Available online at www.sciencedirect.com

ScienceDirect

International Journal of Project Management 35 (2017) 341 – 352

International Journal of Project Management

www.elsevier.com/locate/ijproman

Realizing value from project implementation under uncertainty: An exploratory study using system dynamics☆

Lin Wang [a,*], Martin Kunc [b], Si-jun Bai [c]

[a] Management School, Northwestern Polytechnical University, Xi'an 710129, PR China
[b] Warwick Business School, University of Warwick, CV4 7AL Coventry, UK
[c] Management School, Northwestern Polytechnical University, Xi'an 710129, PR China

Received 26 August 2016; received in revised form 22 December 2016; accepted 12 January 2017
Available online 27 January 2017

Abstract

Project Implementation is not a trivial task even after careful planning and scheduling. One of the reasons is the existence of unexpected events at strategic and operational levels during the project execution process. This paper presents a system dynamics model of a project monitoring and control system. Embedded with both strategic and tactical uncertainties, the model experiments with typical remedial actions to disturbances during the implementation of a project under a behavioral paradigm. Simple proportional adjustment seems to work well under low levels of unexpected disturbances but prospect theory-based behavior works better under extreme situations. Our findings indicate over-reacting behavior, which is influenced by biases and reporting errors, can generate project escalation. Thus, thresholds for remedial actions should be implemented in project control and monitoring systems to avoid over-reacting behavior leading to escalation and waste of resources.

Keywords: System dynamics; Project management; Behavioral OR

1. Introduction

Organizations undertake projects as vital means to implement strategy and realize value (Chih and Zwikael, 2015). However, a great proportion of projects fail, e.g. in 2015 only 29% of software projects are successful, with 52% of the projects canceled and 19% failed to deliver the expected results (Dannis, 2015). One of the main reasons for this situation lies in today's rapidly changing environment. Uncertainties, which cannot be fully estimated and often involve 'unknown-unknown' events like evolving strategy, introduction of new technology and resource conflicts, have impact on project implementation and force the deviation of perceived value from expected goals. Thus even if organizations make great efforts to maintain accurate evaluation of the uncertainties and devise well-designed project plans, project plans never perform in the predicted way, and if the deviation grows, projects will fail. Under these circumstances, effective project implementation processes that consider dynamism under uncertainty should be explored.

The conventional project implementation methodologies follow a linear logic to bring projects 'back on track' with respect to the pre-determined operational plans (Hazır, 2014), whereas recent research suggest that the on-going project is an open system, with both its goals and implementation status evolving (Lee et al., 2006; Aritua et al., 2009). In the dynamic environment, projects have to continuously interact with their implementation context, adapting and evolving requirements

☆ This work was supported by China Scholarship Council; National Natural Science Foundation of China [grant number 71172123]; Shaanxi Soft Science Research Program [grant number 2015KRM039]; and the Fundamental Research Funds for the Central Universities [grant number 310828161001].
* Corresponding author.
E-mail addresses: linwang.nwpu@gmail.com (L. Wang), martin.kunc@wbs.ac.uk (M. Kunc), baisj@nwpu.edu.cn (S. Bai).

http://dx.doi.org/10.1016/j.ijproman.2017.01.009
0263-7863/00/

throughout the system's lifetime to cope with uncertainties (Locatelli et al., 2014). Thus project implementation process should involve not only foresight, but also remedial actions in response to unexpected changes, requiring the combination of both proactive and reactive activities. Some research refer to this perspective as 'bounded planning' and 'interactive problem solving', and claim that the value of a project is not well-known in advance, but being defined and updated with uncertainty prevailing (Engwall, 2003; Ahern et al., 2014). Moreover, the non-linear interdependencies between different project components make the system more complex. These interdependencies may form multiple feedback mechanisms, with which even small variation in individual components may diffuse into serious crisis on the overall project (Williams et al., 2003). Thus without looking into the comprehensive system structure, the effects of both uncertainties and remedial actions on project outcomes are difficult to understand.

Since human activities dominate the project implementation processes, including perceiving and reporting the changes, evaluating the remedial action proposals and making reactive decisions, we should look beyond the 'hard' operational data and focus more on 'soft' factors like stakeholders' perceptions and behavioral biases (e.g. reporting errors and escalation of commitment) (Meyer, 2014). System dynamics (SD) modeling is applicable here, which can combine both 'soft' and 'hard' paradigms in the following way (Pidd, 2009; Rodrigues, 2000): Firstly, when formulating the SD model, multiple stakeholders have to coordinate on the central structure of the system (main components, links and feedback loops) and then draw up the causal diagram. This procedure promotes the organizational learning and provides insights into project implementation. The second procedure is the computer-based simulation, which provides explicit suggestions such as what the possible remedial actions would bring, and when and how to intervene. At this procedure, the SD model can use operational data monitored by conventional methods (Lee et al., 2006).

Based on the above analysis, we propose a SD model to analyze, from a strategic perspective, the management of organizational projects where project goals can evolve in a dynamic and uncertain environment and the remedial actions adopted by managers are influenced by behavioral biases. Our approach is based on a concept of projects as open systems, where project managers intend to maintain equilibrium between the value expected to be created and the value that is being created. Thus, our research aim is to identify what project managers' responses are more adequate given the impact of uncertainties on project implementation.

A theoretical background is illustrated in Section 2, with discussions of the research framework and dynamism of project implementation processes. In Section 3, a system dynamics model that incorporates both strategic and tactical uncertainty effects is constructed. Experiments are carried under diverse situations in Section 4 including the impact of remedial actions and disturbances from reporting errors. In Section 5, two unanticipated crises on a project system are tested, followed by the discussion and conclusions sections.

2. Theoretical background

Project implementation system aims to maintain a dynamic match between strategy and operations (Serra and Kunc, 2015; Slevin and Pinto, 1987). At the strategic level, organizational strategy can be broken down to the individual project's major targets (Lee et al., 2006), which we call 'Expected Value' (e.g. expected productivity or expected function of products); while at the tactical level, the real advance or development of the project ('Realized Value') is achieved. Both Expected Value and Realized Value can be defined as a single target or evaluated by multiple performance indicators.

Uncertainties in the environment generate changes to the system. Strategic Change may arise at organizational level and then be interpreted as a variation in project's strategic targets. Meanwhile, the tactical uncertainty may cause disruptions and delays on project progress even without strategic changes. Thus, there may be situations where the strategic objective for the project cannot be achieved or the project is of little value to new strategic objectives. Remedial actions (i.e. adjustments to schedule priority or investment in additional funds or both) are required to mitigate the deviation (Loch and Kavadias, 2002). Thus the objective of this paper is to present a simulation study of behavioral remedial actions for on-going projects taken to minimize the deviation between Realized Value and Expected Value (see Fig. 1).

2.1. Uncertainty and its impact on project management

There are always unforeseen events, which cannot be conceived or analyzed before projects progress, and have vital effects. If some uncertainties are unknown, how can they ever be planned for? Thus a great deal of research calls for moving from conventional project risk management (PRM) to events that 'come out of the blue' (Petit, 2012; Ramasesh and Browning, 2014). Cleden (2012) clarifies two categories of project risk and uncertainty, of which the 'unfathomable uncertainty' that is ill-understood in probability and impact is the context considered in this paper. When we consider unfathomable uncertainty, events happening without warning require a backward thinking and a 'reactive' way, i.e. remedial actions, to help mitigate the impacts on the development of the project. Uncertainty manifests in two aspects: evolving goals and disruptions and delays (D&D).

2.1.1. Evolving goals

The strategic alignment of projects is always evaluated based on a static plan, with the assumption that the project goals are well-determined and unchangeable. However, this alignment seldom stays stable and 'even "perfect" alignment today would soon turn into misalignment'. The prevailing uncertainties and ambiguity may induce exogenous disruptions on or stakeholders' better understanding of the projects' strategic expectations. Research on project management demonstrated that on average 34% of project strategic priorities change during five years in NSW state (Young and Grant, 2015). Recent, Project Management Institute studies also found that Strategic Change causes the