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Interdependence in IS Development Projects: A Model and Conceptual Overview

Ta-Tao Chuang
Texas Tech University, ogtao@ttacs.ttu.edu

Mary B. Burns
Texas Tech University, odmbb@coba2.ttu.edu

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A Model and Conceptual Overview

Ta-Tao Chuang (email: ogtao@ttacs.ttu.edu)
Mary B. Burns (email: odmbb@coba2.ttu.edu)
ISQS, Texas Tech University
Lubbock, TX 79409 - 2101

Introduction

In today's organizations, interdependence among internal and external work units is increasingly important due to the emphasis upon team projects and the proliferation of inter-organizational partnership agreements. In Information Systems (IS), the frequency of interdependent project teams, such as for IS Development (ISD), is unusually high. Thus, it is important to study the dynamics of interdependence by adapting Tjosvold's (1986) integrated model to IS development activities.

The IS development team is an ideal laboratory for studying such a model because development projects demand interdependent activities. In IS, a major research stream has been devoted to interaction (including conflict) among ISD team members (Newman & Noble, 1990; Robey, Farrow, & Franz, 1989). However, the dynamics of interdependence have not been similarly studied in an IS context. Therefore, this study contributes to research of ISD by: a) adapting a model of interdependence for the IS context; b) discussing the relationship among the proposed variables, and; c) exploring directions for future research. Our paper discusses previous research in ISD, Tjosvold's model (1986), our adaptation of his model, and future research areas.
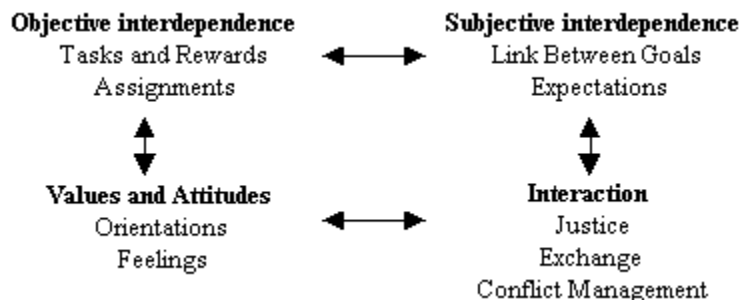
Prior Research in ISD

Figure 1. Model of interdependence (source: Tjosvold, 1986, p. 527).

Research in ISD can be classified into two categories: factor models and process models (Mohr, 1982; Newman & Robey, 1992). The former approach aims to identify the potential indicators of successful systems development, while the latter approach aims to describe the dynamics of social exchange in the ISD process.

Two major streams of ISD research based on the factor approach are: 1) the effect of user involvement and user attitude on system success (Barki & Hartwick, 1994; Doll & Tozkzadeh, 1987; Hartwick & Barki, 1994; Robey, 1979); and 2) the effect of organizational characteristics, such as organizational resources and structure, on the success of systems development (Ein-Dor & Segev, 1978; Srinivasan & Kaiser, 1987).

Three themes of ISD research that use the process approach are: 1) the interpretive (rational and political) perspectives of the ISD process (Markus, M. L., 1983; Newman & Noble, 1990); 2) the issues of communications between users and designers (Bostrom, 1984; Guinan & Bostrom, 1986); and 3) the

dynamics of social processes, including the exercise of power (Markus & Bjorn-Andersen, 1987) and interaction in the ISD process (Newman & Robey, 1992).

Tjosvold's model of Interdependence in Organizations

Significant organizational research has covered isolated aspects of cooperation and interdependence (Saavedra, Earley, & Van Dyne, 1993; Thompson, 1967), but Tjosvold (1986) proposed an integrated model of interdependence in organizations that is comprised of subjective interdependence, objective interdependence, interaction, and values and attitudes (Figure 1). According to his model, personnel who perceive that they have congruent goals will tend to have 'fair' interactions, which in turn, will support perceptions of working towards a common purpose. Perceptions of fairness will have a positive impact upon values and attitudes, which will further enhance the interactions. Positive attitudes will help delineate the tasks and rewards for the joint efforts; perceptions of how the control structure, such as tasks and rewards, support the shared responsibilities will strengthen the values and attitudes. As the supporting controls are developed, perceptions of goal congruence will increase and the group's tasks and resulting rewards will become even more interwoven.

Adapting Tjosvold's Model for ISD Processes

Figure 2 illustrates our modification of Tjosvold's integrated interdependence model adapted to the IS context. Team structure (objective interdependence defined more narrowly), the extent of consensus on the goals and choice of the development approach for ISD (subjective interdependence), interaction, and member attitudes (a subset of values and attitudes) allow us to better understand the dynamics of interdependence of Information Systems Development. Our underlying assumptions are that a cooperative or positive interdependence among the ISD members: 1) can increase the opportunities of system/project success, and 2) can be created by managing the four variables highlighted in Figure 2.

Relationship between two Variables: Consensus and the Interaction Process

Determining the system requirements (goals) and ISD approach (e.g., structured analysis) for the proposed system can be critical to a system's ultimate success. Goal consensus is defined as the participants' preferences for system requirements, while consensus over the ISD approach is related to participants' beliefs about the best way to achieve the goals (Thompson, 1967). Basic assumptions about knowledge and the world held by ISD participants can direct the ISD process and influence the project (Hirschhiem & Klein, 1989). Because users and designers have different conceptual frameworks and perspectives (Guinan & Bostrom, 1986), it is not unusual that both parties do not share a high degree of consensus about the requirements of a proposed system.
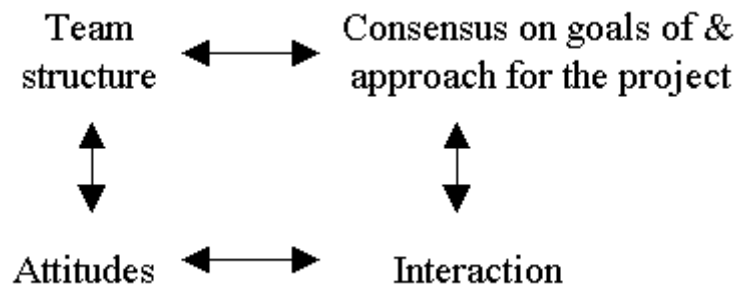
Figure 2. An interdependence model in system development processes.

Interaction processes can be patterned on the following types: learning, conflict, political, and garbage-can (Newman & Noble, 1990). The learning model considers an interaction process in which users learn from designers or both parties learn from each other. The conflict model describes situations in which conflicts

of interest and goal incongruence arise. The political model takes "account of conflict but [is] concerned with the way in which conflict is structured …, the role of power in conflict resolution" (p. 93). The garbage-can model explains situations in which randomness and accident dominate the ISD process.

Our model suggests that the degree of consensus (high, low, or indifferent) on the goals and approaches for the project will affect the ISD interaction processes. Specifically, low consensus tends to cause a conflict or a political Interaction process. Failure to manage conflict or politics, in turn, reinforces low consensus. High consensus tends to generate a learning (one-way or mutual) interaction process, which in turn tends to create even greater consensus. The garbage-can interaction process occurs when participants in the ISD process are indifferent to the project.

Managing either variable (consensus or interaction process) well can establish constructive relationships between users and designers. Although further empirical studies are needed to test this relationship, this is supported by a case study reported by Robey et al. (1989) in which users appealed to their supervisor to intercede when designers changed the features of the system without consulting with users.

Relationship between two Variables: the Interaction Process and Attitudes

While Ajzen defines an attitude as "an individual's disposition to respond favorably or unfavorably to an object, [or] person…" (1989, p. 241), we can also categorize attitudes in two other distinct categories: neutral and indifferent. We define a "neutral" attitude as an individual's disposition to not respond to an object or person at a particular point in time. An "indifferent" attitude is defined as an individual's disposition to respond uninterestedly to an object or person.

Previous research (Hartwick & Barki, 1994; Robey, 1979) focuses on user attitudes toward the system. However, as defined in our model (Figure 2), attitudes refer to group members' attitudes toward each other as well as the system.

A learning interaction process positively affects members' attitudes toward each other and the system, which in turn reinforces the learning interaction. Conversely, a conflict and/or political interaction pattern tends to negatively affect members' attitudes toward each other and the system, which in turn increases the opportunity for the exercise of power. Finally, a garbage-can interaction pattern tends to make participants indifferent to each other and the system, which will reinforce the garbage-can pattern.

Our model suggests that members' prior attitudes, formed during experiences with previous projects in the organization, will influence interaction processes. Favorable attitudes tend to create a learning interaction pattern, while unfavorable attitudes tend to create conflict or political interaction pattern. Neutral attitudes can develop into favorable attitudes if the subsequent interaction pattern is a learning process. On the other hand, neutral attitudes may shift to unfavorable attitudes if the subsequent interaction pattern is a conflict or political process. Indifferent attitudes will arise from subsequent garbage-can interaction processes.

Relationship between two Variables: Attitudes and Team Structure

Team structure refers to the formal structure determining how project tasks are shared or allocated and can be characterized by the following types: joint system development, analyst-led development, user-led development, and equivocation (Newman & Robey, 1992). "Each of the first three represents an equilibrium where the parties have agreed on project leadership responsibilities" (p. 254). Because an equilibrium can last longer when favorable attitudes exist, each of the first three types of team structure can be sustained by favorable attitudes. Although the attitudes among participants may not affect the initial formal leadership arrangement, these attitudes can change (formally, or more frequently, informally) the team structure later on. For example, unfavorable attitudes can shift team structure so that informal leaders emerge, and tasks are re-negotiated. Conversely, when a team structure shifts, attitudes will be affected by how participants view the change.

Relationship between two Variables: Team Structure and Consensus

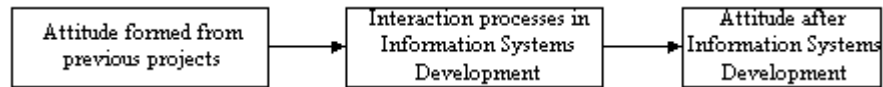| Attitude formed from previous projects | → | Interaction processes in Information Systems Development | → | Attitude after Information Systems Development |

Figure 3. Relationship between attitude and interaction process.

Newman & Robey (1992) point out that traditional structured methods are more likely to be employed in an analyst-led team structure while more user-friendly methods or tools (such as 4GL) tend to be used by user-led team structures. Thus, how tasks are divided among developers and users through team structure may prevent the team from achieving consensus in determining the system features or in evaluating the development tools or methods. Conversely, a lack of consensus over major goals or approach may cause informal shifts in team structure.

Future Research and Conclusions

Although previous research has been cited to support certain relationships in this model, we believe there are several additional research opportunities:

1. Empirical study to examine each pair or triad of interrelated variables, or the complete model should be undertaken.
2. The model can be adapted for studying other interdependent efforts within IS, such as intranet development, inter-organizational partnership (EDI), or business process re-engineering.
3. It should be noted that the components of this model are mutually causal. Future research can examine how variables influenced by previous experiences affect their relationship with other variables. For example, for attitude and its relationship with interaction processes (Figure 3).

Earlier research has treated each project as an isolated case without taking into account the effect of previous projects on the system being developed. Our perspective is similar to Newman and Robey's view (1992) that "the outcomes of a whole history of prior projects [antecedent conditions] ...will usually affect subsequent events" (p. 255).

Because our focus is on the interdependence of Information Systems Development, our model suggests that studying these variables in an integrated manner will identify opportunities for positive interdependence, and ultimately, a successful systems effort.

(References are available upon request.)