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Reducing Requirement Perception Gaps through Coordination Mechanisms in Software Development Team

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ABSTRACT

Users and IS development staff often have different interpretations and understandings on software requirements because of the difference in knowledge, experiences and values. Jiang et al (2002) argue that this perception difference must be well managed to lead to the new understanding of requirements. This study tries to solve this question by examining the impact of coordination mechanisms on the requirement perception differences. Coordination theory and collective mind theory are used to explain the cognitive process underlying these coordination strategies, which enable the development of shared understandings on requirement development.

Keywords

Perception gaps, coordination, collective mind.

INTRODUCTION

To uncover, understand, and specify the user requirements has become one of the most challenge tasks for any information systems (IS) development (Curtis et al. 1988; Davis et al. 1997; Walz et al. 1993). This difficulty is often termed as requirement uncertainty (Davis 1982). While additional information is necessary for requirement determination, in many instances, the information is ambiguous, fuzzy or equivocal and requires subjective interpretations. Because of different knowledge structures, experiences, values and beliefs, users and IS developers often exhibited enormously different frames of references to interpret information (Davidson 2002; Gash et al. 1991). It is referred as a perception difference between users and IS developers on requirements (Stork et al. 1995). A high level of perception gaps has critical influence on the requirements development and ultimately affects IS project performance (Jiang et al. 2002; Kydd 1989; Linberg 1999; Stork et al. 1995; Umanath et al. 1992).

As a result, the notion of perception differences between stakeholders has been considered as a critical challenge for system success (Davidson 2002; Jiang et al. 2000; Jiang et al. 2002). In trying to reduce perception differences, Stork and Sapienza (1995) recommend that project managers must be flexibility enough to change project team's communication and resolve different types of disagreement. Jiang and Klein (2000) suggested pre-project partnering activities, such as getting top management's commitment to the partnering process or building a collaborative relationship between the major players involved, to build a foundation for collaboration and coordination before disputes/gaps arise. Others have argued that coordination mechanisms can help clarify user requirements (Andres et al. 2001; Nidumolu 1995; Nidumolu 1996).

This research tries to solve the question "how or why can coordination mechanism reduce perception difference in software development projects". Among the coordination mechanisms, vertical and horizontal coordination should get particular attention because of its alignment with organizational structures (Thompson 1967). Horizontal coordination includes both inter-personal interaction and group meetings between people at the same organizational level. Vertical coordination involves the conversation between people along the hierarchical line of the organization. These two coordination mechanisms serve different purposes in software development projects. Nidumolu (1996) argues that horizontal coordination seems to promote exploration while vertical coordination seems to promote process control. Will both vertical and horizontal coordination mechanisms help eliminate the extents of perception gaps between users and Information Systems developers? The current literature, unfortunately, does not provide an answer.

Based upon the coordination theory, this study proposes that the horizontal coordination and vertical coordination mechanisms are the managerial strategies for dealing with the examined software development challenge – the user-IS requirements perception gap. The results of this research study can help project managers to understand how vertical and horizontal coordination, can be employed to reduce perception differences between users and software developers and the underlying process of changes in cognitive understanding of software requirements initiated by coordination.

THEORY AND RESEARCH MODEL

It is generally agreed that user requirement elicitation is a social process (Byrd et al. 1992; Marakas et al. 1998; Newman et al. 1992). Linberg (1999) pointed out that the perception difference between IS staff and users is one of the major problems that cause project failures. Jiang et al (Jiang et al. 2002) provided the evidence of perception difference between IS staff and users through a comparison between user perception and perceived user perception from IS staff, and between IS staff perception and perceived IS staff perception from users. Klein et al. (2002) proposed a consonance model to suggest all the stakeholders in the project to seek consonance, make a contract to clarify requirements, attain common goals and eventually cause project success. If a consonance among all the stakeholders in IS development project can be attained, what is the mechanism that project managers can use to reduce the perception differences and, thus, enhance the project success rates? Coordination could be an effective mechanism.

Organizational Coordination Theory

Van de Ven et al. (1976) defined coordination as integrating or linking together different parts of an organization to accomplish a set of tasks. Reconciling conflicts and aligning goals are the two major functions of coordination. Gerwin and Barrowman (2002) argue that parties must align differing interpretations of goals and tasks. Two types of coordination mechanisms were proposed: vertical and horizontal.

Horizontal coordination include both personal mode and group mode (Van De Ven et al. 1976). In the personal mode, individual role occupants (e.g., project managers) serve as the mechanism for making mutual task adjustments (Van De Ven et al. 1976). Perception differences come from different knowledge structure, experiences, values and beliefs (Jiang et al. 2002).When user input on a written document is insufficient to ensure that the requirements are correct and converted to

system requirements appropriately, individual face-to-face discussions can expose the different knowledge structures and understandings. Personal discussions can enable both parties to recognize the knowledge difference and have opportunity to acquire more information and knowledge. Therefore perception differences can be mutually adjusted by face-to-face focused communications. In the group mode, the mechanism for mutual adjustment is vest in a group of role occupants through schedule or unscheduled staff or committee meetings. Though the group meetings, users and IS staff can recognize the perception differences and use rich media (Daft et al. 1987) such as face-to-face discussion, immediate feedback, multiple cues and various languages to reduce the difference. The involved users representatives and system analysts and designers are exposed to all the requirements and develop an overall picture of the proposed software. Incomplete information gap can be filled through group communications and ambiguous information can be explored and clarified.

While horizontal coordination involves the users, vertical coordination involves the senior management and steering committee. Users and software developers have their own goals and expectations when they start to participate in the requirement specification process. Their goals prioritize the software specifications but might conflict to each other. When senior managers and steering committee are involved in the requirement specification process, power plays a role and the priority of software features is decided by placing organizational interests in the first place. Perceptions differences are forced to be reduced by mandating orders.

Collective Mind Theory

Coordination theory sheds some light on the understanding of how coordination strategies reduce perception difference. Although coordination theory is suitable for requirement analysis in software development which is a complex process, however, Crowston and Kamerer (Crowston et al. 1998) argues that collective mind theory (Weick et al. 1993) can complement coordination theory by explaining the development process of shared understandings and collective sense-making at the cognitive level.

Aggregate mental processes have to be fully developed to produce reliability continuously when lack of comprehension can lead to significant consequences. Collective mind is conceptualized as a pattern of heedful interrelations of actions in a social system. Collective mind theory basically argues that individuals develop sharing understanding of the group's tasks of one another that facilitate group performance through three processes. These three processes are contribution, representation and subordination.

The development process of shared understanding and collective sense-making at the cognitive level, is also the process of reducing perception difference between IS staff and users in the software development context. Users contribute when they generate a list of requirements and software developers contribute when they interpret users' requests and discuss with users. All the contributions are integrated to create a final list of system requirements in representation process through horizontal coordination. This integration process enables each team member to obtain a clear picture of the group process such as their roles in the project, other team members' responsibilities and how the interactions between team members affect the software development which finally impact on the project performance. Vertical coordination is more related to subordination process described by collective mind theory. When senior managers involve into the requirement specification, organizational goals are stated clearly and play a dominant role for the project team's decision making. Users and software developers have to make decisions based on needs of the system above and beyond their own personal needs.

Based upon the discussion of coordination theory and collective mind theory, we, therefore, argue that both vertical and horizontal coordination can moderate the impacts of perception difference on a software development project (see Figure 1). In the following section, more detailed hypotheses examined in this study are discussed.

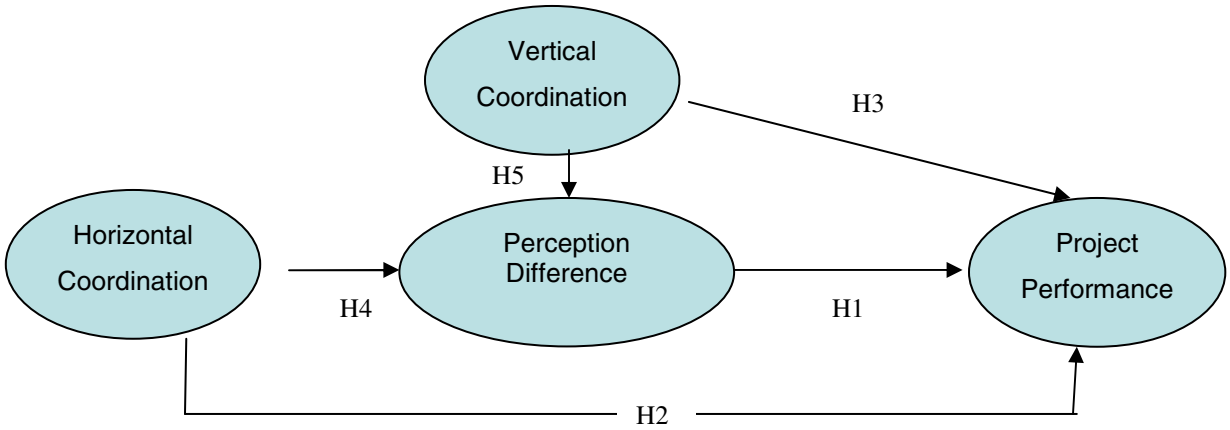

Figure 1: Research Model

HYPOTHESES

Because of different backgrounds, positions and goals, perception differences naturally occur in IS development projects (Jiang et al. 2002). Davidson (2002) also observed that different stakeholders had different frames of references when they interpret system requirements. Perception gaps between users and IS developers make it difficult to achieve agreements on project goals and performance measures (Jiang et al. 2002). Incomplete, ambiguous or inconsistent requirements often lead to project failures (Eva 2001; Moynihan 2000; Nidumolu 1996). Building upon the existing literature on requirement uncertainty, we propose that a negative effect of perception differences on software project performance.

H1: Higher levels of perception difference will lead to lower levels of project performance.

According to coordination theory, coordination is an extra effort that must be made to accomplish a group's goal because of inherent task dependency. A software development process has many highly interdependent tasks that require coordination. Horizontal coordination is realized through multifunctional teams, group meetings between IS staff and users and liaison roles between the two departments. User participation is one type of horizontal coordination. Studies have provided the evidence that user participation is positively related to project performance (Barki et al. 1994; Nelson et al. 1996). Vertical coordination is realized by involving project manager and steering committee in the software development process. Vertical coordination can clarify project goals, solve group conflicts in the project team and take proactive measures to manage risks (Nidumolu 1995). All these efforts of uncertainty reduction will have a positive impact on project performance. Therefore the following two hypotheses are proposed.

H2: Higher levels of horizontal coordination will directly lead to higher levels of project performance.

H3: Higher levels of vertical coordination will directly lead to higher level of project performance.

The perception differences must be well managed to lead to new understandings of requirements (Jiang et al. 2002). As the coordination theory indicates, both vertical and horizontal coordination can reduce the perception gaps among stakeholders. Through horizontal coordination, IS staff and users have the opportunity to communicate, to recognize the perception difference and to work toward unified views about requirements (Nidumolu 1995). During personal interaction and group meetings, users and IS staff can contribute to the requirement specifications and assimilate their contributions to the final requirement list by discussion, argument, negotiation and conflict resolution. Along with this intensive interaction process, different beliefs and values are modified and shared understandings become possible. These arguments suggest that:

H4: Higher levels of horizontal coordination activities will lead to lower levels of the perception gap between users and IS staff on project outcomes.

Vertical coordination involves various stakeholders including project managers and senior management. A project manager centrally controls and coordinates the project process, controlling resources, managing conflicts and following a project schedule. A steering committee consists of different stakeholders to work with the project manager to coordinate at a high organizational level. Vertical coordination can make decisions about the project direction that IS staff and users cannot make and settle down the conflicts between IS staff and users to unify their views (Nidumolu 1996). One of the important tasks of vertical coordination is to achieve the goal congruence between the organizational goal and the goal of the IS development project. IS staff and users can have different project goals because of different positions, perceived work needs and career planning. Steering committee and project managers can consider IS project development on a strategic level and make sure the project goal conforms to the organizational goal. This is also a subordination process for each individual team member who changes personal goals accordingly to comply with the dominant organizational goals. When goal congruence is achieved, perception difference will be reduced. Therefore, the following hypothesis is proposed:

H5: Higher levels of vertical coordination activities will lead to lower levels of the perception gap between users and IS staff on project outcomes.

RESEARCH METHOD

Sample

A survey design is selected for testing the proposed model. The existing operationalization and measures of constructs make a survey design possible. Findings of this research can be generalized into population because of survey design. A project-level questionnaire will be mailed to randomly selected 500 Project Management Institute (PMI®) members in the United States. The sample was chosen because members of PMI represent a wide variety of organizational settings and have interest and expertise in project management. While the PMI constituency includes project managers from all disciplines, only IS project managers were contacted. Self-addressed return envelopes for each questionnaire were enclosed. All the respondents were assured that their responses would be kept confidential.

Constructs

a) Project performance: The measure of IS project performance has to represent many aspects of the process development and be recognized as important by the past literature. The measure of project performance includes seven items (ability to meet project goals, expected amount of work completed, quality of work completed, adherence to schedule, adherence to budget, efficient task operations and high work morale) and requires the respondents to answer based on the most recently completed projects (1 – Never, 5 – Always) (Nidumolu 1995).
b) Perception difference:The perception difference is measured by the respondent's extent of agreement (1 - strongly disagree, 5--strongly agree) with the five statements (Jiang et al. 2002). Example statement is "There was a clear perception gap between team members' understanding of the requirement specification".
c) Horizontal Coordination: According to Nidumolu (1996) horizontal coordination is measured by the extent (1—Never Achieved, 5—Great Extent) to which the following four procedures were relied upon to coordinate activities among users and the project team in the earlier phases of the project: (1) oral communication; (2) written communication; (3) scheduled group meetings; and (4) unscheduled group meetings.
d) Vertical Coordination: According to Nidumolu (1996), vertical coordination is measured by the extent (1—Never Achieved,, 5—Great Extent) to which the following three persons or groups were relied upon to coordinate activities between users and the project team in the earlier phases of the project: (1) an individual with formal responsibility for coordination (e.g., a project manager); (2) an external committee or group responsible for coordination (e.g., a steering committee); and (3) senior IT or senior user management.

Factor analysis will be used to assess the construct validity. Cronbach's alpha test will be used for reliability. Partial Least Square (PLS) will be used for data analysis.

CONCLUSIONS

This research tries to solve the question "how or why can coordination mechanism reduce perception difference in software development projects". Because of the characteristics of software development project, requirement equivocality is high in the early phase. Because of the diversified stakeholders involving in the project, perception differences become barriers for the project success and has negative effects on the project performance. Jiang et al. (2002) emphasized the critical importance of reducing perception differences for project success. We argue that coordination mechanisms can reduce the perception differences by enabling the stakeholders to communicate, mutually adjust and reach the agreement that is needed for project development and success. Project managers will find more understanding of the underlying processes of coordination mechanisms. While personal interaction and group meetings are employed daily at work, project managers can provide supportive atmosphere and encourage team members to contribute, to understand other team members' values and roles in an active manner and to purposely build a shared understanding process.

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