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Jamie Chang

James J. Jiang

Eric T.G. Wang

Gary Klein

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Jamie Chang
National Central University
Jamie.chang0310@gmail.com

James J. Jiang
The Australian National University
james.j.jiang@anu.edu.au

Eric T.G. Wang
National Central University
ewang@mgt.ncu.edu.tw

Gary Klein
University of Colorado Colorado Springs
gklein@uccs.edu

ABSTRACT

IT programs are a common management structure put in place to govern multiple IT projects and complex IT deployments. The presence of multiple project teams can lead to difficulties in driving toward a common organizational goal for the program. One desirable behavior for program teams is the ability to adjust to changes in requirements due to environmental shifts or errors in requirements. We develop a model that considers how adjustments are fostered. The model suggests that goal interdependence and commitment, combined with monitoring, lead to heightened adjustment behaviors. Adjustment behaviors, in turn, lead to desirable program outcomes, but the relationships are moderated by requirements uncertainty.

Keywords

IT program management, interdependence, team behavior, program goals

INTRODUCTION

Information Technology (IT) programs are organized as a set of interdependent information technology (IT) projects dedicated to common business objectives focused on IT-business alignment (Ritson, Johansen, Osborne., 2012; Parolia, Jiang, Klein, and Sheu, 2011). In spite of the wide adoption of IT program management practices, organizations still experience a high failure rate of IT programs (Denyer, Kutsch, Lee-Kelley, and Hall,, 2011; Koh, Gunasekaran, and Goodman, 2011). Failures are observed as inability to deliver within a reasonable schedule, greatly exceed anticipated resources, or simply not deliver the functionality to achieve expected program objectives and often due to changes in business requirements (Boehm, 1991; Schmidt, Lyytinen, Keil, and Cule., 2001; Brown and Eisenhardt, 1995). To achieve desired outcomes, IT program teams must be able to effectively adjust their actions in response the demands of changes in the business environment. The challenge faced by management is how to facilitate essential adaptive behaviors throughout the entire program.

Programs possess two major characteristics: interdependence and a common goal (Prieto, 2008). The structure of interdependence in a group will influence how individuals interact and the interaction pattern will determine the collective outcomes (Johnson, Johnson, and Stannic, 1989). Further, action regulation theory indicates that monitoring team performance and its environment should be among the desired interactions to recognize deviations from goals due to environmental changes and uncertainty of requirements (Kozlowski, Gully, Nason, and Smith, 1999). Once deviations are recognized, team members can make adjustments to efficiently and effectively progress toward goal attainment (Rousseau, Aube, and Savoie, 2006). Program goal consensus theory (PGCT) leads to expectations that commitment to a common goal leads to more desirable outcomes of a program (Chang, 2012).

The purpose of this study is to examine the impacts of project goal interdependence on the program team's environmental monitoring behaviors and subsequent adjustments which, in turn, lead to program goal attainment and program implementation efficiency. The specific research questions include 1) do project goal interdependence and goal commitment influence goal seeking behaviors and program outcomes and 2) will system requirements uncertainty moderate the relationship between adaptability and desirable outcomes? The following section will provide background about the variables of this study. Then the research model is derived, based on social

interdependence theory and action regulation theory. Following that, the associated hypotheses are stated for empirical testing. Finally, we state expected contributions of this empirical study.

BACKGROUND

Uncertainty can be defined as the difference between the amount of information needed to accomplish tasks in a given environment and the amount of information possessed (Galbraith, 1973; Nidumulou, 1995). IT project development and implementation uncertainty usually comes from the changes in the business and technological environment (Lee and Xia, 2005). These business changes subsequently result in changes to system requirements under implementation. When business changes are recognized, they are translated into requirements by the program management teams. System requirement uncertainty refers to the extent of change and differences among projects regarding system requirements during the implementation life cycle. A high level of system requirement uncertainty will require a program team to be adaptive.

Adaptability

The ability of a team to respond to dynamic performance demands is called team adaptability (Salas et al., 2005). Team adaptability is one dimension of team adjustment behaviors (Rousseau et al., 2006), it may reflect both non-teamwork and teamwork behaviors (Goodman, Devadas, and Griffith-Hughson, 1988). Non-teamwork behaviors include an increase of effort and securing additional resources. Teamwork behaviors include supportive and process adjustment behaviors. Supportive behaviors are when team members help each other perform their roles and duties (Porter et al., 2003). Support suggests provision of tangible task-related help by one team member when another team member is failing to reach the goals defined by his or her role (Salas, et al., 2005). Supportive behavior differs from cooperation which is when team members work together to accomplish collective tasks (Hoegl and Gemuenden, 2001). Process adjustment behaviors are activities to invent and implement new or improved ways of doing tasks (Cohen, Ledford, and Spreitzer, 1996). When team members work together to develop and apply new ideas and new working methods, team members are more likely to react adequately to changing requirements and be more effective (Drach-Zahavy and Somech, 2001).

In an IT program, each project team must accomplish a specific set of tasks (Parolia et al., 2011). For example, in an Enterprise System implementation, different project teams typically implement different business functions to accomplish the overall integrated-business objective. Unlikely will one project team take over other another project's tasks – i.e., a support behavior. However, within the same project team, team members may often show support behaviors. Team process adjustments, on the other hand, are critical behaviors across teams, especially when projects are interdependent. The change of one project's tasks or goals is likely to affect another project's tasks or goals within the IT program. Each project team must improve or change processes to achieve the overall program goals. In this inter-team study, we focus on the process adjustment behaviors of project teams, instead of support behaviors.

Evaluation is a cognitive precursor to adaptation. According to action regulation theory, the evaluation function may lead team members to make some adjustments to efficiently and effectively progress toward goal/task completion (Rousseau et al., 2006). Monitoring team performance and its environment, team members are more likely to recognize deviations from the work-related goals and environmental changes that may result in a lack of resources (Kozlowski et al., 1999). This function of evaluation is carried out through work assessment behaviors of performance monitoring and system monitoring.

Performance monitoring refers to tracking progress toward goal attainment and determining what needs to be accomplished for goal attainment (Marks and Panzer, 2004). Performance monitoring is when team members keep track of another's work while carrying out their own (McIntyre and Salas, 1995). Monitoring may observe work accomplishment to make certain that everything is running as expected and observing team members to ensure procedures are followed correctly and in a timely manner. Performance monitoring enables team members to recognize when they make mistakes or perform inadequately (Marks and Panzer, 2004). It is a means for self-regulation to determine whether actions have moved them closer to attaining goals (Weldon, Jehn, and Pradhan, 1991). Consequently, by monitoring performance, team members are more likely to react properly when performance gaps emerge or when they veer off in a wrong direction.

System monitoring is defined as tracking team resources and environmental conditions as they relate to task accomplishment (Marks, Mathieu, and Zaccaro, 2001). It includes monitoring levels and performance of team

resources such as personnel, equipment, information, environmental conditions, and organizational changes. When team members monitor their environment, both internal and external to the team itself, they are better able to apply appropriate task strategies and respond in timely fashion to ongoing changes (Cannon-Bowers, Tannenbaum, Salas, and Volpe, 1995). Consequently, when team members work in dynamic environments, the monitoring of environmental conditions enables them to detect any changes and take appropriate responses.

Social Interdependence Theory

Social interdependence theory postulates that the structure of interdependence will influence how individuals interact with each other. The pattern of interaction will then determine the collective outcomes (Johnson et al., 1989). Resulting interactions can be either beneficial, such as cooperation, or detrimental, such as conflict. Desirable interactions are those that promote progress, when team members encourage and facilitate each other in order to reach the group's goals. These interactions could be mutual assistance, communication, information and resource sharing. In the pattern of oppositional interaction, team members are discouraging and obstructing.

Goal Commitment

Commitment is a force that binds an individual to a course of action relevant to a target and can be accompanied by different mind-sets that play a role in shaping behaviors even in the face of conflicting motives or attitudes (Meyer and Herscovitch, 2001). Desire to work toward the attainment of an organizational goal will correlate not only with a measure of the focal behaviors, but also with measures of behaviors that fall outside the specified boundaries. Individuals who are committed primarily out of desire may have a stronger inclination to follow through on their commitment than those who are committed primarily out of obligation. Without measuring specific actions, management studies demonstrate that when goals of equivalent difficulty are assigned to different individuals, those who are strongly committed to the goals performed better than those who are less committed to the goals (Shehu and Akintoye, 2010). Program goals assigned to IT program teams by top management are important in achieving expected business objectives (Chang, 2012).

RSEARCH MODEL AND HYPOTHESES

Based on the above discussion, the research model in Figure 1 was developed. The model suggests that both project goal interdependence among projects and overall program goal commitment will facilitate goal seeking behaviors (mutual performance monitoring, system monitoring, and adaptability) which then lead to program goal achievement and program implementation efficiency. Furthermore, we suggest that the magnitude of the relationship between adaptability and program outcomes is moderated by the level of system requirements uncertainty.

Social interdependence theory establishes that the project goal interdependence will positively influence the promotive interaction pattern among stakeholders (Johnson et al. 1989). In the pattern of promotive interaction, team members are encouraging and facilitating each other's efforts to complete tasks in order to reach the overall goals (Johnson et al. 1989). The behaviors of system monitoring, mutual performance monitoring, and process adjustment are often conducted to ensure the planned IT program goals can be achieved. Parolia et al. (2011) found interdependence enhanced promotive behaviors. Thus:

> *H1a: The levels of goal interdependence among projects within IT programs is positively associated with system monitoring.*
> *H1b: The levels of goal interdependence among projects within IT programs is positively associated with mutual monitoring performance.*
> *H1c: The levels of goal interdependence among projects within IT programs is positively associated with program teams' process adjustment behaviors.*

Commitment is a force that binds individuals to a course of action of relevance to a target (Meyer and Herscovitch, 2001). As successful task completion requires appropriate teamwork, it is expected that individuals with commitment to goal attainment will conduct more activities to ensure goal completion. Goal commitment is likely to facilitate supportive behaviors among team members because of the collective nature of team goals (Aubé and Rousseau, 2005). Thus:
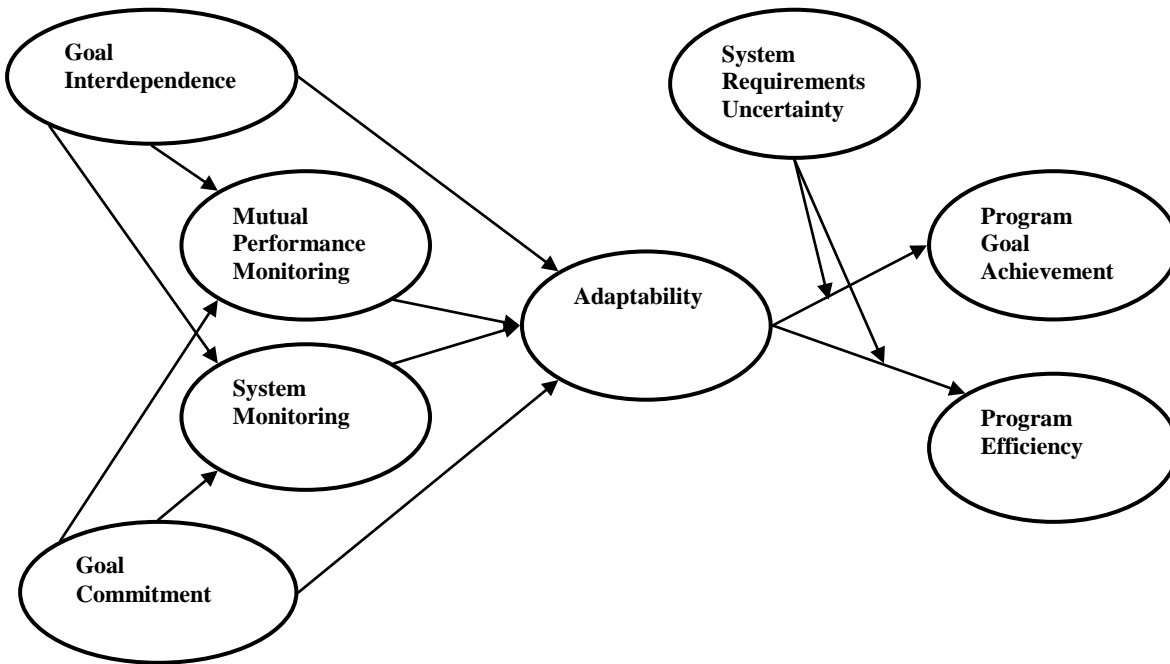
Figure 1. Proposed Research model

> *H2a: IT program goal commitment is positively associated with system monitoring.*
> *H2b: IT program goal commitment is positively associated with mutual performance monitoring.*
> *H2c: IT program goal commitment is positively associated with adaptability.*

Individuals may not be aware of their own performance deficiencies (Bolin, Sadacca, and Martinek, 1965). Therefore, team member feedback can lead to an individual becoming more cognizant of performance. The information gathered includes errors or lapses and allows for correction action. Thus:

> *H3: The levels of mutual performance monitoring among projects within IT programs is positively associated with adaptability.*

Salas et al. (2005) argue that as team members make progress toward task completion, the monitoring of their environment enables them to make sure that they are doing the right things. A team can't take process adjustment behaviors unless they recognize the change in conditions. Thus:

> *H4: The levels of system monitoring within IT programs is positively associated with adaptability.*

Adaptability is the ability to recognize deviations from expected actions and outcomes and readjust actions accordingly (Priest, Burke, Munim, and Salas, 2002). Therefore, when IT program members detect errors or environmental changes, the ability to adjust plans and actions to program objectives will directly affect the IT program's outcomes. Thus:

> *H5a: Process adjustment behaviors are positively associated with IT program goal achievement.*
> *H5b: Process adjustment behaviors are positively associated with IT program implementation efficiency.*

During the initial phases, program teams are challenged to uncover, understand, and specify system requirements to meet goals. The better the understanding of system requirements the better the ability to develop and implement a system which meets the business needs. Further, issues caught early in the life cycle result in greater efficiency due to time and expenses associated with rework and corrections later in the life cycle (Boehm and Basilli, 2001;

Browne and Rogich, 2001). Uncertainty of IT system requirements represents a risk to IT deployment that leads design and implementation astray (Nidumolu, 1995).

Once the required information has been specified by the organizations, the development process consists of successive transformation of those initial requirements until the IT solution is achieved.   This will lead to changes in specifications due to early lack of information about the state of the environment upon completion of the IT. Teams must be able to response quickly and effectively to any environmental changes or differences form the initial plan. This capability is more critical to the final outcomes when system requirements are unstable and uncertain. Thus:

> *H6a: The relationship between the program team's adaptability and IT program goal achievement is moderated by the levels of IT system's requirement uncertainty – the magnitude of the relationship is larger when the level of system requirement uncertainty is high.*

> *H6b: The relationship between the program team's adaptability and IT program efficiency is moderated by the levels of IT system's requirement uncertainty – the magnitude of the relationship is larger when the level of system requirement uncertainty is high.*

METHODOLOGY

Sampling

The target sample is programs that implemented enterprise systems. We chose to limit the sample to enterprise systems due to their frequent instances of resource overutilization, frequent lack of implemented functionality, and wide spread usage (Koh et al., 2011). Further, the common traits of IT programs considered in the model (interdependent projects having unique functional level goals) are commonly exhibited in enterprise system implementations. A mail survey is near completion of a sample from the top 1000 performing Taiwanese firms as published by the C*hina Credit Information Service*, *Ltd*, a leading business database.

There were three criteria necessary to be selected as potential respondents: (1) the firm had implemented at least two projects within the enterprise system program, (2) the implemented enterprise system program had already gone-live, and (3) three key informants from the program were available for answering the questionnaires. This study first contacted a key individual (e.g., CIO, functional manager) in each firm to introduce the purpose of this study and to obtain permission of access. For those willing to participate, an appointment was made for an advance visit. The contact person was asked to identify the informants in the firm, and then a package of three questionnaires with a cover letter was delivered by mail.

Instrument

A questionnaire in Chinese was verified and refined for translation accuracy by two MIS professors and one senior doctoral student familiar with extensive research on project management. In addition, the items were validated by a couple of senior project managers with industrial experience. The draft questionnaire was pretested for face and content validity with three program managers who have led enterprise system programs and one consultant who has extensive experience in enterprise system program implementation. This procedure resulted in some modifications and/or deletions to the questionnaires.

Constructs

All measures come from prior studies and are adjusted to fit our research context. Table 1 shows the measurement items, the source of the construct, and the respondent class (IT manager, program manager, or functional manager). *Goal commitment* refers to the extent to which the key program members dedicate themselves to believe program goals are important. *Goal Interdependence* refers to the extent to which project goals overlap. *System monitoring* refers to the extent to which project teams keep track of other project teams' resources and environmental conditions as they relate to the program mission. *Adaptability* is the extent to which project teams adjust/alter a course of actions to changing conditions during the enterprise program implementation. *System Requirement uncertainty* refers to the extent of change and differences among projects regarding to system requirements over the course of the enterprise program implementation. Mutual performance monitoring refers to the ability to keep track of fellow

team members' work to ensure that everything is running as expected. *IT program goal achievement* refers to the extent to which the program team meets expectation regarding the quality of the outcome. *IT program efficiency* refers to the extent to which the program team accomplished the IT program implementation according to resource usage, schedule, and scope. This study will employ structural equation modeling (SEM) to assess the measurement and structural models using SmartPLS (Anderson and Gerbing, 1988).

Construct	Item	Respondent
Goal Commitment (Hollenbeck et al., 1989)	All key program members are strongly committed to pursuing the goals established for the Enterprise program.	IT manager
	Key program members believed that it is realistic to expect to reach the goals specified in our Enterprise program.	
	It is easy to say that key program members take the Enterprise program goals seriously.	
Goal Interdependence (Chen et al, 2005)	Our team reaches project objectives by helping the other project teams' reach their objectives.	IT manager
	Our project goal andother project teams' goals structured so that they were win-win.	
	Accomplishing our project goals affected whether the other project teams achieved or did not achieve their goals.	
	All the teams within the Enterprise System program are collectively held accountable for performance/success	
Mutual Performance monitoring (McIntyre and Salas, 1995).	Each project team can easily identify mistakes and lapses in other project teams' actions.	IT manager
	Each project team can effectively provide feedback regarding other project teams' actions to facilitate self-correction.	
	Each project team understands actions made by other project teams	
	Team members were aware of other project teams' implementing procedures	
Adapability (Salas et al., 2005)	Each project team altering a course of action in response to changing conditions.	IT manager
	Each project team altering strategies in response to changing conditions.	
	Each project team altering plans in response to changing conditions.	
System Monitoring (Marks et al., 2001)	Each project team successfully tracked other project teams resources such as personnel, equipment, and other information that is generated or contained within the Enterprise program.	IT manager
	Each project team successfully tracked the environmental conditions relevant to the Enterprise program.	
	Each project team successfully tracked the task accomplishment relevant to the Enterprise program.	
System Requirement Uncertainty (Nidumolu, 1995)	Differences among projects regarding system requirements	IT manager
	Difficulty in identifying common set of system requirements among projects	
	System requirement fluctuation in later phases	
	Difference in system requirements between beginning and end	
IT Program Goal Achievement (Hoegl and Gemuenden, 2001)	Going by the results, this program can be regarded as successful	Program manager
	All objectives/goals of the program have been satisfied.	
	From the company's perspective, all project goals were achieved.	
	The organization was satisfied with the program results.	
IT Program Efficiency (Hoegl and Gemuenden, 2001)	The specified scope of the program was delivered with time and budget	Functional manager
	It is easy to say that this program was efficiently implemented	
	Generally speaking, we are satisfied with the operational efficiency of this Enterprise program implementation.	

Table 1. Constructs and Questionnaire Items

Three informants within an enterprise system program implementation will assess items of different constructs. The informants will include the enterprise system program manager, one functional manager from a subordinate project, and one IT manager involved with the enterprise system implementation. Program managers are in charge of the entire program implementation and in a good position to answer items assessing program goal achievement. Functional managers will respond to items about IT program efficiency.   IT managers will assess the goal commitment of the functional managers as they supervise IT related issues for the all individual projects and have

the opportunity to observe commitment levels, system monitoring, mutual performance monitoring, adaptability, and requirement uncertainty. The use of three questionnaires and three key informant classes prevent potential problems arising from single respondents and common method bias (Podsakoff et al., 2012).

Expected Contribution and Implications

Interdependence and common goals among projects are two key characteristics of IT programs. Organizations wishing to efficiently enable functionality and reach the program goals through information technology require a better understanding of developing the essential program teamwork required, especially the adaptability to effectively response the rapidly changing environments today. In this study, we examine how project goal interdependence at the program level foster necessary program adaptability in the deployment of complex systems. Specifically, goal interdependence among projects and broad commitment to the assigned program goals shape essential teamwork behaviors (i.e., monitoring and adapting) toward completion of overall IT program goals.

The results of this study should provide new insights to our understanding of adaptability theories and phenomena. First, the model suggests that the magnitude of the relationship between adaptability and program outcomes will depend upon uncertainty of requirements – the more the uncertainty, the more the important becomes adaptability. Second, the model suggests that feedback (including system monitoring and mutual performance monitoring) are necessary mechanisms for effective adaptive behaviors. According to action regulation theory, the evaluation function leads team members to make adjustments to efficiently and effectively progress toward goal and task completion (Rousseau et al., 2006). Finally, the model enhances our understanding of social interdependence theory by suggesting that some promotive interactions (e.g., adaptive behaviors) may not be directly linked with positive interdependences but facilitated by other promotive interactions (e.g., system monitoring and mutual performance monitoring).

The results of this study will provide several important implications to IT program management practitioners. First, goal interdependence in IT program implementation not only can enhance promotive interaction behaviors but also negative behaviors. A positive relationship will mean that it is advisable to ensure there is a common program goal among these interdependent projects. Thus, program managers would need to set up reward mechanisms for program goals achievement. Further, confirmation would mean that increased goal commitment from key program members would enhance promotive interaction behaviors. To attain this, program managers should enhance commitment at the early stage of program implementation. Third, system monitoring and performance monitoring are expected to enhance adaptability. To achieve this, IT program managers would consider goal structures (i.e., a cooperative goal) among each individual project to facilitate the necessary internal and external monitoring. Finally, adjustment behavior is highly associated with program goal achievement and efficiency. IT program implementation is different than project implementation. Due to the complexity of program goal achievement, individual projects may need to adjust to unexpected events of other projects. To achieve this, IT Program managers should ensure that the established program goals by the top management team are properly shared among individual projects. These implications must be tempered by the limitations of the data: only specific adaptive behaviors were examined in this study and the sample consists only of "Enterprise System implementation" programs.

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