Journal of Business Research 64 (2011) 1327–1334

Contents lists available at ScienceDirect

Journal of Business Research

# Analytic collaboration in virtual innovation projects

Krista K.B. Ko [a,*], Chester K.M. To [a], Z.M. Zhang [a], Eric W.T. Ngai [b], Theresa L.K. Chan [a]

[a] Institute of Textiles and Clothing, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong
[b] Department of Management & Marketing, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong

ARTICLE INFO

*Article history:*
Received 1 September 2009
Received in revised form 1 April 2010
Accepted 1 January 2011
Available online 9 February 2011

*Keywords:*
Innovation
Virtual project
Collaborative work
Collaboration
Antecedents
Coordination mechanism

ABSTRACT

Researchers attend to innovation and collaboration issues. Yet, the relevant literature devotes scant attention to the relationship between collaboration effectiveness and virtual innovation team context, while there are clear indications that both subjects relate with growing concerns in today's business setting. This article reviews extant literature and state-of-the art collaboration systems, and elucidate dynamic contextual factors among virtual innovation team members. The results show the antecedents and interrelationship among these factors, suggesting an optimal collaboration model for virtual innovation project teams. This paper documents the empirical observations of a virtual innovation project for advanced textile manufacturing technologies, and examines the due collaboration taking place among different project participants. Understanding the set of contextual factors emerging from virtual innovation projects can help managers classify, and employ the most effective collaboration mechanism for enhancing the corresponding project performance and effectiveness pragmatically.



## 1. Research issues and motivation

Innovation is one of the most vexing challenges but vital to the survival and prosperity of modern corporations; however, innovation would involve project teams that are nomadic and have to align contingently with one another in today's globalizing organizational structures. Well-integrated collaborative platforms and coordination mechanisms are thus critical to the support of their interdependent tasks and the accomplishment of definite goals; therefore, inappropriate adoption of coordination mechanisms from a wide array of information communication technologies would impede the collaboration effectiveness among innovation teams.

In nowadays globalizing business environment, organizations must develop and introduce innovative, enhanced products in great complexity. They have to respond rapidly to the changing, intractable customers' requirements. Nonetheless, these corporations should improve their internal operation effectiveness by advancing their established production processes. This empirical study thus examines the issues of collaboration in virtual innovation team management through observing the development of a novel production monitoring system in a large-scale textile processing plant. During the course of the study, the research team tracks and analyzes the intensive interactions between virtual innovation team members. The research team hence discerns and construes the underlying factors which led to exchange of opinions and ideas at different development stages in a highly collaborative manner. Notably, the advancement of telecommunications and information technologies furnishes the essential base for the development of virtual team collaboration. This advent of worldwide connectivity through virtual and information technologies enables multi-site organizations to achieve round-the-clock business operations and interaction. From the perspective of organization sciences, a number of facilitating or inhibiting factors influence the cross-functional operation and collaboration during the course of innovation process. These factors are ranging from the nature of heterogeneity in psychological engagement between individual team members (Guzzo and Dickson, 1996; Pertusa-Ortega et al., 2009), social interaction among team members, organizational aspects such as technological supports (Knoll and Jarvenpaa, 1995), social contexts of work (Ancona and Caldwell, 1992), to various cultural norms and custom (Carmel, 1999).

Within the context of innovation management, this paper examines the peculiar effects of the three major antecedent constructs, which refer to adequacy of consensus, organizational contexts and innovation complexities, upon the fulfillment of cross-functional collaboration within the context of virtual innovation project team. The study further explores the dynamic outcome under the effect of cross-functional operation. Past research has either dealt primarily with teams within structures of innovation team units or cross-functional teams working on phases of non-routine collective work tasks. The structural contexts of innovation mainly center on product development projects which operated across institution borders. Researchers (Forrester, 2000; Hall and Andriani, 2003; To and Harwood, 2000) often put their focus on the discussions of project

* Corresponding author.
*E-mail addresses:* krista.ko@polyu.edu.hk (K.K.B. Ko), tctokm@inet.polyu.edu.hk (C.K.M. To), tczhanzm@inet.polyu.edu.hk (Z.M. Zhang), mswtngai@polyu.edu.hk (E.W.T. Ngai), tcchant@inet.polyu.edu.hk (T.L.K. Chan).

0148-2963/$ – see front matter © 2011 Elsevier Inc. All rights reserved.
doi:10.1016/j.jbusres.2011.01.012

contexts and knowledge management among innovation teams. In conventional organizational studies, researchers (Ancona and Caldwell, 1992; Curtis et al., 1988; Pinto and Pinto, 1990; Wynn and Novick, 1995) paid much attention to team activities and the effectiveness of communication and coordination. In this investigation, the authors therefore attempt to get a balance between these two structural contexts, and view the analytical coverage of these into a dynamic landscape of virtual innovation project management.

In a rigorous attempt to generalize the collaboration pre-requisites, infrastructures, impediments, conditions and all contextual influences, the authors propose an analytic framework to capture and contextualize the effectiveness of collaborative innovation under the theoretic rubrics of Actor-network and Absorptive Capacity in strategic organization science (Callon, 1991; Cohen and Levinthal, 1990; Latour, 1992). The Actor-network Theory (ANT) evolves and acts distinctively in the social theory and research. In the field of science and technology, ANT recognizes both human actors and nonhuman participants which act equally in the networks of practices and they are defined relationally as arguments in the network. These definitions lead to a relational epistemology that actors or objects do not exist in themselves prior to any participation in social and semiotic networks of interactions. For instance, this paper proposes that a number of influential factors are indeed affecting the collaboration of virtual innovation team. As ANT concerns the heterogeneous nature of actors and networks, both the background of virtual innovation projects and all factors should be taken into account.

With reference to the theoretic Absorptive Capacity, implementing innovation projects includes a multiplicity of dispersed functional tasks, as the process of developing new products and programs demand combinations of knowledge of multidiscipline function teams (Cohen and Levinthal, 1990). Geographically dispersed virtual innovation teams have to avail themselves for efficient communications and knowledge sharing, while maintaining their functional independence and autonomy. Therefore, creating and sustaining a highly cooperative atmosphere and workplace among the team individuals is important (Adenfelt and Lagerstrom, 2006;2008; Snell et al., 1998).

The research setting encompassed observations and analyses of a virtual innovation project, which was jointly done by two university research centers and a handful of private textile enterprises. The initiation of collaboration was under a scheme of government-funded technology innovation that purported at a technology breakthrough to control and integrate cross-border production processes on a real time basis. Significantly, this research suggests a methodological framework which guards the analysis and evaluation of collaboration among virtual innovation teams. The case study allows us for valuable insights on management technology breakthrough through better collaboration by virtual means.

In order to generalize the observed virtual innovation teams' collaboration pre-requisites, hurdles, conditions and all contextual influences, the authors propose an analytic framework to capture and contextualize the collaboration effectiveness of such process innovation. The proposed framework, as shown in Fig. 1, demonstrates the research basis and proposes a three-step path analytic model, which characterizes the cross-functional virtual collaboration processes as in three stages: (1) input stage of various potential antecedents, (2) implementation stage of both communication and coordination processes and (3) output stage as the evaluation of virtual innovation projects. The input stage consists of three main antecedent constructs: (1) adequacy of consensus, (2) organizational contexts and (3) innovation complexities; these constructs intend to elucidate the effects on the attainment of cross-functional collaboration, the preferred alternatives of task systems and the subsequent project outcomes. The implementation stage is the resulting effectiveness of both communication activities and coordination procedures among virtual innovation teams. The output stage serves as a final measurement indicator of the overall virtual innovation projects. The inclusion of both task outcome and personal achievement provides an overview of virtual innovation teams' accomplishment.

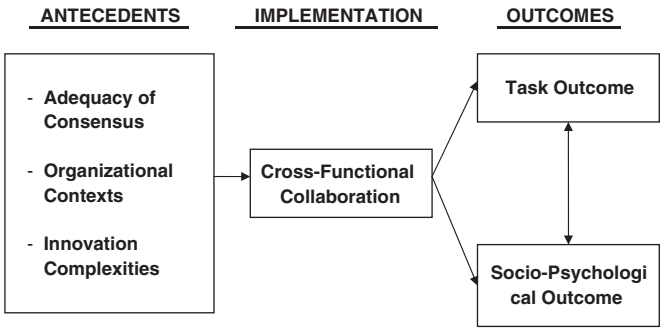


**Fig. 1.** Antecedents of consequences of cross-functional collaboration.

The following sections consist of detailed discussions on the importance of virtual teams in the organizational aspects, the antecedents of cross-functional collaboration, the construct of cross-functional collaboration and research findings respectively.

## 2. Antecedents of cross-functional collaboration effectiveness

A number of contextual factors influence the process and mechanism of collaboration, which affect the virtual innovation team performance correspondingly. These factors are influential to the design of communication and coordination tools for the accomplishment of desirable project outcomes. This study identifies the following constructs as the antecedents of cross-functional collaboration: (1) adequacy of consensus, (2) organizational contexts and (3) innovation work complexities. The details are discussed in the sections that follow.

### *2.1. Adequacy of consensus*

Researchers (Hall and Andriani, 2003; Mowshowitz, 1997) regard the team involved in innovation project as a new organizational form, which operates in accordance with the modern process based organization theory. In this perspective, organization goals are set on a collective basis, emphasizing on the principles of entire team integration, and creating maximum performance in their chained activity tasks. The project team members have to be inter-supportive and ready to reach at an understanding on common issues or decisions. The team could therefore realize collaboration through a series of opinion interchange, interests politicking, and underline "value consensus of all collaborated parties on types of views, ideas and opinion so that the best possible decision has to be made" (Dooley et al., 2000).

According to research on team consensus and task collaboration (e.g., Mathieu et al., 2000), different levels of consensus may deliver divergent outcomes, including strategic cooperativeness within project teams, group cohesiveness, and teams' ability for reaching consensus in subsequent work tasks. Team collaboration in a high level of consensus acts as an important input for cross-functional innovations and has a significant effect on the task outcome. Also, the analytical study of mobile telephone operator in Hall and Andriani (2003) highlights the importance of reaching consensus for improving project management. Therefore, to observe and measure the adequacy of consensus is essential for empirically learning their effect on the cross-functional collaboration of virtual innovation teams.

**Proposition 1.** *Better versus worse collaborative systems and communication mechanisms give rise to consensus among well-partitioned functional teams. Complementarily levels of inter-team consensus form a source of knowledge interchange requirements among virtual innovation*