ABSORPTIVE CAPACITY AND SYSTEM QUALITY IN IS DEVELOPMENT PROJECTS

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ABSTRACT

Expertise from multiple disciplines has long been considered essential in the development of quality information systems. However, the literature lacks a coherent model explaining the deployment of knowledge during a development project to where the output of the effort is enhanced. Based upon the absorptive capacity perspective, a formal model is derived to represent the process of applying knowledge maps and open sharing to improve aspects of absorptive capacity, which then lead to a system, which is more flexible, responsive and efficient. Partial least squares analysis of a survey confirms the anticipated relationships. Implications for IS managers and researchers are discussed.

Keywords: Information Systems Development, Absorptive Capacity, Software Quality, Knowledge Maps, Problem Solving

INTRODUCTION

Information system (IS) development must be responsive to a changing environment to produce a high quality product that achieves the objectives set forth in a project (Byrd & Turner, 2000; Lee & Xia, 2005; Standish Group International, 2009). Within the context of turbulent business environments, it is typically espoused that active participation of experts enables an IS development team to assimilate essential knowledge and generate creative ideas to address emerging issues and fluctuations in requirements and technology (Li, Yang, Klein, & Chen, 2011). The research question we address in this study is what aspects of knowledge must be present in an IS project team to lead to better knowledge application in solving problems of development and eventual system quality. One theoretical lens that provides a perspective to study the sharing, integration, and application of expertise is that of absorptive capacity (AC). We apply the absorptive capacity perspective to explain IS development team capability to identify valuable external knowledge, transform valuable external knowledge, and apply assimilated external knowledge during the course of a development project. The purpose of this study is, therefore, to examine how absorptive capacity within a team is developed to produce quality system products. A model is developed based on the AC perspective and empirically confirmed via a survey involving members of IS development teams.

THEORETICAL BACKGROUND

Absorptive capacity is defined as the ability of a firm to recognize the value of new, external information, assimilate it and apply it to commercial ends (Cohen & Levinthal, 1990).
Absorptive capacity is often decomposed into three sequential activities: identifying external knowledge, assimilating external knowledge, and applying the assimilated external knowledge (Volberda, Foss, & Lyles, 2010). These three components have been defined with different proxies under different contexts (Roberts, Galluch, Dinger, & Grover, 2012). For the IS development team, we consider knowing where expertise is located (Faraj & Sproull, 2000), knowledge sharing (Eng, 2006; Mesmer-Magnus & DeChurch, 2009) and team problem solving competence (Aladwani, 2002; Hoegl & Parboteeah, 2006) are context equivalents to identifying, assimilating, and applying the knowledge, respectively (Pavlou & El Sawy, 2006). The existence of expert knowledge is not sufficient for team problems solving needs, however. Knowledge sharing is essential to create the opportunity for combining different sources of knowledge and applying the knowledge towards emergent problems in the project (Eng, 2006; Pavlou & El Sawy, 2006; Van Wijk, Jansen, & Lyles, 2008). AC is realized when the teams successfully apply the existing knowledge to solve the problems associated with developing a quality IS. Furthermore, AC theorists suggest that social integration mechanisms must be present in order to promote the interaction, communication and coordination among the entities. In the IS development context, Faraj and Sproull (2000) suggest that bringing expertise to bear is an effective mechanism. Therefore, in this study, we argue bringing expertise to bear could facilitate a team’s knowledge sharing and problem solving competence. In summary, we propose the research model of Figure 1. Knowing expertise location will be positively associated with both knowledge sharing and problem solving competence and higher levels of knowledge sharing among team members will lead to higher levels of team problem solving competence. Furthermore, the social integration mechanism (bringing expertise to bear) will be positively associated with knowledge sharing and team problem solving competence. Finally, realized AC (team problem solving competence) will significantly enhance IS product quality (system flexibility, system operational efficiency, and system responsiveness).

FIGURE 1 The Proposed Research Model

HYPOTHESES DEVELOPMENT
Knowing the location of expertise enables the team to have access to complementary knowledge in a timely manner (Zahra & George, 2002). Knowing the source of expert knowledge enables the IS project team to have access to the past project lessons learned and experts with similar project experience. IS development teams with knowledge of previous experience have a greater understanding of requirements and the potential impact of system complexity on project performance. Knowing expertise location generates a direct impact on the potential acquisition of new knowledge and integration with the knowledge base of the team. Teams that know how knowledge is distributed and know a variety of potentially useful expertise sources have been shown to increase ability to solve problems. Therefore the following hypotheses are proposed:

**H1a:** Knowing expertise location will be positively associated with the levels of an IS development team’s knowledge sharing.

**H1b:** Knowing expertise location will be positively associated with an IS development team’s problem solving competence.

Potential AC enables the team to acquire and assimilate essential external knowledge, creating a broad knowledge base for future exploitation. Realized AC reflects the team’s capacity to leverage the knowledge already integrated. Potential AC and realized AC are complementary in nature (Jansen, Tempelaar, van den Bosch, & Volberda, 2009). In the IS development project context, teams usually adopt approaches of recruiting highly skilled personnel (Li et al., 2011). Team members should have complementary knowledge bases, making it easy to communicate and learn from each other. The more knowledge sharing activities occur in the IS development teams, the more likely innovative solutions can be generated. The team’s integration and exploitation capacity is realized when the “best” solution has been identified. Therefore, we propose that

**H2:** The levels of knowledge sharing will be positively associated with the levels of an IS development team’s problem solving competence.

When the knowledge resources for problem solving in an IS development team are limited, exposure to external expertise sources may not be sufficient for the development of absorptive capacity. Knowledge integration and exploitation requires knowledge sharing processes among team members and a mutual understanding of the material (Jansen et al., 2009). External experts have to be brought to work on a problem on a timely manner (Faraj & Sproull, 2000). A social integration mechanism, bringing expertise to bear, can facilitate the knowledge sharing process (Jansen et al., 2009). Bringing expertise to bear is useful in increasing cross-functional interaction, exchanging ideas and deepening knowledge flow across functional boundaries. Thus, bringing expertise to bear enhances the knowledge acquisition and assimilation underlying the team’s potential absorptive capacity. Bringing the expertise to bear provides opportunities to gather new information and exchange tacit knowledge in a particular context. In addition, bringing expertise to bear is beneficial in integrating diverse knowledge sources and supporting the innovative thinking required to apply new knowledge. Thus, bringing expertise to bear enhances the transformation and exploitation underlying the team’s realized absorptive capacity. Therefore the following hypotheses are proposed.

**H3a:** Bringing expertise to bear will be positively associated with the levels of an IS development team’s knowledge sharing.
**H3b:** Bringing expertise to bear will be positively associated with the levels of an IS development team’s problem solving competence.

Due to the changing socio-technical environment, user requirements continuously change during the development project and after (Lee & Xia, 2005). Many IS projects fail due to an inability to map the requirements of the users to the final product delivered (Robertson & Robertson, 2006). IS development team’s problem solving competence becomes critical because of the inherent uncertainty and complexity (Aladwani, 2002; Hoegl & Parboteah, 2006). Teams with high problem solving competency have the capacity to handle ongoing variability in task demands, producing flexible IT systems (Sheremata, 2000). Highly skilled project members and integrated technology tools enable the team to make the “best” decisions in new situations and to respond in a comprehensive fashion to business changes. Teams with problem solving competence have the aptitude to respond to business changes in an efficient way because of team design and resource allocation at an early stage. Therefore we propose that

**H4a:** An IS development team’s problem solving competence will be positively associated with levels of system flexibility.

**H4b:** An IS development team’s problem solving competence will be positively associated with the levels of system responsiveness.

**H4c:** An IS development team’s problem solving competence will be positively associated with the levels of system operational efficiency.

**RESEARCH METHOD**

A survey design was selected to collect data and test the proposed model employing previously published scales. Target respondents were members of IS project teams in order to determine experiences in actual development situations. Target respondents were provided a cover letter defining the purpose of this study, instructions on completing the survey, and the questionnaire. The packet was sent directly to the target sample. Personal contacts and phone calls were made to encourage participation. Follow-up calls and reminder emails were sent out two weeks later after the initial contacts. The target sample was 179 subjects and 119 usable instruments were returned. Hypotheses were tested and verified by employing the method of Partial Least Squares (PLS) (Löhmoller, 1989).

**DATA ANALYSIS AND RESULTS**

All constructs showed high convergent validity. All indicators have loadings higher than 0.7. The minimum composite reliability of each construct is 0.85. Cronbach’s Alpha of each construct exceeds 0.7 and the AVE is always greater than 0.5. These test results exceed recommended thresholds. Figure 2 shows the path analysis result. The result shows that knowledge source and complementarity (knowing expertise location) has positive and significant effects on potential and realized AC (problem solving competence and knowledge sharing). A social integration mechanism (bringing expertise to bear) also has positive and significant effects on both potential and realized AC. As expected, potential AC (knowledge sharing) has a positive and significant effect on realized AC (team problem solving competence). Team problem solving competence has positive and significant impacts on all three product quality dimensions: system flexibility,
system responsiveness and operational efficiency. Therefore, all the proposed hypotheses were supported.

**FIGURE 2** Path Analysis Results

The results indicate that the practices of open sharing and development of knowledge maps will increase an IS development team’s ability to solve problems related to the system and build higher quality information systems. Industry practitioners should take away several implications in this study. First, IS managers could apply the concept of absorptive capacity at the team level to enhance the output of a development project. Second, IS managers are recommended to develop a map of experts in the organization to cultivate potential AC and be sure the mechanism of bringing expertise to bear is in place. Finally, IS managers should also take necessary steps to enhance the IS teams’ realized AC. Often it is assumed that multiple functional experts on the team constitute the team’s AC. Like any study, this study has several limitations including the limits of sampling, survey methodology and using a single respondent to answer the survey. Future studies may consider involving multiple respondents per project team and using a qualitative approach.

**REFERENCES**


[Data Tables are not included due to page restrictions. For full paper please contact Yuzhu Li.]