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The relation of requirements uncertainty and stakeholder perception gaps to project management performance

James J. Jiang [a,c,1], Gary Klein [b,*], Shelly P.J. Wu [c], T.P. Liang [c,2]

[a] Department of Information Management, Department of Management Information Systems, University of Central Florida, Orlando, FL 32816-1400, United States
[b] University of Colorado, College of Business and Administration, P.O. Box 7150, Colorado Springs, CO 80933-7150, United States
[c] Department of Information Management, National Sun Yet-Sen University, 70, Lienhai Rd., Gushan District, Kaohsiung 804, Taiwan

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ABSTRACT

Researchers consider requirements uncertainty as a problem to be addressed during information system development by choosing an appropriate strategy to mitigate the uncertainty. However, this strategy avoids addressing issues present at the start of a project. Those include differences in perception between two prominent stakeholders: users and developers. The problems caused by this perception gap are demonstrated to be at least as significant as components of requirements uncertainty. A model is developed and empirically tested that shows a good portion of residual performance risks in a project are explained by perception gaps. These gaps present a new opportunity to address difficulties in a project before the development efforts begin.

1. Introduction

A prime cause of schedule slippages and cost overruns in information systems (IS) projects is requirements uncertainty (Barki et al., 1993; Lyytinen et al., 1998; Jiang and Klein, 2000; Schmidt et al., 2001; Wallace et al., 2004). In fact, requirements uncertainty has long been recognized as a major risk factor for IS development projects (Curtis et al., 1988;Walz et al., 1993;Jiang et al., 2002; Jiang and Klein, 2000; Hickey and Davis, 2004). Using a contingency perspective, many researchers suggest that project management performance is determined by the match between requirements uncertainty and a structural ability to process the information required to cope with the uncertainty (Andres and Zmud, 2001; Daft and Macintosh, 1981; Jiang and Klein, 1999; Lyytinen et al., 1998). That is, each requirements uncertainty should be evaluated in depth to design an appropriate response in information processing capabilities, or else IS project management performance is adversely affected (Tushman and Nadler, 1978; Davidson, 2002). The problem still remains to identify various requirements uncertainties and match them to the structure that maximizes performance in a reactive fashion.

Another direction of attack is to work backwards and consider the conditions set up by requirements uncertainties with the hope of reducing any resulting risks earlier in the project cycle. One specific condition concerns the existence of a stakeholder perception gap in the IS domain that is centered on perceived differences in understanding system requirements and evaluation (Jiang et al., 2002; Stork and Sapienza, 1995). Formally, this perception gap is defined as the existence of multiple and conflicting interpretations about an organizational situation by different stakeholders (Daft et al., 1987; Lyytinen, 1988; Jiang et al., 1998). Perception gaps are large when frames of reference differ (Davidson, 2002). In this study, we concentrate on two primary stakeholders, the users and developers, since most interactions will be between these two groups.

Unfortunately, users often exhibit completely different frames of reference than do IS developers (Laudon and Laudon, 2004). To point, users and IS professionals exhibit significant perception differences on service requirements and service quality (Jiang et al., 2003a,b). To improve success, IS project managers must strive to reduce this gap to achieve "consonance" – where IS users and IS developers agree on the system requirements, success criteria, and interpretation of system delivery characteristics (Klein and Jiang, 2001). Achieving consonance is a necessary condition for meeting stakeholders' needs and project requirements. Therefore, reducing the stakeholder perception gap is one goal of activities among IS users and IS developers. The presence of a link between requirements uncertainty and the stakeholder perception gap

* Corresponding author. Tel.: +1 719 262 3157; fax: +1 719 262 3494.
E-mail addresses: jjiang@bus.ucf.edu (J.J. Jiang), gklein@uccs.edu (G. Klein), d964020006@student.nsysu.edu.tw (S.P.J. Wu), tpliang@facmail.nsysu.edu.tw (T.P. Liang).
[1] Tel.: +1 407 823 4864.
[2] Tel.: +886 7 525 2000x4711.

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would provide an opportunity to reduce conditions of uncertainty instead of responding to uncertainties on a contingency basis. The question remains as to whether this relationship exists.

To test for the presence of the questioned relationship, this study incorporates the stakeholder perception gap into an established requirements uncertainty research framework (Nidumolu, 1995). Specifically, instead of a direct link between user requirements uncertainty and project management performance, we propose that user requirements uncertainty is one source of the stakeholder perception gap. From there, residual performance risk is included as a mediator between the perception gap and project management performance to explain remaining uncertainties (Nidumolu, 1995). Support of the model, based upon a survey of IS project managers, indicates that a core practice of requirements uncertainty management may reduce the stakeholder perception gap by achieving agreement among different stakeholders on project traits instead of focusing solely on contingency plans.

2. Background

All information system project work is embedded in an environment that contains data, cues, hints, and other knowledge resources necessary to complete the project. At the start of any IS project, team members possess some of these resources but need to gather more knowledge to accomplish the job. This knowledge gap between what the team requires and what they have at any given time is called "uncertainty" (Galbraith, 1973). Uncertainty is reduced by collecting, processing, and sharing information. Requirements uncertainty is the aggregation of a number of generating "sources". Among those are requirements instability (i.e., changes in user requirements over the course of the project) and requirements diversity (i.e., users disagree on the requirements among themselves) (Nidumolu, 1995).

The notion of requirements uncertainty has been the focus of research for decades (Nidumolu, 1995; Barki et al., 1993; Lyytinen et al., 1998; Davis, 1982; Moynihan, 2000). Many empirical research studies provide evidence that requirements uncertainty has a negative relationship with project management performance (Eva, 2001; Jiang et al., 1998; Jiang and Klein, 2000; Nidumolu 1995). Contingency theorists believe that project management performance is determined by the "fit" between the uncertainty in the unit's tasks and the ability of the methodology adopted to process the information required to cope with uncertainty (Daft and Macintosh, 1981; Nidumolu, 1995; Andres and Zmud, 2001; Lyytinen et al., 1998). To cope with requirements uncertainty, strategies are directed at addressing the problem during the development stages. These strategies include asking users, deriving requirements from an existing system, synthesizing requirements from user activities, and discovering requirements through experiments (e.g., prototyping).

Researchers study mechanisms that maximize performance for a particular IS requirements uncertainty – a contingency perspective. Fig. 1 shows a generalized model for this perspective. The uncertainty coping mechanism is a strategy or process followed during the development of a system designed to reduce requirements uncertainty. The work of Nidumolu (1995) uses horizontal and vertical coordination as such mechanisms. Residual performance risk represents the requirements uncertainty remaining after the implementation of the coping mechanism. It is considered as the extent of difficulty in revising estimates in the later stages of the project, regardless of the specific estimation technique used. In other words, residual performance risk includes the lingering uncertainties that the chosen reduction strategy do not mitigate. These remaining risks are good predictors of eventual project management performance (Na et al., 2007; Nidumolu, 1995). Using this model, the effective reduction of risk due to uncertainties can be determined for different process strategies and different sources of risk. Variations of this model have shown the relationships hold (Na et al., 2007).

An additional early source of risk in projects is the presence of a gap in understanding between users and developers (Cleland and Ireland, 2006; Klein et al., 2002; Schwalbe, 2007). Klein and Jiang (2001) argue that IS project managers must strive to reduce this gap to achieve a consonant view among stakeholders. For the model of this study, IS users and developers should come to a common understanding of the system requirements, business objectives, performance measures, and project goals before the start of a project. This serves to achieve a common understanding of the purpose of a project and the measures by which it will be deemed a success. Uncertainty-reducing strategies should also strive to reduce the gap between users and IS team members on the understanding of the system requirements. Unfortunately, users and IS developers often exhibit completely different frames of reference and suffer from a lack of common basis to carry forward into the project (Laudon and Laudon, 2004).

Uncertainty of requirements, including requirements instability and requirements diversity, would be a portion of this gap (Stork and Sapienza, 1995). However, perception differences are shaped by the different backgrounds of the different stakeholders and the gap is a complex result of social shaping as much as understood

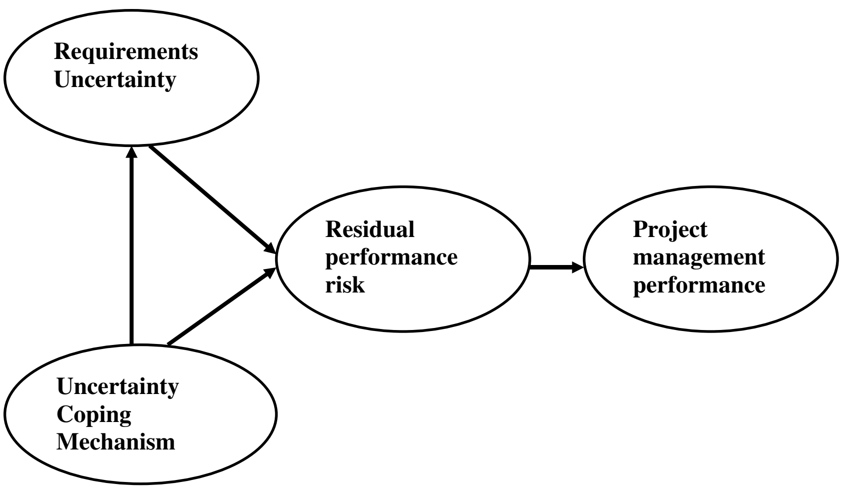

Fig. 1. General uncertainty framework (adapted from Nidumolu, 1995).

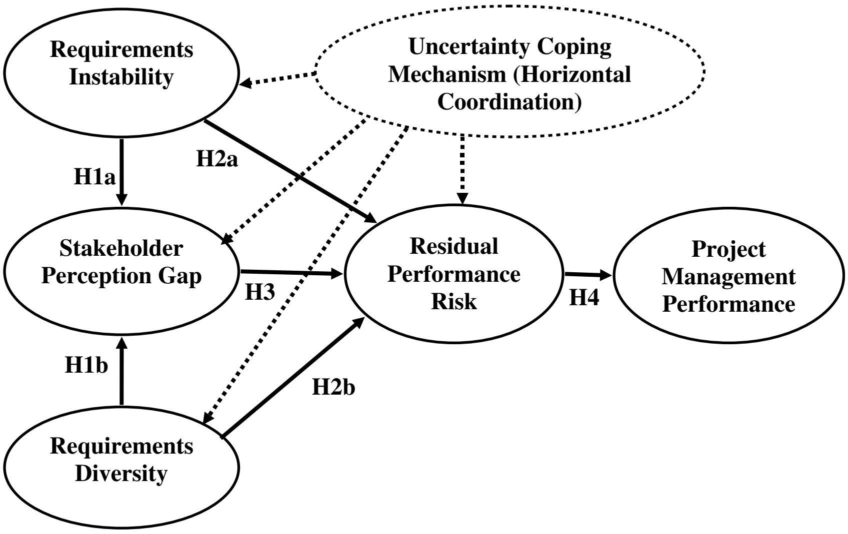

Fig. 2. Proposed perception gap model.

needs (Davidson, 2002). It is this difference in perceptions among all stakeholders involved in an IS development project that limits the mutual understanding needed to accomplish the goals of the project (Daft and Lengel, 1986). Thus, not only do developers have difficulty in following mechanical steps to convert user needs to a set of specifications, but also the difficulty of working with users whose perceptions must be taken into account and reconciled (Davidson, 2002). In turn, requirements specification is often characterized as an ongoing sense-making process among stakeholders that is chaotic, nonlinear and continuous (Curtis et al., 1988; Walz et al., 1993; Newman and Robey, 1992; Davidson, 2002). Many organizations struggle with managerial interventions and tools to close this gap.

Unfortunately, this stakeholder perception gap is not yet incorporated into an uncertainty research model. We, therefore, extend Fig. 1 as shown in Fig. 2. The extended model includes the links where uncertainty components (e.g., requirements instability and requirements diversity) contribute to a stakeholder perception gap as well as residual performance risk. Additionally, the perception gap will still influence the residual performance risk. As in the original model, residual performance risk determines the final project management outcomes. The coping mechanism to reduce uncertainty is still included, but as a control variable. In this case, we use horizontal coordination. Horizontal coordination is the placement of communication structures into the project that span functional boundaries (as between the IS department and a user department). Horizontal coordination is direct communication between users and developers and should have a large influence on requirements uncertainty and the perception gap.

3. Hypotheses

IS researchers have identified a number of project risk drivers that lead to difficulties in understanding system requirements and estimating project performance (Barki et al., 1993; Jiang and Klein, 1999, 2000; Schmidt et al., 2001; Wallace et al., 2004). For example, incomplete, ambiguous or inconsistent requirements (Nidumolu, 1995), frequent changes (Berkeley et al., 1990), and lack of user support (Jiang et al., 2006) make it difficult for IS personnel to understand the requirements and scope of the project. The greater the volatility in requirements and the greater the extent to which stakeholders differ among themselves in the requirements add to the complexity of determining system requirements and thus increase the perception gap among the stakeholders. Uncertainty and lack of information about requirements make it difficult for users and IS staff to have an agreement on the project objectives, goals, evaluation metrics, and scope. These arguments suggest the following hypotheses:

H1a: Requirements instability is positively associated with the stakeholder perception gap.
H1b: Requirements diversity is positively associated with the stakeholder perception gap.

Software engineering and IS project management researchers have long argued the negative impact of project risk drivers on predicting performance outcomes even late in the project, because they often necessitate rework (Jenkins and Wetherbe, 1984; Nidumolu, 1995). Requirements uncertainty, including the changes in user requirements over the course of the project and the differences among users, makes it difficult to predict the time and effort that the project will consume, thus increasing residual performance risk. In the IS literature, the link between requirements uncertainty and residual performance risk was empirically supported by Nidumolu (1995) and Jiang et al. (2006). Based upon the above discussion and empirical evidence in the literature, the following hypotheses are proposed:

H2a: Requirements instability is positively associated with residual performance risk.
H2b: Requirements diversity is positively associated with residual performance risk.

A main purpose of software engineering is to manage the particular sources of project risks and lead to a successful project development. Risk-based software engineering describes why software requirements uncertainties have an adverse impact on performance (Boehm, 1991). Accordingly, a perception gap between users and IS developers can be viewed as risk drivers that increase the residual performance risk of the project. Perception gaps between users and IS developers make it difficult to achieve agreements on project requirements, goals, and performance measures – which in turn can lead to difficulty in estimating the final project schedule and cost. Based upon the above discussion, we propose the following hypothesis:

H3: The stakeholder perception gap is positively associated with residual performance risk.

Poor project estimates cause problems in IS development projects even late in the project for several reasons. First, without accurate estimates, IS managers do not know what resources still need to be committed to complete a development effort. Resource-dependency theory relates poor resource allocation to poor performance (Schmidt et al., 2001). Second, poor estimates can lead to excessive schedule pressure and unrealistic expectations (Lyytinen, 1988). The failure to consider residual performance risk and take corresponding corrective actions is why many projects are unsuccessful (McFarlan, 1981). IS researchers have directly tested this link and found it to hold (Nidumolu, 1995; Nidumolu, 1996). Project management research suggests the ability to accurately estimate the final project's cost, time, and quality will relate to the final project management performance (Shumskas, 1992; Thamhain and Wilemon, 1987; Nidumolu, 1995, 1996; Jiang et al., 2006). From the above discussion we expect:

H4: Residual performance risk is negatively associated with project management performance.

4. Research methods

4.1. Sampling

Questionnaires were mailed to 500 randomly selected IS managers in the US from members of the IS special interest group of the Project Management Institute. These subjects should be familiar with the software project activities and outcomes. Postage-paid envelopes for each questionnaire were enclosed. All the respondents were assured that their responses would be kept confidential. Of the initial surveys mailed, a total of 85 valid responses were received. In order to increase the response rate, two follow up mailings were conducted. The total number of responses from the three rounds was 151.

Non-response bias is when the answers to the survey by the respondents do not represent the overall target sample. One test for potential non-response bias is to compare the demographics of early versus late respondents (Sivo et al., 2006). *T*-tests were computed on the means of key demographics (work experience, project duration, and team size) for the first and third mailings to examine whether significant differences existed. No significant difference was found; therefore, all respondents were combined for further analysis. Demographic features of the sample are in Table 1. Since project duration and team size are believed to influence project management performance, these are included as control variables in the analysis (Cleland and Ireland, 2006; Schwalbe, 2007).

Table 1
Demographic features.

Variables	Categories	Number	Percent
Gender	Male	97	64
	Female	54	36
Job position	IS Manager	61	40
	Project leader	79	52
	IS Professional	11	8
Industry type	Service	117	77
	Manufacturing	34	23
# of IS employee	<11	9	6
	11–100	35	23
	101–500	38	25
	>500	69	46
Avg. team size	<8	40	26
	8–15	63	42
	16–25	30	20
	> = 26	18	12
Avg. project duration	<1 year	83	55
	1–2 years	52	34
	2–3 years	10	7
	>3 years	6	4
Total sample size: 151			

4.2. Constructs

The *Requirements Instability* scale is originally derived from the concept of changes in the IS development task environment. This construct is designed to measure the extent of changes made in user requirements over the course of the project. The three items are adopted from Nidumolu (1995) and appear in Table 2. A Likert-type scale captured responses from 1 (strongly disagree) to 5 (strongly agree).

Requirements Diversity considers heterogeneity in the task environment (Scott, 1981) and is described as the extent to which users differ amongst themselves in their requirements. It was measured by the three items in Table 2 (Nidumolu, 1995). A Likert-type scale captured responses from 1 (strongly disagree) to 5 (strongly agree).

The *Stakeholder Perception Gap* is measured by the five items in Table 2. These items are listed as common points of disagreement during the course of a project (Cleland and Ireland, 2006; Klein et al., 2002; Schwalbe, 2007). A Likert-type scale captured responses from 1 (strongly agree) to 5 (strongly disagree) on whether or not there was a mutual understanding about the items at the start of the project.

Horizontal Coordination (control variable) measures the extent to which communication is conducted and structured between individual users and IS personnel and within groups across functional boundaries (users and IS personnel). The construct is from Nidumolu (1995). Each item is scored using a five-point scale ranging from never (1) to always (5). All items are presented such that the greater the score, the greater the extent of the particular item.

Residual Performance Risk represents the difficulty in estimating the project scope, time, and costs during the later stages of the project. As such, the measure is an outcome of development steps and indicates estimation difficulty, not why estimation is difficult, nor the methods used in estimation. The residual performance risk measure is as applied by Nidumolu (1996). The scales were originally derived from McFarlan (1981). The questionnaire asks respondents the extent of difficulty in estimating five items during the *later* phases of the project from 1 (very difficult) to 5 (very easy) on a Likert-type scale. Each item, seen in Table 2, was presented such that the greater the score, the harder the estimation of project management performance at the later stage.

Project Management Performance: Authors argue a minimum of three dimensions of project management performance – meeting budget, making schedule, and satisfying user requirements (McFarlan, 1981; Wateridge, 1995). Others suggest additional dimensions to include the amount and quality of the work produced and an ability to meet project goals (Deephouse et al., 1995–1996; Jones and Harrison, 1996). The items adopted by this study are from Henderson and Lee (1992). Similar items were also used by Jiang et al. (2006). The questionnaire asks typical questions about satisfaction of project management performance for their organization when developing information systems. The specific items are listed in Table 2. Each item was scored using a five-point scale ranging from never (1) to always (5). All items were presented such that the greater the score, the greater the satisfaction of the particular item.

We used partial least squares (PLS) analysis to test the item reliability, convergent validity, and discriminant validity (Chin, 2001).

Table 2
Validity and reliability.

Construct	Items	Factor loading	*t*-statistic*	ITC
Stakeholder	Requirements specifications	0.81	25.87	0.70
Perception gap	Project scope/objectives	0.87	44.11	0.79
α: 0.889	Project management performance criteria	0.85	33.32	0.76
CR: 0.92	System capabilities and limitation	0.82	19.69	0.72
AVE: 0.69	Inputs and outputs of the system	0.79	24.65	0.68
Horizontal coordination	Oral communication between users and IS developers	0.88	42.10	0.73
α: 0.80	Written communication between users and IS developers	0.87	37.62	0.72
CR: 0.88	Scheduled group meetings between users and IS developers	0.75	12.17	0.54
AVE: 0.64	Unscheduled group meetings between users and IS developers	0.70	13.22	0.49
Requirements instability	Requirements fluctuated quite a bit in later phases of the project	0.83	27.31	0.59
α: 0.741	Requirements identified at the beginning of the project were quite different from those existing at the end	0.84	35.94	0.60
CR: 0.81	Requirements are expected to fluctuate quite a bit in the future	0.77	14.69	0.52
AVE: 0.53				
Requirements diversity	Users of this software differed a great deal among themselves in the requirements to be met	0.86	38.00	0.66
α: 0.776	A lot of effort was spent in reconciling the requirements of various users of this software	0.83	23.30	0.60
CR: 0.87	It was difficult to customize the software to one set of users without reducing support to other users	0.80	21.16	0.57
AVE: 0.69				
Residual performance risk	What the costs of the project would be?	0.74	15.16	0.59
α: 0.787	What the project completion time would be?	0.70	11.70	0.54
CR: 0.85	What the benefits of the software would be?	0.66	10.39	0.48
AVE: 0.54	If software would be compatible with environment?	0.73	18.29	0.55
	If software could meet user needs?	0.83	34.63	0.69
Project management performance	Ability to meet project goals	0.80	24.69	0.69
α: 0.87	Expected amount of work completed	0.79	21.95	0.67
CR: 0.91	High quality of work completed	0.74	14.41	0.62
AVE: 0.61	Adherence to schedule	0.82	21.18	0.73
	Adherence to budget	0.78	19.88	0.68
	Efficient task operations	0.78	22.14	0.68

* All significant at $p < 0.05$.

Individual item reliability is examined by observing the factor loading of each item. A high loading implies that the shared variance between constructs and its measurement is higher than error variance (Hulland, 1999). To be viewed as having high reliability, factor loadings should be significant (*t*-statistics in Table 2) and greater than or equal to 0.70. Table 2 shows that the factor loading for each item is above 0.70 except one item in residual performance risk (i.e., 0.66). Because of the successful, historical use of this construct, the item is retained in further analysis. Item-total correlation (ITC) refers to the correlation between an individual item and the total score of all other items in the same construct. ITC can be used to understand the internal consistency of a construct. Items with extremely low ITC (e.g., <0.3) should be eliminated before conducting advanced analysis.

Convergent validity should be assured when multiple indicators are used to measure one construct. Convergent validity can be examined by composite reliability and variance extracted by constructs (AVE) (Fornell and Larcker, 1981). To obtain the composite reliability (CR) of constructs (>.70 recommended), the sum of loadings is squared and then divided by the combination of the sum of squared loading and the sum of the error terms (Werts et a., 1974). AVE reflects the variance captured by indicators. If the AVE is less than 0.5, it means that the variance captured by the construct is less than the measurement error and the validity of a single indicator and construct is questionable (Fornell and Larcker, 1981). The results shown in Table 2 indicate the constructs adopted in this study exhibit an acceptable level of convergent validity.

Discriminant validity focuses on testing whether the measures of constructs are different from each other (Messick, 1980). It is assessed by testing whether the square root of the AVE is larger than the correlation coefficients (Fornell and Larcker, 1981; Chin, 1998). For each construct in this study, the square root or AVE is larger than the correlation between each pair of constructs (see Table 3). The responses have good distribution since skewness is less than two and kurtosis less than five (Ghiselli et al., 1981).

Table 3
Summary statistics.

	Mean	σ	M3	M4	Correlations					
					RS	RD	HC	RR	PG	PP
Requirements stability	2.97	0.97	0.09	−0.73	**0.73**					
Requirements diversity	3.15	1.03	−0.27	−0.54	0.45	**0.83**				
Horizontal coordination	4.01	0.74	−0.59	−0.15	−0.24	−0.23	**0.80**			
Residual performance risk	2.57	0.82	0.18	−0.29	0.49	0.30	−0.39	**0.73**		
Stakeholder perception Gap	2.81	0.99	0.01	−0.59	0.49	0.49	−0.28	0.44	**0.83**	
Project management performance	3.65	0.78	−0.25	−0.60	−0.45	−0.22	0.40	−0.60	−0.46	**0.78**

M3: Skewness; M4: Kurtosis; The diagonal in the correlation matrix contains the square root of the AVE (bold).

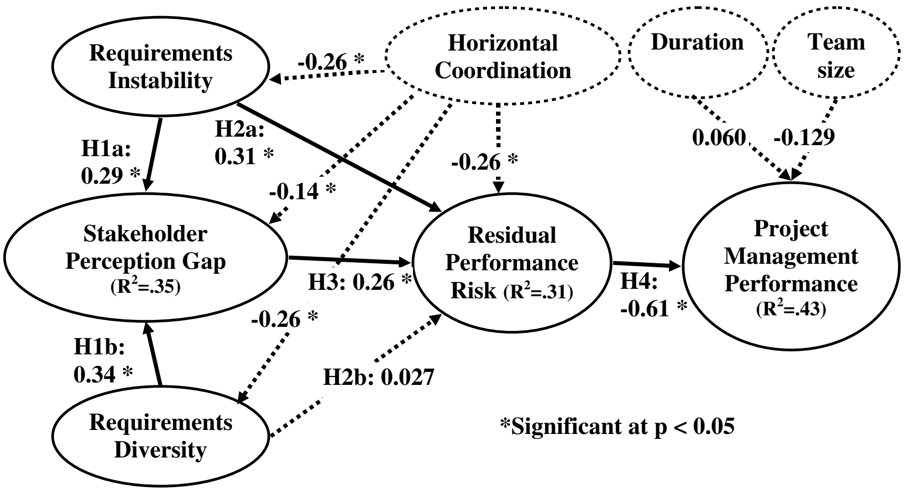

Fig. 3. Structural model results.

4.3. Data analysis

PLS is also employed to test the structural model. Results from PLS include an estimate of the path coefficients – which indicate the strengths of the relationships between the dependent and independent variables, and the R^2 values – which indicate the amount of variance explained by the independent variables. R^2 represents the predictive power of the model and interprets the same as in a multiple regression. PLS employs a bootstrap resampling procedure to generate *t*-statistics and standard errors (Chin, 1998). Fig. 3 shows the coefficients of the path analysis. Based on the results, H1a, H1b, H2a, H3, and H4 are supported. H2b, however, is not.

5. Discussion

This study, based on consonance theory and a residual performance risk model, provides an extended framework for studying the association of stakeholder gaps and ongoing requirements uncertainty on IS development projects. More specifically, instead of examining the direct relationship between requirements uncertainty and residual performance risk, we examined the interactions between requirements uncertainty (in the form of user requirements instability and user requirements diversity) and both the stakeholder perception gap and residual performance risk. Likewise, the indirect effect of stakeholder perception gap on project management performance was explored through the inclusion of the residual performance risk as a mediator. Such segmentation confirms the importance of the perception gap and allows future investigations into development techniques that address the gap. Techniques targeted to achieve consonant stakeholder views can serve as antecedents.

A survey of 151 IS professionals indicates that requirements instability and requirements diversity increase the stakeholder perception gap, as shown in Fig. 3. Likewise, the direct link between stakeholder perception gap and residual performance risk was supported. However, though requirements instability remains positively related to residual performance risk (support of H2a), the direct relationship between requirements diversity and residual performance risk was fully mediated by the stakeholder perception gap. This indicates that requirements diversity can be addressed by attacking the stakeholder perception gap. Requirements instability, however, is only partially mediated by the gap, indicating further techniques must be applied. Lastly, the link between residual performance risk and project management performance was confirmed. This, along with the significance of horizontal coordination as a control variable, enhances the external validity of the results.

There exist implications to IS researchers for studying requirements uncertainty on IS project management performance. First, the support of H1a and H1b indicate that future studies examining user requirements uncertainty in IS development should consider not only process deficiencies, but also the perception differences among stakeholders to begin a project. Second, this study expands our understanding of the relationship between uncertainties and later residual performance risks by incorporating the stakeholder perception gap. Results show a stakeholder perception gap is a full mediator between requirements diversity and residual performance risk and a partial mediator between requirements instability and residual performance risk. Thus, different types of uncertainty should be examined separately in future studies and other mediators may also exist between requirements uncertainty and residual performance risk.

At a first glance, the existence of a mediator between uncertainty and residual performance risk may not seem a great deal. However, consonance theory argues that IS project managers must attempt to reach a common understanding among stakeholders on the project objectives, scope, and success criteria (Klein and Jiang, 2001). A gap due to a lack of understanding clearly is crucial in improving eventual project management performance. This stakeholder perception gap can become the focus of a research framework to determine effective means to achieve consonance before the project commences rather than responding to uncertainty with contingent project processes. The stakeholder perception gap is a cause of residual performance risk which must be resolved and well managed by the IS project managers. It opens new research avenues for studying requirements uncertainty relationships with project management outcomes and confirms that management must work on building processes and culture that promote consonance early in a project and throughout the organization rather than solely react to the consequences of uncertainty during development.

The results of this study also have an important implication for IS project managers. According to current wisdom, the focus of uncertainty management at the project level is to identify corresponding coping mechanisms. However, this study suggests that IS project managers must also manage the stakeholder perception gap as an indirect indicator of final project management performance. Though it may be common knowledge that stakeholders do not agree among themselves, specific sources of that disagreement can lead to more specific techniques to address the gaps. For those associated with requirements, the IS project manager can address the perception gaps with effective strategies early in the life of a project. One need not wait until the latter stages of a project to select from among contingencies.

The perception gap can be effectively addressed with techniques to influence understanding of the project's goals, measures, and objectives. Such techniques include pre-project partnering dedicated to building common understanding of the project before any project task is begun and assumption based estimation (Jiang et al., 2006). As part of pre-project partnering, one should strive for a mutual understanding of the definitions and measures of success, having different concepts of terminology is one form of disagreement that leads to a lack of commonality (Jiang et al., 2003a,b). Organizational changes should also be pursued to achieve common ground in matching goals to the needs of the organization and an appropriate culture for projects (Benko and McFarlan, 2003). It is often too late at the latter stages to realize the effectiveness of the adopted coping strategies.

However, the perception gap is not limited in its relation to just the final outcome. As shown in this study, the stakeholder perception gap directly associates with residual performance risk. It should not be unexpected that a gap in understanding between the users and developers will lead to difficulties in bringing the project to a close due to risks not brought under control. Due to different backgrounds and interests between users and IS staffs, it is necessary for IS project managers to promote ongoing communication and coordination mechanisms to enhance the agreement among different stakeholders. Formal and informal reviews are an effective device for achieving much of this type of coordination and newer approaches to system design that actively involve users and managers should also serve to lessen the gap in the development stages (Augustine et al., 2005; Wang et al., 2008).

Like any research, our study has certain limitations. First, the study focused only on requirements diversity, requirements instability, and the stakeholder perception gap. Consequently, how other types of uncertainty (skill lacks, project complexity) interact with the stakeholder perception gap to influence project management performance was not explored. Second, the project outcomes measured in this study mainly focus on project management performance as perceived by the subjects. Other dimensions of success such as impact to the organization, impact on individuals, user satisfaction, and system usage are not considered. Likewise, objective measures of budget and schedule might reveal different relationships. Lastly, the subjects are all from the United States and the results may not generalize to regions that differ in software development maturity or culture. Nonetheless, results of this study are encouraging enough to warrant future multivariate research efforts.

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Dr. James Jiang is Professor of Management Information Systems at the University of Central Florida. He obtained his Ph.D. in Information Systems at the University of Cincinnati. He is also the honorary Sun Yat-Sen Management Chair Professor of Information Management at National Sun Yat-Sen University, Taiwan, 2007-2010. His research interests include IS project management and IS service quality management. He has published over 100 academic articles in these areas in the journals such as Decision Sciences, Decision Support Systems, Journal of Management Information Systems, Communications of ACM, IEEE Transactions on Systems Men & Cybernetics, IEEE Transactions on Engineering Management, Journal of AIS, European Journal of Information Systems, Information & Management, Data Base, Journal of Systems & Software, Information Resources Management Journal, and MIS Quarterly. Currently, he is an AE of MIS Quarterly and Information Resources Management Journal.

Dr. Gary Klein is the Couger Professor of Information Systems at the University of Colorado in Colorado Springs. He obtained his Ph.D. in Management Science from Purdue University. Before that time, he served with the company now known as Accenture in Kansas City and was director of the Information Systems Department for a regional financial institution. His research interests include project management, technology transfer, and mathematical modeling with over 140 academic publications in these areas. He teaches programming, project management, statistics, management science, and knowledge management courses. He is Director of Education for the American Society for the Advancement of Project Management, a Fellow of the Decision Sciences Institute, Vice Chair of Membership and Community Relations for the AIS SIG on IT Project Management, and an active member of the Institute of Electrical and Electronic Engineers, the Association for Computing Machinery, INFORMS, the Association of Information Systems, and the Project Management Institute.

Shelly P.J. Wu is a PhD candidate in the Department of Information Management at National Sun Yet-Sen University, Taiwan. She received her M.A. from Arizona State University. Her major research interests include IS project management, e-Learning, and electronic commerce. Her research in these topics has been published in the Lecture Notes in Computer Science and Journal of the Chinese Institute of Industrial Engineers, and the 8th IEEE International Conference on Advanced Learning Technologies (ICALT-2008).

Dr. Ting-Peng Liang is the National Chair Professor of Information Management and Dean of College of Management at the National Sun Yat-sen University in Taiwan. He is also a Fellow of the Association for Information Systems. He received his doctoral degree from The Wharton School of the University of Pennsylvania and had served on the faculty of University of Illinois and Purdue University prior to joining National Sun Yat-Sen University. His primary research interests include electronic commerce, intelligent systems, decision support systems, knowledge management, and strategic applications of information systems. He has published papers in a number of academic journals, such as Management Science, MIS Quarterly, Journal of MIS, Operations Research, Decision Support Systems, Information and Management, Decision Sciences, IEEE Computer, IIE Transactions, International Journal of Electronic Commerce, and many others. He serves as the founding editor of the Pacific Asia Journal of AIS and on the editorial boards of several academic journals, such as Decision Support Systems, International Journal of Electronic Commerce, Journal of Computer Information Systems, Electronic Commerce Research and Applications, Industrial Management and Data Systems, among others.