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ScienceDirect

International Journal of Project Management 33 (2015) 1692 – 1703

International Journal of Project Management

www.elsevier.com/locate/ijproman

The impact of team knowledge on problem solving competence in information systems development team

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Received 28 October 2014; received in revised form 14 July 2015; accepted 17 July 2015

Abstract

Information systems development (ISD) work entails a series of problem solving activities and, therefore, knowing how to enhance problem solving competence is critical for project success. Since ISD is a knowledge intensive task, problem solving competence is largely determined whether the members can effectively utilize knowledge resources located within the team. Based on the transactive memory concept and following traditional wisdom, we hypothesized that knowing the location of knowledge allow better problem-solving competency. We also attempted to extend past studies by showing that problem-solving competency is also a function of knowledge complement and deployment. The study results, based on data collected from 215 team project managers, confirmed our hypotheses that having complement knowledge, allocating knowledge in right position, and knowing the allocation of resources are critical for problem-solving competency. In addition, the critical role of problem solving competence in project performance is reaffirmed.

Keywords: Problem solving competence; Resource-based view; Knowledge complement; Knowledge location; Knowledge deployment

1. Introduction

The highly uncertain nature of the ISD project makes it a series of problem solving processes (Cerveny et al., 1990; Jun et al., 2011; Narayanaswamy et al., 2013; Tiwana and Keil, 2009). Each project contains unique problems needed to be solved. To effectively counter challenges, team members must be able to identify sources of problems, generate and validate alternatives, implement selected solutions, and evaluate the implemented results. Such a problem solving competence, how well teams can perform the above activities during the ISD process, is highly correlated with project performance, the extent that teams can reach predefined goals within budget and on schedule (Aladwani, 2002; Liu et al., 2010). Therefore, understanding how ISD can foster their problem solving competence is a critical issue.

An ISD project is a knowledge-intensive task, which demands widely varied knowledge, including technical knowledge and application domain knowledge (Kirsch et al., 2010; Narayanaswamy et al., 2013; Rus and Lindvall, 2002). Prior research has demonstrated that a lack of knowledge resources leads to project failure (Gemino et al., 2007; Reich et al., 2014). Since ISD is a knowledge intensive task, there is a need to understand the role of problem solving competence within the ISD team from a knowledge perspective. Theorists have concluded that the availability of knowledge is critical for fostering problem solving competence (Hagemann et al., 2008; Karacapilidis et al., 2006; Park et al., 2011). Problem solving competence can be cultivated when specific types of domain knowledge are available.

However, previously largely focus on the needed domain knowledge (e.g., Atuahene-Gima and Wei, 2011). It is noticeable that problems may not always be resolved by merely collecting required domain knowledge resources. In addition to bringing

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http://dx.doi.org/10.1016/j.ijproman.2015.07.007
0263-7863/00/

their domain knowledge to the task level, team members also need to blend and coordinate available knowledge resources to counter the problems they face to improve the final outcome (Faraj and Sproull, 2000; Tiwana and McLean, 2005). This implies that different forms of knowledge resource are needed to foster required capability to solve problems. For example, members may also need to know who possess what knowledge and how to map available domain knowledge with tasks in hand. However, the role of other types of knowledge resources on fostering problem solving competency hasn't been investigated systemically. Therefore, the question this study attempts to answer is *what types knowledge resource are needed to foster problem solving competency in an ISD context*.

We adopt resource-based view (RBV) to address this issue. Based on RBV, performance is a function of competence which positively associates with the availability and characteristics of resources as well as the ability in leveraging those resources (Karimi et al., 2007; Teece et al., 1997). We further classified resources into experiential (knowledge complement), relational (knowledge location), and structure (knowledge deployment) three types based on the framework proposed by Gardner et al. (2011). Knowledge complement represents needed knowledge for tasks execution is available, knowledge location refers to the knowing of who knows what within the team, and knowledge deployment represents an effective matching knowledge with task.

The rest of this paper is organized as follows. The next section describes literature reviews and the theoretical framework employed that led to the model development of this study. In the following section, the methodology used to verify our theoretical framework and a data analysis of the study are presented. The final section presents the results and discussion, describes their implications for both academic and practical fields, and identifies the limitations of the study.

2. Theoretical background and hypotheses development

In this section, aligning with our research purpose, we first argue the importance of problem solving in information system development (ISD) project and build according hypothesis (Liu et al., 2010). In the following, based on resource-based view and the concept that ISD is a knowledge intensive process in which knowledge is almost the most important resource, we then construct the critical roles of different types of knowledge on forming problem solving competence.

2.1. Problem-solving competence and project performance

Achieving successful outcomes is the ultimate goal of organizational activities' operations; therefore, evaluating organizational outcomes is an important task in the management field. Such a perspective also emerges in the MIS discipline. ISD teams aim at accomplishing predefined goals within budget and at cost (Henderson and Lee, 1992). Studies based on different perspectives have been conducted to explore possible determinants of project performance. Among them, some studies adopted a problem solving perspective and view ISD as problem solving processes (Aladwani, 2002; Cerveny et al., 1990; Khatri et al., 2006). This perspective indicates that team performance is determined by whether a team can counter the problems it faces in an efficient and effective manner. Some studies show how the problem-solving process takes place in the ISD project. For example, Cerveny et al. (1990) and Kozar (1988) discussed the fundamental issues of problem solving by illustrating how different strategies are manifested in software development approaches to ISD, and recommended the application of the problem-solving model to systems development. Aladwani (2002) proposed that certain IS project design attributes (such as the use of support technology, team size, clear goals, knowledge of staff, and management advocacy) are necessary inputs for accomplishing favorable process outcomes (such as problem-solving competency), which in turn represent necessary conditions to secure the ultimately desired tasks, and psychological and organizational outcomes.

A "competence" is defined as a specialized system of abilities, cognitive skills and behavior used to complete tasks (Li et al., 2011). Furthermore, competence can be divided into two categories by different level: individual competence and team competence. Individual competence is viewed as the critical factor on job effectiveness that can help project team success. But team competence can't be viewed as the sum of individual competence because every team member should collaborate to share information, goals and decisions in project team (Kauffeld, 2006). The problem solving competence is one of the team competencies that help project team achieve goal. In the other word, ISD is viewed as the problem-solving process that every members should share information and collaborate to achieve the project goals.

A "problem" is defined as a gap between an existing state and a desired state (MacCrimmon and Taylor, 1976; Newell and Simon, 1972). Problem solving is defined as work processes for reducing the gap between the existing state and the desired state (Cerveny et al., 1990). This gap in an IS project may result from certain barriers that are related to the staff, the user, the internal organization, the external environment, the task, or technology. For example, Wallace et al. (2004) identified six category risks that might lead to a gap, which then undermines team performance directly or indirectly through reducing the quality of the developing process. One of the challenging issues for the ISD team is to completely understand and overcome problems so that a successfully functioning system can be implemented (Hickey and Davis, 2004). Therefore, it is critical to form a team which can counter risks and solve problems that emerge during the ISD process.

Since risks emerging during the development process create barriers and hydrants for project success, problem solving skills are essential for ISD team members (Whitten et al., 2000). Problem solving includes identifying problems, defining problems, generating alternative solutions, reviewing alternatives and evaluating options. For example, when progress falls behind expectations, the team has to be aware of it before it can diagnose the problem. Once the problem is identified, the team must then define how serious the problem is and the potential causes. With the understanding of potential causes, solutions