not reflective of the overall project fundamentals. Figure 1 describes these three views. The transformation view merely measures the inputs and outputs of each process individually, and disregards the internal interactions between processes, which reduces the project to a black box. It is important to study the "flow" between processes, in order to minimize the waste occurring within. "Flow" pertains to the flow of material, labor, information, and space in the project while "waste" refers to wasted time, cost, and, material. Finally, the overall objective of a process is to generate value to the customer, through meeting his requirements. Consequently, this generation of value should also be evaluated when observing a project to ensure that the customers' objectives are met (Koskela *et al*. 2002). Table 2 clarifies these concepts.

The distinct characteristics of PPP projects, identified in Section 2 above, separate these projects from traditionally procured projects, and add an inherent level of complication to the

former. Consequently, evaluating PPP project success would require a much more comprehensive and holistic study than evaluating the success of traditional projects. Therefore, when considering PPP projects, success should be appraised from a well-rounded perspective to encompass the unique character of these arrangements. The TFV viewpoint seems to satisfy these requirements, and thus, this research projects concepts from the TFV theory into the developed evaluation framework to measure PPP project success.

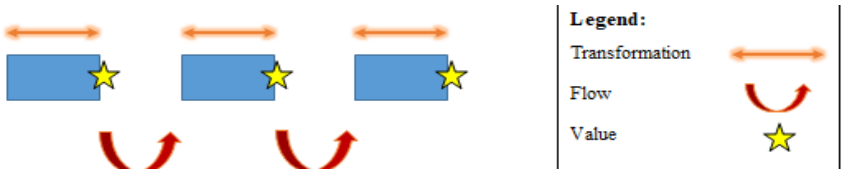

Figure 1. Depiction of the transformation, flow, and value views.

Table 2. Concepts of the transformation, flow, and value views (Amended from Koskela *et al*. 2002).

Viewpoint	Transformation	Flow	Value
Conceptualization of a Process	Transformation of inputs to outputs	Flow of material and information from its initial state to the final product	Generation of value to the customer
Function	Making individual tasks efficient	Minimizing waste (non-value adding activities)	Minimizing value loss (Ensuring customer requirements are met)
Application	Task Management	Flow Management	Value Management
Evaluation	The "input" and "output" of each internal process on its own	The flow between the different processes	The product (intermediate and final) vs. customer

4.2 TFV Framework

As discussed, the first step of performance evaluation is deciding on the perspective used to measure success that forms the basic skeleton of the framework. The second step is developing performance measures, or KPIs, to evaluate success. The KPIs are first identified and filtered from a thorough literature review of studies on the performance evaluation of construction projects, shown in Table 1, specifically detailing project success indicators and factors. The KPIs are then segmented into the three perspectives: transformation (T), flow (F), and value (V). "T" KPIs measure only the process inputs and outputs, "F" KPIs measure the efficiency within the processes, and "V" KPIs measure the generation or loss of value at the product or bi-product level. Although some KPIs may fall under more than one perspective, the most fitting one is chosen. Table 3 presents the identified KPIs, 18 in total, along with their descriptions.

5 CONCLUSIONS AND FUTURE RESEARCH

An efficient performance evaluation framework that accounts for the specific characteristics of PPP projects is critical to their success (Liu *et al*. 2014a). A performance evaluation framework based on a lean background, along with KPIs, adopting a rounded transformation, flow, and value perspective, ensures a holistic representation of PPP project success. Future research can develop further performance measures and apply the framework to a case study for validation of results.

Table 3. TFV framework and key performance indicators (KPIs).

KPI Title	Description	T	F	V
1. Cost / Financial	Cost Growth = (actual incurred cost – initial planned cost) /initial planned cost	x		
2. Project Duration	Time Growth = (final completion time – planned completion time) / planned completion time	x		
3. Level of Dispute	Number of claims and disputes on the project; Size of disputes on the project; Incidents of imposing penalties or damages	x		
4.Environmental Impact	Utilization of non-renewable resources; Greenhouse gas emissions; Carbon and embodied energy; Disturbance to flora and fauna; Consideration for endangered and protected species; Water use (quantity and quality); Promotion of alternative greener or renewable energy; Types of material used			x
5.Health and Safety	Accident rate; Number of injuries or deaths			x
6.Construction Efficiency	Efficiency = actual productivity rate / planned productivity rate	x		
7.Construction Delays	Delays to activity start or completion ; Delay in supplying materials, tools, and/or equipment		x	
8.Operation quality	Dependability of operation service including availability and reliability; Management of health and safety in operation stage			x
9.Maintenance quality	Speed and frequency of maintenance processes; Management of disruption of services			x
10. Information and Communication Systems	Type and quality of intra and inter organizational information systems		x	
11. Monitoring and Management Mechanisms	Quality and efficiency of the monitoring PM systems used		x	
12. Life-Cycle efficiency	Cost of operating and maintaining the facility	x		
13. SPV Stakeholder Involvement	Input of contractor during the design; Input of operator during the design; Number and size of value engineering efforts		x	
14. SPV Collaboration Efficiency	Number of VOs in the construction phase; Incidents of design rework; Incidents of construction rework		x	
15. SPV Communication Efficiency	Means of communication.; Frequency and density of communication; Parties involved in the communications		x	
16. Problem Solving Efficiency	Average time taken to solve problems; Parties involved in solving problems		x	
17. Level of Innovation	New technologies and processes used; Value engineering proposals; Input of parties to the design process			x
18. Innovation Efficiency	Cost and time savings on the project	x		

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