

2004

## The Impacts of Conflicts on Requirements Uncertainty and Project Performance

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### Recommended Citation

Chen, Houn-Gee; Jiang, James J.; Chen, Jun-Cheng; and Shim, J T. (2004) "The Impacts of Conflicts on Requirements Uncertainty and Project Performance," *Journal of International Technology and Information Management*: Vol. 13: Iss. 3, Article 2. Available at: <http://scholarworks.lib.csusb.edu/jitim/vol13/iss3/2>

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## **The Impacts of Conflicts on Requirements Uncertainty and Project Performance**

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### **ABSTRACT**

*Conflict is a pervasive phenomenon that permeates information systems development and implementation. The literature has indicated that conflicts, due to their association with negative emotion, will negatively influence IS project development, even after controlling for the effects of conflict management and resolution; however, the negative emotional characteristic of conflict alone has a limited explanatory power of IS project success. The purpose of this study is to provide additional insight, by including requirement uncertainty as the mediator variable, of the impacts of conflicts on project performance. Surveys were sent to Taiwan's top 1600 companies and the results support the hypotheses. The management implications are discussed.*

### **INTRODUCTION**

Conflict is a pervasive phenomenon that permeates information systems (IS) developments (ISD) and implementations. Numerous symptoms of conflicts have been identified including hostility and jealousy, poor communication, frustration and low morale (Franz & Robey, 1984; Smith & McKeen, 1992). In fact, its omnipresence and the importance of conflict management has long been acknowledged in the IS literature (Robey, Farrow, & Franz, 1989; Barki & Hartwick, 2001). For example, Smith and McKeen concluded that "conflict is a very real part of IS in corporate life and a major obstacle to effective computerization. Some IS managers believe that users are hostile...business managers apparently feel that IS is not responsive to their needs and does not understand business needs."

While the literature in other disciplines suggests that conflict is by itself neither good nor bad, IS researchers such as Barki and Hartwick (2001) challenged this view. They conceptualize negative emotion as a definitional property of the conflict. They found that negative emotion is an integral component of individuals' perceptions of conflict. That is, experientially, conflict is negative. Their empirical findings indicated that conflict consistently and negatively affected ISD outcomes, and also that significant negative effects of conflicts remained, even after controlling for the effects of conflict management and resolution, and even for respondents reporting high levels of satisfactory conflict resolution. They stated "it can be concluded that conflict is not only a negative experience, but also that it negatively affects ISD outcomes, even when managed well." Although the empirical evidence was compelling, the overall project development success variables' (in terms of adherence to budget, schedule, and specification) R-square values were not impressive (15.4 percent, 12.6 percent, and 5.9 percent, respectively). As a matter of fact, a similar relationship was found in Robey, Smith, and Vijayasarathy's (1993) study that project success with an R-square of 19.6 percent was explained by considering conflicts, conflict resolution, and user participation. In summary, IS literature has indicated that conflicts, due to their association with negative emotion, will negatively influence IS project development, even after controlling for the effects of conflict management and resolution; however, the negative emotional characteristic of conflict alone has a limited explanatory power of IS project success (in terms of its adherence to budget, schedule, and requirements).

Interestingly, Barki and Hartwick (1994 & 2001) also suggested two other dimensions of conflict: disagreement and interference. They defined conflict as “an expressed struggle between at least two interdependent parties who perceive incompatible goals, scarce rewards, and interferences from the other party in achieving their goals.” Most ISD cases involve multiple interdependent parties including users, IS staff, manager, and vendors. The diversity of interests and goals of those parties often exists (Smith & McKeen, 1992). As long as the diversity of interests and goals exists during ISD, each party is taking action to carry out his goals. Such action often causes interference with each other. Meanwhile, requirements analysis is an inevitable activity in the progress of information system development. It needs IS staff and users to communicate with each other, to interact frequently, and to work together harmonious. In fact, requirements uncertainty has long been regarded as one of the most important issues in software development projects (Davis 1982; Fazlollahi & Tanniru 1991; Saarinen & Vepsalainen, 1993). A complete requirements analysis is required for project development (Zmud, 1980), and also is related closely to the success of project (Turner, 1992). Based upon the conceptual characteristics of conflict, one would suspect that conflicts among IS stakeholders will lead to requirements uncertainty during the system development process. Unfortunately, the relationship between conflicts and requirements uncertainty has never been examined in the IS literature. We believe that a research model that incorporates this potential consequence of conflict will enhance the explaining power of conflict and provide an additional insight into the impact of conflict on ISD outcomes.

The purpose of this study, therefore, is to examine the impact of conflicts on requirements uncertainty and, thus, the project performance. Specifically, the following three research questions are addressed:

- (1) *Is there a positive relationship between conflicts and requirements uncertainty?*
- (2) *Is there a negative relationship between conflicts and project performance?*
- (3) *Is there a negative relationship between requirements uncertainty and project performance?*

## **BACKGROUNDS AND RESEARCH MODEL**

The failure of software development projects is high, and has been disastrous to organizations. Many researchers have tried to find the factors affecting IS project development and discuss various approaches to mediate them. Decades of research have indicated that two critical factors in system development are the uncertainty of software development (McFarlan, 1981) and the conflicts among IS stakeholders due to their participation in system development (Barki & Hartwick, 1994, 2001; Robey, Farrow & Franz, 1989; Robey, Smith, & Vijayasarrathy, 1993).

Conflict is an important issue discussed in many fields. Barki and Hartwick (2001) extended their previous work and indicated that conflict should be a multidimensional construct, defined by three key dimensions: disagreement, interference, and negative emotion. Disagreement reflects the divergent values, needs, or objectives of the parties involved. Interference exists when one party opposes or prevents the other from achieving its goals. Negative emotion reflects an individual's feelings such as anger and frustration that are likely to result from disagreements with, and interference from, the other party.

Meanwhile, user participation has long been considered a key ingredient in the development of information systems (Ives & Olson, 1984). Barki and Hartwick (1989) defined user participation as the behaviors, assignments, and activities that users or their representatives perform during IS development. Then, some researchers attempted to establish a link between user participation and conflict during system development (Robey, Farrow, & Franz, 1989; Barki & Hartwick, 1994). After establishing the link between user participation and conflict, the relationship between conflict and project performance was then examined by Robey, Smith and Vijayasarrathy (1993) and Barki and Hartwick (2001). These empirical findings supported a negative relationship between conflict and project performance, however, with low R-square values. They argued that the existence of such a negative relationship between conflict and project performance, even for respondents reporting high levels of satisfactory conflict resolution, is due to the existence of negative emotion associated with conflicts. Unfortunately, the other two dimensions of conflicts, disagreement and interference, were not considered in their study. We suspect that a

research model that incorporates the potential consequences of disagreement and interference (i.e., requirements uncertainty) will enhance the R-square values and provide an insight for the impact of conflict on the final project outcomes.

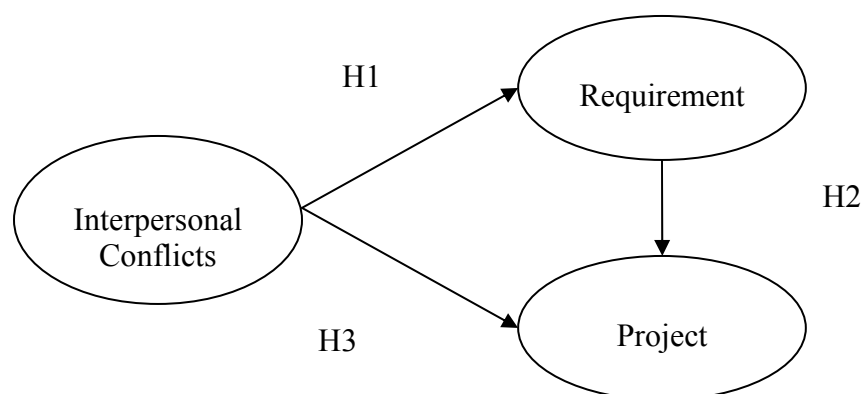
*Uncertainty* is broadly defined as the absence of complete information about the organizational phenomenon being studied (Argote, 1982). From an information processing viewpoint, requirements uncertainty refers to the difference in the information necessary to identify user requirements and the amount of information possessed by the developers (Nidumolu, 1995). In analyzing requirements, two important dimensions of uncertainty often occur: (1) requirements instability. It defines the extent of changes in user requirements over the course of the project, and is derived from the concept of changes in the task environment (Dess & Beard, 1984; Scott, 1981); and (2) requirements diversity. It defines the extent to which users differ among themselves in their requirements, and is derived from the concept of heterogeneity in the task environment (Scott, 1981).

Requirements uncertainty has long been regarded as one of the most important issues in software development projects (Davis 1982, Fazlollahi & Tanniru 1991; Saarinen & Vepsalainen, 1993). In an ISD development team, different parties, IS staff, vendors, users, and executives work together with different interests and expectations, and such interaction often result in conflicts. For examples, many IS researchers have found that parties in ISD often have divergent opinions, interest, or goals (Robey et al., 1989; Smith & McKeen, 1992). In an IS project, users and IS staff often have different viewpoints and use different problem-solving approaches (Argyris, 1971). These disagreements could increase the uncertainty of system requirements during the system development processes (Nidumolu, 1996). The extent of requirements uncertainty during the system development makes it difficult to manage the software development process and to validate the software product (Zmud, 1980). In general, literature has suggested that a proper management of the requirements can have the single biggest impact on project performance, and frequently changes create major problems for system development.

The project performance is defined by efficiency, effectiveness, and timeliness (Henderson & Lee, 1992; Pressman, 1992). Efficiency is often considered to be smooth team operations and adherence to allocated resources—time and cost. Effectiveness is measured as the quality of work produced and meeting with project objectives. IS literature often regards project success as meeting project goals, budget, schedule, and operational efficiency (Henderson & Lee, 1992; Lewis, 1995).

Based upon the above discussion, in this study, the proposed research model is depicted in Figure 1. We would like to examine whether a greater extent of conflicts is associated with a greater extent of requirements uncertainty, and finally negatively influence the final project performance.

**Figure 1. Proposed Research Model**



## Research Hypotheses

Parties in ISD often have divergent opinions, interest, or goals (Robey et al., 1989; Smith & McKeen, 1992). In an IS project, users and IS staff often have different viewpoints and use different problem-solving approaches (Argyris, 1971). Symptoms of conflict identified in ISD included a proliferation of technical rules, norms, and regulations (Franz & Robey, 1984), frustration and low morale (Glasser, 1981), hostility and jealousy (Smith & McKeen, 1992), and poor communication (Franz & Robey, 1984). To ensure the success of an IS project, IS staff need to work with users for requirements analysis. If poor communication exists between IS staff and users, it will be difficult to achieve a useful requirements analysis. A poor communication will make the requirements analysis process inefficient and ineffective. Based upon the theoretical conflict properties and the above discussion, therefore, we proposed the following hypothesis:

### **H1: Conflicts are positively associated with requirements uncertainty.**

According to software risk-based theory, risk drivers causing the difficulties in estimating project performance include incomplete, ambiguous or inconsistent requirements (Thayer & Lehman, 1987) or frequent changes (Berkeley et al., 1990). Such drivers make it difficult to predict performance outcomes, because they often necessitate redoing requirements analyses and resources re-allocation issues (Jenkins & Wetherbe, 1984). It often implies that schedule has to be adjusted and more resources have to be allocated. Thus, the possibility of cost overrun and schedule delay would increase. Other poor results would arise from difficulties in analyzing requirements, such as not responding to the needs of the users, or being inflexible and failing to adapt to changing business needs. In the IS literature, Nidumolu (1995 & 1996) has found a significant negative relationship between requirements uncertainty and project outcomes. Based upon the risk-based theory and the empirical findings in the IS literature, we therefore proposed the following hypothesis:

### **H2: Requirements uncertainty is negatively associated with project performance.**

Previous research indicated that conflicts could cause positive or negative performance outcomes in the management literature (Pruitt & Rubin 1986; Putnam & Poole 1987; Robbins 1978; Wall & Callister 1995). Deutsch (1973) indicated the impact of conflict depends on the style of conflict management. Although both negative and positive outcomes had been identified in past conflict research, negative outcomes were often found in the IS literature. For example, Robey and his colleagues (1993) observed a negative relationship between conflicts and IS project success. Furthermore, in spite of relatively low R-square values (e.g., 0.06 between conflict and adherence to specification, and 0.12 between conflict and adherence to schedule), Barki and Hartwick (2001) indicated that there existed a negative relationship between conflicts and ISD outcomes. They argued that IS managers should “prevent or minimize” conflicts during system development and suggested that “a key issue that future research needs to address is the discovery of means that can encourage individual passion, drive, and involvement without fostering conflict.” Although there exist inconsistent conclusions on the impacts of conflicts on project outcomes, based on the empirical findings in the IS literature, we propose the following hypothesis:

### **H3: Conflict is negatively associated with project performance.**

## RESEARCH METHOD

### Sample

Taiwan's top 1600 companies of the *CommonWealth* magazine ranking are the target subjects of this study. It has been a common practice for large corporations to invest more in their IT infrastructure and hire IT specialists for the IS system development and maintenance. The questionnaire was mailed to the IS managers, who were instructed to answer those items according to recent experience with an ISD project. Postage-paid return envelopes were also enclosed. All the respondents were assured that their responses would be kept confidential, and that the purpose of the questionnaire was solely for academic research.

Of the 1600 mailed questionnaires, 53 questionnaires were returned due to invalid addresses. One hundred and fourteen valid responses were received, resulting in a response rate of 7.37 percent. Profiles of the respondents

by industry sector are summarized in Table 1. Sixty-nine percent of the respondents are from manufacturing firms, 13 percent from service firms, and 11 percent from finance-related organizations (including banking and insurance). As for the number of employees, 24 percent of the firms had 51 or fewer employees, 18 percent of the firms had 51 to 100 employees, 51 percent of the firms had 101 to 500 employees. The companies having 101 employees or more account for 57 percent of the respondents (Table1).

**Table 1. Profile of the organizations that responded**

Company characteristics	Category	Effective data	Percentage
Industry category	Manufacturing	81	68.6%
	Insurance	5	4.2%
	Hospital	2	1.7%
	Transportation	3	2.5%
	Retail	4	3.4%
	Banks	8	6.8%
	Service	15	12.7%
Total asset	Less than 0.1 billion	3	2.5%
	NT\$ 0.1 billion ~ NT\$ 1 billion	41	34.7%
	NT\$ 1 billion ~ NT\$ 2 billion	21	17.8%
	NT\$ 2 billion ~ NT\$ 4 billion	17	14.4%
	NT\$ 4 billion ~ NT\$ 7 billion	6	5.1%
	NT\$ 7 billion ~NT\$ 10 billion	4	3.4%
	NT\$ 10 billion ~NT\$ 20 billion	8	6.8%
	NT\$ 20 billion ~NT\$ 30 billion	4	3.4%
	NT\$ 30 billion ~NT\$ 50 billion	5	4.2%
	Over NT\$ 50 billion	3	2.5%
Missing value	2	1.7%	
Number of employees	Less than 51	27	23.7%
	51-100	20	17.5%
	101-500	58	50.9%
	501-1000	4	3.5%
	Over 1000	3	2.6%
	Missing value	2	1.8%

Table 2 summarizes the basic demographic information with respect to rank of project leaders, project life cycle, and project team size. Almost half of the projects were executed by an IS manager. Sixty-three percent of the projects lasted less than one year. Thirty-two percent of project teams' size varied from five to ten people. All this data showed how firms that responded had diverse characteristics during their project development periods.

**Table 2. Profile of project that responded**

Project characteristics	Category	Effective data	Percentage
Project Leader	CEO/Vice executive officer	32	28.1%
	Managers of Information Department	51	44.7%
	Managers of User department	11	9.6%
	Project Managers	13	11.4%
	Others	3	2.6%
	Missing value	4	3.5%
Duration Time	Less than three months	8	7.0%
	Less than a half year	27	23.7%
	Less than one years	37	32.5%
	Less than one and a half years	14	12.3%
	Less than two years	14	12.3%
	More than two years	10	8.8%
	Missing value	4	3.5%
Project team size	Less than five people	14	12.3%
	Five to ten people	37	32.5%
	Eleven to twenty people	28	24.6%
	More than twenty-one people	32	28.1%
	Missing value	3	2.6%

Table 3 is the basic demographic information of respondents. About 39 percent of respondents are thirty to forty-nine years old. Half of respondents are university graduates. About 70 percent of respondents have worked in information-related departments for at least five years. The participants are well trained in IT skill management.

**Table 3. Profile of Respondents**

<b>Age</b>			<b>Gender</b>		
Age	Count	%	Gender	Count	%
20 ~ 29	6	5%	Male	93	82%
30 ~ 39	45	39%	Female	19	18%
40 ~ 49	42	37%	Total	114	100%
50 ~ 59	18	16%	<b>Working Experience in Information Departments</b>		
No response	3	3%	Year	Count	%
Total	114	100%	1 ~ 5	27	23%
<b>Education</b>			6 ~ 10	28	24%
Education	Count	%	11 ~ 15	27	23%
Vocational School	-	-	16 ~ 20	19	17%
College	23	20%	21 ~ 25	4	4%
University	55	48%	No response	9	9%
Graduate or above	36	32%	Total	114	100%
Total	114	100%			

**Constructs**

A preliminary questionnaire was pilot-tested with three EMBA students who are also IS departments managers at high-tech organizations and familiar with software development and studying in the Institute of Technology Management, National Tsing Hua University, to assess logical consistency, ease of understanding, and task relevance. According to their feedback, there were some modifications to the original instrument to clarify the meaning of particular sections.

**Interpersonal Conflicts**

In IS fields, Robey regarded conflict as a uni-dimensional construct (Robey, 1989, 1993). Barki and Hartwick (2001) extended their previous work and indicated that conflict should be a multidimensional construct, defined by three key factors: disagreement, interference, and negative emotion. The term “interpersonal conflict” was used in their study instead. In this study, the Barki and Hartwick’s (2000) interpersonal conflicts measure is adopted. The questionnaire asks respondents to identify the extent to which each of the three activities occurred in their most recently completed IS project. Each item was scored using a five-point Likert scale ranging from disagree (1) to agree (5).



## Requirements Uncertainty

Often information regarding organizational values and beliefs is difficult to elicit during requirements analysis (Leifer, Lee, & Durgee., 1994). In this study, two items of uncertainty were measured as suggested by (Nidumolu, 1995): 1) requirements instability—it defines the extent of changes in user requirements over the course of the project, and derived from the concept of changes in the task environment (Dess & Beard, 1984; Scott, 1981); and 2) requirements diversity—it defines the extent to which users differ among themselves in their requirements, and derived from the concept of heterogeneity in the task environment (Scott, 1981). Each item was presented such that the greater the score, the higher the extent of user requirements uncertainty (requirements analyzability is reversed).

## Project Performance

The project performance is defined by efficiency, effectiveness, and timeliness (Henderson & Lee, 1992; Pressman, 1992). The following indexes have been used in measuring the project performance: operation efficiency, amount of work produced, the quality of work produced and effectiveness (ability to meet project goals) (Deephouse, Mukhopadhyay, Goldenson, & Kellner, 1996; Henderson & Lee, 1992; Jones & Harrison, 1996). The project management literature defines project success as meeting project goals, budget, schedule, and operational efficiency considerations (Lewis, 1995; Henderson & Lee, 1992).

A confirmatory factor analysis (CFA) was conducted to examine the validity of the constructs used in this study. Table 4 showed the results of CFA. Convergent validity is demonstrated when different instruments are used to measure the same construct, and scores from these different instruments are strongly correlated. Convergent validity can be assessed through t-tests on the factor loadings, such that the loadings are greater than twice their standard error. The t-tests for the loadings of each variable are shown in Table 4. The results showed that the constructs demonstrated a high convergent validity since all t-values were significant at the 0.05 level. In addition, the reliability of each construct was examined by the Cronbach alpha value. All the Cronbach alpha values exceeded the recommend level of 0.70. Discriminant validity is demonstrated when different instruments are used to measure different constructs, and the correlations between the measures of those different constructs are relatively weak. Discriminant validity was assessed by using the confidence interval test. A confidence interval test involves calculating a confidence interval of plus or minus two standard errors around the correlation between factors, and determining whether this interval include 1.0—if it does, discriminant validity is demonstrated. The results of the confidence interval tests supported the discriminant validity of the factors in this study.

The means, standard deviations, and intercorrelations are presented for all the variables in Table 5.

**Table 4. Measurement Model – Confirmatory Factor Analysis Results**

Construct Indicators	Standardized Loadings	t-value	Alpha
<b>Interpersonal Conflicts</b>			<b>.88</b>
Disagreement	0.63	6.76*	
Interference	0.86	9.80*	
Negative Emotion	0.75	8.38*	
<b>Requirements uncertainty</b>			<b>.77</b>
Instability	0.68	5.76*	
Diversity	0.75	5.77*	
<b>Project Performance</b>			<b>.92</b>

Ability to meet project goals	0.66	7.36*	
Expected amount of work completed	0.71	8.07*	
High quality of work completed	0.83	9.91*	
Adherence to schedule	0.73	8.39*	
Adherence to budget	0.72	8.17*	
Efficient task operations	0.69	7.73*	
Maintain high work morale	0.85	10.18*	

**Table 5. Descriptive statistics and correlation**

	Interpersonal Conflicts	Requirements Uncertainty	Project Performance
Mean	2.57	3.5	3.62
Median	2	4	4
Std. Deviation	1.21	1.19	1.01
Kurtosis	-1.13	-0.58	-0.02
Skewness	0.18	-0.59	-0.59
Interpersonal Conflicts	1.00		
Requirements Uncertainty	0.280	1.00	
Project performance	-0.185	-0.339	1.00

**DATA ANALYSIS AND HYPOTHESIS TESTING**

Table 6 shows the results of the SEM model. Hypothesis H1, testing the relationship between interpersonal conflicts and requirements uncertainty, was supported at the 0.05 level with path coefficients of 0.63. This result shows that interpersonal conflicts have a significant positive impact on requirements uncertainty. Hypothesis H2, testing the relationship between requirements uncertainty and project performance, was supported at the 0.05 level with path coefficients of -0.42. This result shows that requirements uncertainty has a significant negative impact on project performance. Hypothesis 3, testing the relationship between interpersonal conflicts and project performance, was not supported at the 0.05 level.

**Table 6. Summary of Hypothesis Tests**

Hypothesis	Coefficient	t-values
H1 : Interpersonal Conflicts → Requirements Uncertainty	0.63	4.04*

H2 : Requirements Uncertainty → Project Performance	-0.42	-2.32*
H3 : Interpersonal Conflicts → Project Performance	0.02	0.15
Goodness of Fit Statistics		
Chi-Square / Degrees of Freedom (< 3 is recommended)	2.54	
Comparative Fit Index (CFI) (>0.9 is recommended)	0.88	
Root Mean Square Residual (RMR) (< 0.10 is recommended)	0.06	

## DISCUSSIONS AND CONCLUSIONS

Our study also showed that interpersonal conflicts have a significant effect on requirements uncertainty. Requirements uncertainty is an important risk factor to be controlled in ISD projects. The outcome of requirements analysis is the requirements specifications which will, in turn, determine how the developed system should be performed. This further triggers the definition of the product performance. If requirements uncertainty existed in ISD projects, the request needed to be further analyzed by examining the possible options. Such uncertainty often results in cost overrun, and schedule delay. Requirements uncertainty is often cited as one of the most crucial risk factor for ISD.

The results interestingly showed a strong relationship between interpersonal conflicts and requirements uncertainty. Requirements analysis needs IS staff and users worked close together. If conflict is a pervasive phenomenon during ISD, project leaders should pay attention to the extent of requirements uncertainty. Project leaders should try to manage the extent of interpersonal conflicts for fear that it will give rise to unharmonious interaction. A team-based working style is inherent in the development of information systems. A good formation of project team will certainly influence on the ultimate project performance. However, the fact of background difference among project team members often lead to interpersonal conflicts, including interdependence, disagreement, and interference.

Our study showed that the effect of interpersonal conflicts on project performance was not congruent with past conflict related studies in the IS field (Robey, Smith, & Vijayasarathy, 1993; Barki & Hartwick, 2001). We regard the absence of negative effects on project performance to the fact that the inclusion of the mediator, requirements uncertainty, in the model. Different viewpoints toward the effect of conflicts exist in communication, marketing, and management literature (Deutsch, 1973; Kolb & Sheppard, 1985; Pruitt & Rubin, 1986). These literatures regard conflict as neither positive nor negative but neutral. This important and interesting finding suggests that future studies need to further examine other potential mediators of conflicts to explain the impacts of conflicts on project outcomes. Of course, like any empirical studies with a potential sampling bias—most of our respondents were senior IS managers in this study, the results of this study should be examined with different samples (i.e., users) to increase its generalizability.

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