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ABSTRACT

Project teams are composed of a diverse collection of individuals to provide the necessary background and skills to complete an information system. The diversity within groups can be problematic from the standpoint of creating conflict that inhibits progress. A model is derived from theory that shows expected relationships among informational diversity (knowledge), conflict, and learning. All three of these variables are expected to impact eventual success of the project; with learning, informational diversity, and conflicts about the task being positive influences, but relationship conflicts being detrimental. A survey instrument composed of published metrics has been sent to project team members.

Keywords

IS Staffing Issues, Software Quality, Project Management, Informational Diversity, Conflict Management, Team Learning.

RESEARCH OBJECTIVES AND QUESTIONS

Information systems (IS) development (ISD) teams have become important vehicles in the project environment for identifying and designing high-quality solutions to emerging business problems. In large part, the use of teams as fundamental building blocks for IS development is premised on the assumption that variety in membership leads to a diversity of information and backgrounds necessary to meet the required scope of the project, leading to the advice that a project team should consist of members with diverse educational backgrounds and functional experience (Klein, Jiang and Tesch, 2002). However, a team presents its own intrinsic problems of coordination and conflict management that have the potential to interfere with team tasks (Jehn, 1995). Diversity potentially compounds problems in group functioning leading to poor group performances (Guzzo and Dickson, 1996). An understanding of how these problems can impact the benefits of an ISD project is essential for IS project managers.

Information theorists devote considerable attention to how teams can generate knowledge and insight beyond the reach of their individual members (Oldham and Cummings, 1998). The creation of knowledge and the discovery of insight by teams depend on the presence of diverse viewpoints and perspectives (Nonaka and Takeuchi, 1995). Empirical research on the effects of diversity, unfortunately, has produced mixed results, perhaps due to an omission of intervening variables or inadequately defined objectives (Williams and O'Reilly, 1998). Results in the IS literature indicate that diversity among the stakeholders often goes hand-in-hand with conflict, leading to a potential problem during the project duration (Barki and Hartwick, 2001). This provides a seeming conflict: What makes a group diverse may also prevent the group from realizing the benefits of its diversity.

The objective of this research is, therefore, to examine the impact of informational diversity among ISD team members on final system quality, where quality is considered from a perspective of operational efficiency, maintenance, and usability. As part of the complete picture, we look at the impact of informational diversity on task-related conflicts that promote system quality and relationship conflicts among team members that detract from system quality (Amason, 1996). Additionally, since learning is a recognized byproduct of informational diversity and contributes to system quality, we include learning in the model to account for its effects (Stein and Vandenbosch, 1996). In general, we provide an integrated model that links variation in the composition of ISD teams through group processes and consequences to outcomes. The practical questions we address include whether or not management should staff IS project teams with diverse backgrounds as a forum for sharing information across functional boundaries, does informational diversity add to conflict within IS project teams and impact eventual quality, and do learning and conflict follow expectations in their impact on quality?

DEFINITIONS AND THEORETICAL FOUNDATIONS OF THE STUDY

A project team is defined as a collection of individuals who are *interdependent* in their tasks, who share responsibility for *outcomes*, who see themselves and who are seen by others as *an intact social entity* embedded in one or more larger social systems, and who manage their relationships across organizational boundaries. ISD Project teams are time-limited and produce one-time outputs that often posses the following characteristics: are non-repetitive in nature, involve considerable application of knowledge and expertise, create an incremental improvement over an existing concept or a radically different idea, draw their members from different disciplines and functional units, and require intensive coordination and cooperation so that members' specialized expertise can be applied to the project.

Three categories of diversity proposed by Jehn (1999) are widely accepted in the recent literature -- informational diversity (e.g., variations of skills, abilities, and knowledge among members), social category diversity (e.g., variations in the demographic composition of groups such as age, status, sex), and value diversity (e.g., attributes such as attitudes and values). It is believed that different types of diversity will affect team performance differently. IS project development is a knowledge and learning intensive process; therefore, this study will focus on diversity from the informational perspective. *Informational diversity* refers to differences in knowledge and perspectives that members bring to the group and is a derivative of social capital (Koka and Prescott, 2002). The members of a team bring their different expertise, knowledge, and information to the team as a whole.

Learning is achieved in many fashions, one of which is through knowledge distribution. In this case, the knowledge distribution is among members in a team and may or may not be carried to the organizational level. A team with members having knowledge in different domains has a wider knowledge distribution than a team with members with expertise in the same domain and, thus, a potential for greater learning (Liang, 1994). Knowledge distribution rises as a function of differences among group members in education, experience, and expertise (Stasser, 1992).

Many definitions and categories of conflict have been proposed over the last several decades. A distinction that serves the project environment well is between task related conflicts and relationship conflicts (Jehn, 1997). Task related conflicts involve disagreements about processes, requirements, and goals. Relationship conflicts involve personalities, tensions, and emotions. It is generally believed that task-related conflicts will increase innovation, assist to solve complex problems, and improve product designs (Pelled, Eisenhardt and Xin, 1997). On the other hand, relationship conflicts will have a negative impact on trust, communications, and coordination (Williams and O'Reilly, 1998).

System success is a global term for the desirable outcome of a system development project. The selection of a success metric can be difficult due to the many dimensions involved in success. One aspect is the product view. The resulting product should have certain qualities that determine it to be of value to an organization. These product properties include meeting the requirements of users, providing flexibility in meeting ongoing operations of the organization, providing timely information, and being cost efficient to operate (Nidumolu, 1995).

The impact of informational diversity is supported by information theory. Information theory allows that variance in team composition has a direct impact on an outcome through an increase in skills, abilities, information, and knowledge that diverse members bring, independent of what happens in the team process (Tziner and Eden, 1985). This added information may enhance performance even as the diversity may have negative impacts on the process (Ancona and Caldwell, 1992). For example, the proponents of diversity argue that diversity promotes creativity in the workforce (Jehn, Chadwick, and Thatcher, 1997). To accomplish this, it is believed that a member must have information that is different from the existing membership, have information that is relevant, must be able to communicate the information to others in the group, and have others learn from the increased information. From this perspective, one would expect a positive impact of diversity on team performance, due to having multiple perspectives and diverse knowledge.

Researchers largely agree that functional or background diversity provides the range of knowledge, skills, and contacts that enhance problem solving (Pelled, et al., 1997). In the literature, empirical studies based upon information theory have been mainly conducted through laboratory or other controlled settings such as the classroom. Although these studies are provocative, they are few in number and not strongly supported by studies on organizational work groups (Jehn, et al., 2000). Additionally, instead of arguing a direct relationship between diversity and group performance, diversity researchers suggest mediators (such as conflict and learning) should be incorporated to explain diversity effects (Jehn and Chatman, 2000). In this study, conflict and learning are, therefore, incorporated as mediators between informational diversity and system quality as shown in Figure 1.

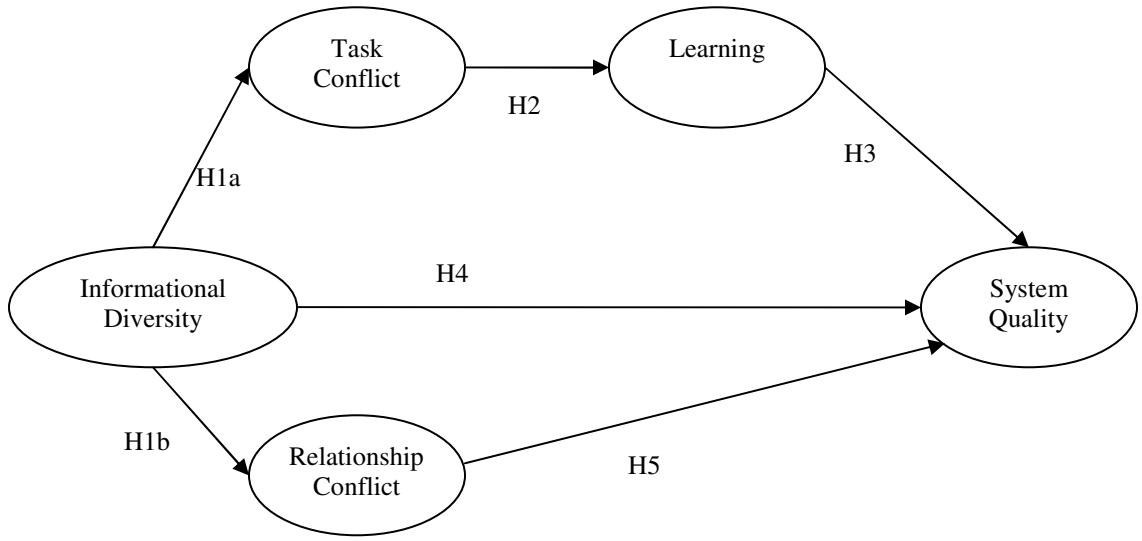

Figure 1: Research Model

Diversity and Conflict

When members of a team have different educational backgrounds and expertise, they may have dissimilar belief structures; Assumptions about tasks, and understandings of alternatives, based upon previous training and experiences (Wiersema and Bantel, 1992). For example, researchers have found that executives who have sales and marketing backgrounds typically see opportunities and issues from vantage points that differ from those with engineering backgrounds (Eisenhardt, Kahwajy, and Bourgeois, 1997). Team members with different expertise and educational backgrounds often possess divergent preferences and interpretations of tasks which, in turn, are likely to manifest as conflict (Bunderson and Sutcliffe, 2002). Individuals hold multiple belief structures about a variety of information domains and those belief structures most relevant to the information processing task at hand influence interpretation of the task. Job-related attributes which require capturing experiences and skills germane to cognitive tasks have strong relationships with task conflict (Pelled, et al., 1999). In other words, as informational diversity within a group increases, task conflict is likely to increase. Members in a more informational diverse team are more likely to hear views that diverge from their own, so task conflict becomes more pronounced. Research in organizational behavior has demonstrated that differences in educational background lead to an increase in task-related conflict in work teams (Jehn, et al., 1997).

H1a: Informational diversity will positively impact task conflict.

While task conflict is largely shaped by the job-relatedness of diversity, relationship conflict may be shaped by a different set of forces. One key factor is social categorization, the subconscious tendency of individuals to sort each other into social categories, often on the basis of demographic attributes (Zimbardo and Leippe, 1991). People in different social categories often approach each other with negative stereotypes and self-serving biases. In this fashion, relationship conflict becomes pronounced. Factors in social diversity have a more impermeable nature than education and expertise backgrounds. The permeability of an attribute is the degree to which that attribute can be altered. Educational background is but one of these differences, the one we focus on in this study because ethnicity, gender, age, and tenure are not easily permeated. However, team members can transfer from one functional area to another if they want exposure to different areas. Thus,

H1b: Informational diversity will not impact relationship conflict.

Conflict and Learning

IS researchers have observed that interactions during system development promote learning (Pawlowski and Robey, 2004). When people are forced to reflect on how they undertake their work in order to explain how to automate it, they have the opportunity to modify their understanding of how their work processes can be improved (Davenport and Short, 1990). These insights, experience and intuition are exchanged and transferred through person-to-person and intra-project networking. Although not all types of communication yield beneficial outcomes, interaction among team members provides an open exchange of views that may increase each other's knowledge.

Furthermore, no learning can be effective without feedback – that is, knowledge of the results of one's actions. Feedback provides information on the effectiveness of one's learning (Bettenhausen and Fedor, 1997). ISD project team members often continue to solicit feedback from the users, managers, and other team members to refine the system requirements until agreement is achieved. Such intensive learning is a necessary activity for improving the effectiveness of analysis and design in loosely-structured, high-technology development projects (Beath and Orlikowski, 1994). This dialogue process extends to the point where the IS professional is considered to be a knowledge broker in an organization, spreading both technology and functional knowledge across internal boundaries (Pawlowski and Robey, 2004).

Task conflicts have been perceived as different from relationship conflicts by members experiencing the conflict (Jehn, et al., 1997) and have different effects on group outcomes (Jehn, 1995). In general, researchers believe that task conflict improves group decision-making quality by increasing group learning through devil's advocacy roles and constructive criticism (Amason, 1996). Individuals are more likely to learn when the evidence is contradictory to ones' expectations rather than confirming. Research also suggests that task conflicts are constructive, since they stimulate discussion of ideas that help groups perform better (Jehn, 1995). Teams with an absence of task conflict may miss the opportunity of learning new ways to enhance productivity. Thus,

H2: Task-conflict positively impacts team member learning.

Learning and System Quality

The theory of action perspective assumes that organizations hold to an established practice in the formulation of corrective action (Argyris, 1999). The theory of action held by an organization determines the level of learning that will be achieved in any situation where a mismatch occurs. The adaptive learning model of trial and error describes one such process (Van de Ven and Polley, 1992). This model says that when a gap between actual performance and expectancy is realized, organizations deviate from the previous course of action. The goal of such learning is improved performance.

Whether performance at any level is improved by learning is generally a matter of assumption in previous research (Jackson, Joshi and Erhardt, 2003) and in the IS literature (Stein and Vandenbosch, 1996). In limited circumstances, research also shows the impact of learning on IS project development. Vandenbosch and Higgins (1995) provide evidence that IS success is dependent upon IS members' learning effectiveness; however, they call for future research to examine the direct relationship between learning and IS project success. Larsen (1993) found that an organization's function and technology knowledge could both stimulate innovativeness as well as information technology adoption success. Huang and Newell (2003) found that the level of knowledge sharing has a positive impact on project outcomes. Templeton, Lewis and Snyder (2002) argue a positive relationship exists among organizational learning, organizational outcomes and the exploitation of information technology. Thus, based on limited empirical results of learning models in the IS literature, we expect to find:

H3: Team members' learning will have a positive impact on system quality

Diversity and System Quality

As discussed above, some researchers have argued that diversity can be beneficial for groups. Others, however, have found that diversity is deleterious to group functioning (Guzzo and Dickson, 1996). A comprehensive diversity review conducted by Milliken and Martins (1996) concluded that diversity appears to be a double-edged sword, increasing the opportunity for creativity as well as the likelihood that group members will not function effectively. A summary of studies finds few patterns in relating diversity to performance (Jackson, et al., 2003). Teams with diverse members often prove ineffective at capitalizing on the potential benefits of their informational diversity while they may be better at sharing information needed to complete projects (Cummings, 2004). Managers have expressed frustration with the time and resource demands of functionally diverse teams (Dumaine, 1994). Diversity researchers suggest that success often hinges on the ability of the team to embrace, experience, and manage disagreements that arise, leading to rigorous requirements to achieve potential benefits (Gruenfeld, Mannix, Williams and Neale, 1996). Therefore, we expect to find:

H4: Informational diversity will exhibit a direct negative impact on system quality.

Relational Conflict and System Quality

Prior studies have indicated that interpersonal conflicts seriously limit team performance and productivity. According to Deutsch (1969), relationship conflicts decrease goodwill and mutual understanding, which hinders the completion of organizational tasks. Time is often spent on interpersonal aspects of the group rather than on technical and decision-making tasks (Jehn, 1997). These studies lead us to expect:

H5: Relationship conflict will have a negative impact on system quality.

RESEARCH METHODOLOGY

Sampling

The target sample for this study is project managers and team members of information system projects at or nearing completion. The target sample should represent the perspective of the IS function involved in development projects and be aware of the issues involved. Surveys were mailed to IS project managers listed in the Project Management Institute's (PMI) member list in south Taiwan. The managers were first contacted by phone to determine whether they had completed a project within the prior year as a project manager and whether the project team consisted of at least 5 members with a maximum of 10 members. A questionnaire package, including cover letter and questionnaire, was sent to 30 identified project managers (and 185 their team members) who agreed to participate. Respondents were asked to answer questions based on their most recently completed project with the identified project manager.

Constructs

Informational Diversity refers to differences in knowledge bases and perspectives that members bring to the team. Such differences are likely to arise as a function of differences among group members in education, experience, and expertise. Following past research (Jehn, et al., 1997), informational diversity measures assessed heterogeneity of education and functional areas in the firm. These characteristics are sought in the demographic section of the instrument. As is typical in the treatment of categorical variables, we used an entropy-based index (Ancona and Caldwell, 1992) to compute an aggregate measure of the informational diversity within the IS team such that the higher the diversity index, the greater the distribution of characteristics within the team. The overall informational diversity is the sum of the education and functional area indices. This measure is at the team level and applied to all individuals on the team for analysis.

Relationship Conflict and Task Conflict: The items for measuring conflicts were developed by Jehn (1995) to measure the amount and type of perceived task and relationship conflicts. The 9 items were rated on a 5-point Likert scale anchored by 1 = "do not agree at all" and 5 = "totally agree". Table 1 shows these items. All items are subjective and presented such that the greater the score, the greater the extent of conflict.

Learning describes the knowledge acquired by ISD team members (Cooprider and Henderson, 1990). Three items applied in previous studies involving team learning measure this construct as shown in Table 1 (Cooprider and Henderson, 1990; Nidumolu, 1995). Respondents were asked to indicate the extent of the items incurred when developing their most recently completed information systems project. Each item was scored using a five-point scale ranging from never occurring (1) to always occurring (5). All items were presented such that the greater the score, the greater the particular item occurred.

System Quality has three dimensions in this study including software responsiveness, software operation effectiveness, and software flexibility. The items are all listed in Table 1. *Software responsiveness* refers to how the system meets user needs and is measured by three items adapted from Nidumolu (1995). Three items measure software *operations efficiency*, which considers the ability of the software to run efficiently and in a timely fashion. *Flexibility* describes the software's ability to adapt to changing business needs. Likert scales ranging from 1 to 5, with anchors ranging from ''strongly disagree'' to ''strongly agree,'' were used for all questions.

Structural Equation Modeling (SEM) with Partial Least Squares (PLS) analysis will allow empirical assessment of the constructs used in this study. Using ordinary least squares, PLS performs an iterative set of factor analysis and applies a bootstrap approach to estimate the significance (t-values) of the items. In this study, PLS-Graph Version 3.01 will be used to verify the measurement model and examine construct validity and individual item reliability (Hulland, 1999). Convergent validity will be examined by the composite reliability of constructs and item-construct correlation (Fornell and Larcker, 1981; Kerlinger, 1986). Evidence regarding discriminant validity can be obtained with the square root of the average variance extracted which should be greater than the correlations of the constructs (Fornell and Larcker , 1981).

Construct	Items
Task conflict	Team member often disagree about opinions
	Team members have different goals
	Team members have different ideas about project content and project goal
Relationship conflict	There is much friction among members in your team
	There is much personality conflict evident in your team
	There is much tension among members of your team
	There is much emotional conflict among your team
	Team members envious and counter each other
	Some team members don't like each other
Learning	Knowledge is acquired by you about use of key technologies
	Knowledge is acquired by you about use of development techniques
	Knowledge is acquired by you about supporting users activities
	Overall knowledge is acquired by you through the project conducted
Responsiveness	Ease of use of software
	Ability to customize outputs to various user needs
	Range of outputs that can be generated
Flexibility	Efficient cost of adapting software to changes in business
	Rapid adapting of software to changes in business
	Efficient cost of maintaining software over lifetime
Operation Efficiency	Reliable software
	Efficient cost of software operations
	Quick response time
System Quality *(2^{nd} order)*	Responsiveness
	Flexibility
	Operation efficiency

Table 1: Item list

CURRENT STATUS OF THE PROJECT

Data collection will be closed prior to the conference and preliminary analysis of the data according to the proposed methodology will be presented.

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