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The role of team problem solving competency in information system development projects

Yuzhu Li [a,*], Ming-Hsien Yang [b], Gary Klein [c], Houn-Gee Chen [d]

[a] Department of Decision & Information Sciences, Charlton College of Business, University of Massachusetts at Dartmouth, 285 Old Westport Rd., North Dartmouth, MA 02747, United States
[b] Department of Information Management, Fu-Jen Catholic University, No. 510 Chung Cheng Rd, Hsinchuang City, Taipei County, 24205 Taiwan
[c] College of Business and Administration, The University of Colorado at Colorado Springs, 1420 Austin Bluffs Parkway, Colorado Springs, CO 80933-7150, United States
[d] Department of Business Administration, National Taiwan University, College of Management Floor 9, No.1, Sec. 4, Roosevelt Road, Taipei, Taiwan

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Abstract

Organizations are justifiably concerned about the quality of the information system that will drive the operations of an organization. The vagaries of the environment and multiple stakeholders create uncertainty in the requirements for an information system product that impedes development of a high quality product along common dimensions of efficiency, flexibility and responsiveness. The ability of a team to solve problems that arise before and during the course of the project can help overcome uncertainty of requirements. A project can be designed with both reactive and anticipatory mechanisms that heighten problem solving competency and improve product quality of the resulting information system. We develop a model based on work in new product development and test it with a sample of 119 information system (IS) development professionals to examine the expected relationship. The confirmed relationships indicate that IS development project managers should consider problem solving expertise when building a team that considers elements that prepare for the development environment creatively as well as coordinate effectively to achieve a quality IS product.

Keywords: Information system development projects; Team competency; Problem solving competency; Software quality; Requirements uncertainty

1. Introduction

Information systems are most often developed within a project structure and seem particularly prone to failure (Schwalbe, 2009). The root of many failures is the inability to map the requirements of the users to the final product delivered (Robertson and Robertson, 2006). This is particularly difficult in the information systems development arena because of an inordinate amount of uncertainty in the desired information system on the part of the clients (Lee and Xia, 2005). Conversion of client needs into a final product is complicated by complexities based in ambiguity of information requirements, evolving business practices, and changing technologies (Hoorn et al., 2007; Lee and Xia, 2005). The diversity of desires held by the eventual users of the system can prohibit development of sound specifications and interfere with effective communication of requirements between users and developers and even among project team members responsible for delivering a system meeting quality expectations, where quality considers flexibility, operational efficiency, and responsiveness (Davidson, 2002; Nidumolu, 1995). Further, information system (IS) development is compounded by the complexities of having to organize the multiple components of hardware, software, infrastructure and trained personnel to facilitate business processes such as planning, control, coordination, and decision making (Schwalbe, 2009). In all, these conditions result in a moving target of requirements that are perceived differently by each individual and communicated across

* Corresponding author. Tel.: +1 508 910 9502; fax: +1 508 999 8646.
E-mail addresses: yuzhu.li@umassd.edu (Y. Li), mhyang@mail.fju.edu.tw (M.-H. Yang), gklein@uccs.edu (G. Klein), hgchen@ntu.edu.tw (H.-G. Chen).

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functional boundaries where different backgrounds and terminologies are in use (Chen et al., 2005). Just how these difficulties can be overcome is a large issue for IS development projects.

Two major perspectives from the development literature are explored as to how to address the problem. Requirements engineering rose from the computer science side to define the best techniques to elicit requirements from the system's stakeholders (Robertson and Robertson, 2006). The processes are directed at acquiring the best specifications possible and how to modify the specifications when conditions change (Hickey and Davis, 2004). Much of the information system project research examines this issue through studies on risk and control (Jiang et al., 2009; Wang et al., 2008). The thought here is that if risks can be identified then a portfolio of controls can be selected to be certain that the product tracks the specifications and that the specifications still represent the evolving needs of the stakeholders (Nieminen and Lehtonen, 2008). These two views consider procedures, techniques, climates and cultures that can improve the project process and outcomes.

Recently, other disciplines have proposed a different strategy where managing projects is a matter of enabling the crossing of functions and knowledge bases (Soderlund, 2002). This perspective considers the skills and competencies of the project team members and argues that handling changes in a project environment can enhance the achievement of project success (Aladwani, 2002; Byrd et al., 2004; Hoegl and Parboteeah, 2006). In particular, one set of competencies is required at the start of a project to generate the needed flow of ideas and creativity (termed centrifugal forces), while a second set of competencies are required during the course of the project to connect all of the essential elements and keep the project moving toward its goals (termed centripetal forces) (Sheremata, 2000). Centrifugal forces are those that gather the essentials for a project while centripetal forces are those that transform potential into action through integration. These forces are directed at solving the problems at distinctly different times and may require different sets of contradictory structural elements that must coexist. Unfortunately, empirical studies of this concept are not evident in the literature.

The purpose of this study is, therefore, to examine the relationship between uncertainty and project outcomes by focusing on one of the most crucial meta competencies of a software development project team, that of being able to make decisions (Aladwani, 2002). By examining the link between the more problematic elements of achieving a high quality product and the actual product quality of the information system, we are able to address an important question: What is the relationship between problem solving competency held by an IS development project team and the quality of the system in light of uncertainties? The quality of the system considered consists of three dimensions: operational efficiency, responsiveness, and flexibility (Nidumolu, 1995). Further, which mechanisms contribute to the development of problem solving competence in an IS development project? Based upon the centrifugal and centripetal forces concepts we propose that anticipation mechanisms and reaction mechanisms are two determinants of a team's problem solving competence. Reaction mechanisms refer to a collection of actionable items to handle unexpected constraints and opportunities during product development. Anticipation mechanisms refer to actionable items that develop capabilities to anticipate changes and identify critical knowledge areas in the early phase of product development.

2. Literature review and research model

The tasks in IS development projects are knowledge intensive, contain a high-level of uncertainty, and involve multiple stakeholders (Kraut and Streeter, 1995; Nidumolu, 1995). Moreover, IS development teams differ from other work teams in terms of team structure, team member selection from multiple functions, frequent replacement at different stages, project process control, and performance evaluation (Schwalbe, 2009). These high-level, uncertain tasks require the IS development teams to not only have the necessary knowledge and skills to complete the tasks but also develop meta-competencies to deal with situation-specific changes.

Problem solving competency, concerned with the ability to cope with uncertainty, is one of the meta-competencies that should be present in the IS development project team (Aladwani, 2002). This is because the work of IS development projects is essentially a problem solving endeavor (Cerveny et al., 1990). These features of an IS development project lead us to consider the relationships among the meta-competency of problem solving, the uncertainties of the information system, and the final quality of the product. In addition, we consider the importance of reactive and anticipatory mechanisms in the application of competency to achieve success.

For new product development projects, research indicates that team problem solving requires new knowledge, new information, and creative ideas, particularly at the start of a project. Centrifugal forces in this context exist as structural elements and processes that increase the quantity and quality of ideas, knowledge, and information an organization can access. Centrifugal forces pull an organization outward, away from its conceptual center (Sheremata, 2000). As a complement, centripetal forces increase efficiencies of problem solving by bringing connectedness and collaboration to the project such that goals remain in sight. These forces are expressed as organizational conditions that have been empirically found to improve problem solving outcomes and product quality (Atuahene-Gima, 2003).

An alternate perspective to conditions that exist in an organization are mechanisms that can be enacted to help generate desired outcomes (Larson and Gray, 2011). As a complement to centripetal forces, reactive mechanisms embed structural flexibility factors in IS development by maintaining the flexibility of resources, ensuring effective communication and using redundancies as buffers (Verganti, 1999). Similar to centrifugal forces, anticipatory mechanisms develop planned flexibility for a specific project by pooling information, ideas and knowledge into the early phases of development. We anticipate that an effective problem solving team must possess and balance both these aspects just as they should have both