IT and Knowledge in Teams:
A Longitudinal Study

Emergent Research Forum (ERF)

Hamid Reza Nikkhah
University of Arkansas
HNikkhah@walton.uark.edu

Franck Loic Soh Noume
University of Arkansas
Flsohnou@uark.edu

Beverly Hodges-McDaniel
University of Arkansas
BMcDaniel@walton.uark.edu

Rajiv Sabherwal
University of Arkansas
RSabherwal@walton.uark.edu

Abstract

The literature on information systems development (ISD) appears to be fragmented into two main streams: one that uses a knowledge management perspective and another one emphasizes the role of information technology to enhance ISD. Such fragmentation can be detrimental to establish a common ground for future research. In this paper, we synthesize the prior literature on information systems development and propose a theoretical model for ISD performance based on knowledge-oriented factors and IT. We argue the effects of knowledge-oriented factors on ISD team performance and how IT can impact such effects overtime. This study aims to understand how IT facilitates the stream of knowledge within teams to enhance ISD team performance over the course of IS projects implementation.

Keywords

information systems development, team performance, longitudinal study, panel data.

Introduction

The development of information systems plays an important role in today's knowledge-based organizations. Information systems are becoming the principal backbone of organizations from which strategic value is created (Bharadwaj 2000; Mithas et al. 2012). Information systems aim at supporting business needs. In today's hypercompetitive environment, business needs are amenable to change over time. This implies that information systems are constantly developed to meet business needs. Teams constitute key building blocks of organizations (Kanawattanachai and Yoo 2007). Indeed, organizations are structured around teams for key business functions including information systems development (ISD) (Robert et al. 2008). Because of the well-known importance of teams for key organizational operations such as R&D and production (Mesmer-Magnus and DeChurch 2009; Breu et al. 2002), team performance has a significant organizational impact (Dyer et al. 2013). Thus, managers are concerned about methods and techniques to improve team performance in general, and especially in the context of ISD.

Prior ISD research has adopted very distinct approaches in order to understand the performance consequences of ISD. First, some studies indicate that ISD is a knowledge-intensive process. Thus, several constructs related to knowledge management have been used to understand ISD performance (Tiwana et al. 2003). Second, some studies argue about the importance of technology in understanding ISD performance (Choi et al. 2010). Despite a large number of studies on ISD projects, there is an urgent need to provide a more concise theoretical model about ISD performance. We propose to look at the triangle of organization, individual, and information technology (Griffith et al. 2003). The paper's main research objective is to synthesize the current state of research on ISD by providing a concise model to explain ISD performance over the course of an IS implementation. More specifically, the research questions of this study are: *(1) how do knowledge-oriented factors affect IS development team performance over time? (2) how*

does IT moderate the effects of knowledge-oriented factors on ISD team performance over time? We build the theory through reviewing the literature of knowledge management and information system, and empirically test the hypotheses using a three-wave longitudinal dataset of different IS project teams consisting of more than 250 individuals.

Literature Review

According to prior research, there is a need for sharing specific knowledge and applying knowledge within the ISD team (Choi et al. 2010; Sabherwal and Becerra-Fernandez 2005). There are three types of specific knowledge that are needed to improve performance (1) context-specific knowledge, which is the detailed knowledge about a particular setting (i.e., knowledge about your team or organization); (2) technology-specific knowledge, which is the skill based (i.e., programming knowledge); and (3) context-and technology-specific knowledge, which is a combination of context-specific knowledge and technology-specific knowledge (i.e., not only do you have knowledge about the problem, but you are also able to create a solution (Sabherwal and Becerra-Fernandez 2005).

Several theoretical perspectives have been used to better understand ISD teams, for example, transactive memory systems (TMS) (Choi et al. 2010; Kankanhalli et al. 2005) and knowledge-based view (Grant 1996). Some studies have focused on "feedback, learning, communication and the impact of TMS on ISD teams (Choi et al. 2010). Whereas other studies have examined the impact of knowledge integration, which produces new knowledge with the application of individual knowledge to achieve the desired outcomes of the ISD teams (Sabherwal and Becerra-Fernandez 2005; Grant 1996, Nonaka 1994). The focus is on integrating tacit knowledge (i.e., the knowledge that is found within individuals) with new tacit knowledge and transferring tacit knowledge into explicit knowledge (i.e., the knowledge that is shared with other individuals), which is useful in ISD (Sabherwal and Becerra-Fernandez 2005; Nonaka 1994). Knowledge integration can be enhanced when ISD team members engage with other each (Alavi and Tiwana 2002). However, ineffective interactions among the team members can have a negative impact on knowledge integration (Alavi and Tiwana 2002) within ISD teams.

Knowledge is created and shared through social interactions and translates into the individual level, team level, and organization level (Nonaka 1994). Team problem solving and decision making requires communication between the team members for successful integration, especially for significant, complicated tasks (Grant 1996). The ISD team is characterized by opportunity and risk; and influenced and changed by collaborative, cooperative, and competitive interactions among the team members (Poppo et al. 2016).

Theory Development

As figure 1 shows the research model, this study draws on knowledge management and information systems literature to argue how knowledge-oriented factors and IT impact team performance.

Human Capital and Team Performance

Problem-solving plays an important role in ISD projects because they allow team members to create innovative and effective solutions. Human capital is usually used to refer to knowledge and skills existing an organization and is considered the source of innovation in organizations (Stewart 1997). Human capital enhances the ability of the teams to solve complex problems. ISD is a knowledge-intensive process (Mitchell and Nicholas 2006). Knowledge or expertise represents the most critical resource of ISD projects. Developers are constantly facing new problems that need to be solved. They have to rely on their own skills and expertise to provide an adequate solution. If a skill or expertise that is necessary to resolve a specific problem does not exist within the team, the ISD process will be hindered. However, teams with sufficient skills and expertise will be able to provide effective and innovative solutions to business problems. Thus, we hypothesize that:

H1: Human capital has a positive influence on team performance.

Absorptive Capacity and Team Performance

Absorptive capacity represents the ability to recognize, assimilate, and apply valuable external knowledge (Cohen and Levinthal 1990). Teamwork plays an important role in ISD projects because they increase

efficiency and effectiveness. Absorptive capacity is the result of team members' expertise in specific domains. Moreover, absorptive capacity is built through interrelation among team members' expertise (Cohen and Levinthal 1990). Thus, absorptive capacity reflects the extent to which team members' expertise interrelate or work together. Absorptive capacity enhances teamwork. Team members' expertise is distinct and complementary. One important characteristic of teams with high absorptive capacity is that team members are aware of their cognitive boundaries, and how to cross those boundaries by tapping into other team members' expertise. In teams with high absorptive capacity, team members are less likely to rely on their own expertise. Instead, they are more likely to rely on complementary sources of expertise within the team. This behavior will enhance teamwork (Cohen and Levinthal 1990). Thus, we hypothesize that:
H2: Absorptive capacity has a positive effect on team performance.

Knowledge Integration and Team Performance

Knowledge integration refers to the extent to which knowledge is shared and applied across the team (Sabherwal and Becerra-Fernandez 2005). Knowledge integration enhances various aspects of ISD projects including development flexibility. Development flexibility constitutes an important aspect of ISD (Tiwana et al. 2003). Indeed, team members should be able to incorporate changes that occur during the ISD process. These changes could be related to the market, the firm's business needs or the technical aspects of the solution. Knowledge integration enhances team's reactions to changes by facilitating information flows among team members. The sooner team members are aware of changes, the quicker they will be able to provide an adequate response (Dyba 2000). Knowledge integration also facilitates coordination among team members. Thus, incorporating changes will be easier. The ability of the team to adapt to changes depends on team members' coordination. Thus, we hypothesize that:
H3: Knowledge integration has a positive effect on team performance.
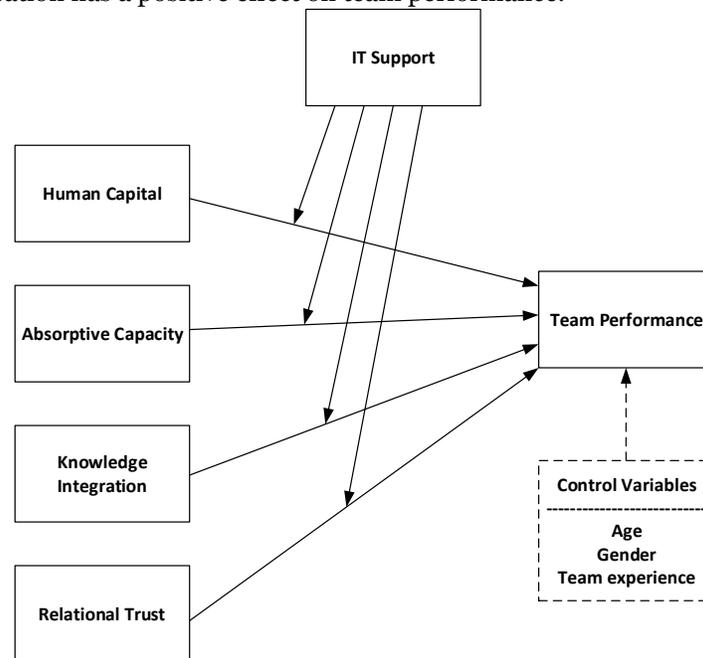
Figure 1. Research Model

Relational Trust and Team Performance

Relational capital is defined as the nature and quality of the relationships among individuals and how those relationships affect behavior (Nahapiet and Ghoshal 1998). One of the key facets of relational capital is relational trust which is the confidence in a vulnerable state that the intentions or behavior of another individual will be what is expected from him/her (Nahapiet and Ghoshal 1998). Relational trust fosters knowledge contributions by creating an environment wherein team members can collaborate, exchange ideas and advice with ease (Wasko and Faraj 2005). Relational trust facilitates the establishment of commitment and reciprocity among team members. First, commitment is important for ensuring

knowledge contributions. Committed team members feel morally obligated to contribute to the project. They have a stronger sense of responsibility regarding the progress of the project. Prior research shows that members with a strong sense of commitment provide valuable contributions to the project and valuable assistance to other members (Wasko and Faraj 2000). Second, reciprocity is also important for ensuring knowledge contributions. Team members who trust each other develop a sense of mutual indebtedness. They tend to reciprocate other team members' contributions, enabling ongoing contributions (Shumaker and Brownell 1984). Prior research shows that members with a strong sense of reciprocity provide valuable contributions (Wasko and Faraj 2005). Thus, we hypothesize that:

H4: Relational trust has a positive effect on team performance.

IT Support and Team Performance

IT support represents the extent to which IT is utilized to assist collaboration, communication, storage, search, and access to information (Choi et al. 2010). Information technology supports various aspects of ISD projects including organizational learning. Organizational learning constitutes an important aspect of ISD because it enhances teams' ability to provide innovative solutions. Information technology enables exploitation and exploration of knowledge (Xue et al. 2012). IT facilitates exploitation by providing features that support and stimulate collaboration and communication practices (Choi et al. 2010). Prior research indicates that IT facilitates dialogic practices (Majchrzak et al. 2005), effective and frequent communication among team members (Alavi and Leidner 2001; Kanawattanachai and Yoo 2007). Additionally, IT facilitates exploration by providing features that support information search from external sources (Alavi and Leidner 2001). IT enables access to external sources of information. Thus, we hypothesize that:

H5: IT support positively moderates the effects of (1) human capital, (2) relational trust, (3) knowledge integration and (4) absorptive capacity on team performance.

We also adopt control variables to rigorously examine the research relationships. Specifically, the control variables of this study are age, gender, and team experience.

Methodology, Discussion and Conclusion

We develop the measurement scales of the constructs in the proposed model based on reviewing literature extensively. To understand individuals' perception of team performance and IT support, we adopt the items from Choi et al. (2010). We measure human capital and relational trust based on the items from Subramaniam and Youndt (2005) and Tiwana and McLean (2005), respectively. The measures of absorptive capacity are derived from Pavlou and El Sawy (2006). We adopt the items of knowledge integration from Tiwana and McLean (2005). All the items used in the survey will be based on a seven-point Likert scale. A web-based survey will be administered by a research firm. We expect to collect data from at least 250 IT professionals working on IS projects in teams. However, we first conduct a pilot study with 20 respondents who are similar to the respondents in the primary study. We survey IT professional at three points in time: 1: before the beginning of IS project; 2: during doing the project; and 3: after finishing the project. Moreover, we identify each participant in each wave of data through the last four digits of his or her phone number so that we can trace each participant at each point of time. We analyze the sample data through multivariate techniques, especially latent growth curve modeling (LGM) to examine individual and team differences over the course of implementing an IS project.

This study complements prior studies on ISD. It integrates the main theoretical perspectives used in the ISD literature and also takes into account the knowledge management perspective that has been widely used in the ISD literature (e.g., Tiwana and McLean 2005). Moreover, we consider the effect of technology that has significantly shaped communication and collaboration processes in organizations (Choi et al. 2010). This study has important implications for developers and project managers by providing insights into on how the interplay between knowledge management and IT can enhance team performance. IT can fuel the knowledge in the team throughout doing an IS project, which would lead to higher performance.

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