

## Chapter 64

# A Qualitative Systems Thinking Approach in Understanding the Implementation of Innovation on Construction Projects

**Arun Bajracharya**  
*The British University in Dubai, UAE*

### ABSTRACT

*As a leverage to improve productivity and to gain competitive advantage, the concept of innovation has been evolving as an additional dimension in construction apart from the cost, quality and time factors. However, owing to the very nature of the industry and production practices, the rate of innovation in construction is reported to be slower than expected. This paper considers that the source of the problem of the low rate of innovation in construction could be traced in the behaviour of construction firms especially at the production (project) level. The fundamental questions of “why” the construction firms would initiate and implement innovation and “how” the firms would behave and interact during the initiation and implementation process are addressed. A qualitative systems thinking model was developed to depict the behaviour of and interaction among the individual parties that get involved in implementation of innovation on construction projects. Four main sets of feedback loops were developed to explain the dynamics of implementation process of construction innovation. On the feedback loop model, judgment and decision points were identified. The understanding of these points could help in finding the ways to foster innovation in construction.*

### 1. INTRODUCTION

Innovation is one of the essential drivers of progressive change of any sector in the economy. Every sector needs deliberate support of one or the other type of innovation for reaping some ex-

pected benefit – the benefit could be an incremental progress or a radical leap. However, despite the associated potential benefits that could be reaped out of innovation, it is a challenging undertaking with several inherent risks and paradoxes (Seaden et al., 2003; Janszen, 2000). As such innovation is

DOI: 10.4018/978-1-4666-9619-8.ch064

termed as a “complex, tumultuous and frustrating task” to gain expected benefit (Quinn, 2000). At the same time each sector of the economy possesses different challenges and opportunities for fostering innovations. The temporal variations of the resultant forces of challenges and opportunities and their management affect the trend of innovations and progressive change.

Construction sector with its own type of industry base and production processes has evolved with various challenges and opportunities (Gann, 2000). However, it seems that the construction sector lags behind in managing the challenges and opportunities for fostering innovation (Ozorhon et al., 2010; Seaden, 1996; Oster and Quigley, 1977). The rate of innovation and progressive change in construction has been found to be slower than other sectors of the economy (Eaton et al., 2006; Lenard, 2001; Winch, 1998; Bernstein and Lemer, 1996; Nelson and Winter, 1977).

A certain level of dichotomy exists between construction industry and its production processes. The construction industry has evolved as a predominantly loosely coupled system whereas its project based production process as a tightly coupled system (Dubois and Gadde, 2002). Such dual coupling systems have evolved due to the underlying complexity of construction and they affect the innovative behaviour of the firms in construction business. At the industry level, construction firms and related institutions hardly interact with each other unless they are engaged in construction projects in which a limited number of the firms work together. Such loose relationships at the industry level would not be conducive for collective learning and R&D activities.

At the production level that is on construction projects, the involved firms get tightly interdependent within the rules of the adopted procurement and contractual frameworks. A small change in one component of a firm’s work creates ripple effects on other firms’ works in such tightly coupled project systems (Stermann, 1992). Moreover, as the

construction is one-of-a-kind site based production which is carried out by a temporary project organization (Cox and Thompson, 1997), the involved firms work under various project-related pressures (Kumaraswamy and Dulaimi, 2001). With such institutional and production settings, the behaviour of the firms in construction is bound to be oriented towards increasing their short-term project-based productivity instead of preferring the long-term learning and innovation (Dubois and Gadde, 2002).

The explanation above suggests that the problem of low rate of innovation in the construction sector seems to be originated from the very way the construction firms behave and interact at the production (project) level. It is therefore argued that the fundamental questions of “why” the construction firms would initiate and implement innovation and “how” the firms would behave and interact during the initiation and implementation process need to be studied. This research therefore attempts to study the behavioural aspect of construction firms while initiating and implementing innovation on construction projects. The need of study on these aspects of construction innovation have also been highlighted by Sexton and Barrett (2003), Atkin (1999), Manseau (1998), and Nam and Tatum (1989).

In this paper, first the literature review on the concept of innovation in general, and then innovation in construction industry in particular have been presented. After that a set of theoretical understanding has been developed which is relevant to answer the research questions of “why” the construction firms would initiate and implement innovation and “how” the firms would behave and interact during the initiation and implementation process. Then the theoretical understanding has been utilised in developing a feedback loop based systems thinking model. On the basis of the model, a detail account of conceptual discussion has been presented to address the research questions.

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