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Discriminative effect of user influence and user responsibility on information system development processes and project management

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ABSTRACT

Context: User participation in information system (IS) development has received much research attention. However, prior empirical research regarding the effect of user participation on IS success is inconclusive. This might be because previous studies overlook the effect of the particular components of user participation and other possible mediating factors.
Objective: The objective of this study is to empirically examine how user influence and user responsibility affect IS project performance. We inspect whether user influence and user responsibility improve the quality of the IS development process and in turn leads to project success, or if they have a direct positive influence on project success.
Method: We conducted a survey of 151 IS project managers in order to understand the impact of user influence and user responsibility on IS project performance. Regression analysis was conducted to assess the relationship among user influence, user responsibility, organizational technology learning, project control, user–developer interaction, and IS project management performance.
Results: This study shows that user responsibility and user influence have a positive effect on project performance through the promotion of IS development processes as mediators, including organizational technology learning, project control, and user–IS interaction.
Conclusion: Our results suggest that user responsibility and user influence respectively play an important role in indirectly and directly impacting project management performance. Results of the analysis imply that organizations and project managers should use both user participation and user influence to improve processes performance, and in turn, increase project success.

1. Introduction

The use of information systems (IS) has become pervasive in organizations in the past two decades. The spread of information systems has provided users with more experience on IS usage, allowing them to form their own opinions and expectations regarding IS development (ISD) projects. As a result, the issue of user participation has received much attention in IS project management research [7,21,27]. User participation refers to the behaviors and activities that the target users or their representative perform in the system development process [6]. Early studies showed no relationship between user participation and ISD performance [46]. However, rapid changes in today's computer technologies and business strategies have made it increasingly hard to predict and control project goals and system requirements [18]. Today, user participation in ISD typically clarifies system requirements to ensure the achievement of project goals and ultimate success [27].

Advocates of user participation indicate that user participation affects human resource management [52], traditional course of user–IS interaction [27] and the quality of product development processes [15]. User participation had a significant influence on IS success for several years [34]. Barki and Hartwick [6,37] distinguished between user participation and user involvement by referring to the objective practice portion and subjective psychological states, respectively. User involvement refers to a subjective psychological state defining the importance and personal relevance that users attach to IS in general. The distinction enriched empirical evidence for positive effects of user participation on user satisfaction [37]. Nevertheless, previous studies also revealed possible negative effects of user participation, including ambiguous roles, conflicts, requirements creep, and ineffective communication [17,25,31,56]. Thus, the extent to which user participation affects IS success

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remains elusive [21]. Possible reasons may be which components of user participation are employed and the use of models that are not sufficiently explanatory in system development [34].

An examination of the relationship between user responsibility (or user influence) and project performance might help explain the inconclusive results of the literature on user participation/involvement. User responsibility and user influence are important measures of user participation and user involvement, respectively [22]. User responsibility refers to the assignment and activities reflecting a user's overall accountability to the success or failure of a project [22]. User influence grants users decision-making authority in system design [37]. Involving users in a project without granting them power and accountability can eventually lead to poor project performance. On the other hand, empowered users can influence the direction of the project for which they are responsible. Users feel psychologically empowered and engaged in the system when they are enable to reconfigure it [48]. This study selects user responsibility and user influence because these two components are commonly adopted, explaining why the results are comparable with previous studies [17,22,31,37]. For ease of exposition, this study adopts the term "user participation" to refer to the general activities or behaviors of users during system development.

This study empirically examines how user influence and user responsibility affect the performance of ISD projects. We pose the following research questions: Does the practice of user responsibility (or user influence) prompt (or enervate) the quality of ISD processes, and which in turn influences project performance? Does the practice of user responsibility (or user influence) affect project performance only in the presence of established processes? The answers to these questions may allow project managers to plan interventions on involving users in projects to improve project performance.

2. Theoretical background and hypotheses

Due to the rapid changes in today's business environment, user requirements fluctuate constantly to meet business goals, and have become increasingly hard to predict and control [18]. User participation refers to the assignment, activities and behaviors that users or their representatives perform during ISD process [22]. Advocates of user participation claim that effort of users on the project can reduce the uncertainty of user requirements [27]. Many researchers have suggested user participation as an effective way to ensure beneficial results in IS projects, including risk control [29], user satisfaction [37], management quality [45] and system quality [34].

However, previous research also found that user participation can pose more threats to the implementation of IS due to its unknown complexity [56]. IS project teams only benefit from the selection of appropriate user participants [31]. Users lacking knowledge or a clear sense of requirement, or users differed amongst themselves in their requirements might lead to requirement uncertainty [31,41]. Fluctuating requirements could impair the climate of the project and the trust between the users and IS personnel. This in turn could lead to conflicts between users and IS personnel that require significant effort and time to resolve, therefore decreasing process performance [17].

To mitigate the potential negative effects of user participation in the ISD process, and encourage active user participation, several methods and managerial intervention are proposed, including prototyping [11], user partnering [27] and user empowerment [48]. For instance, prototyping helps users understand the specification of system design as their requirements are transformed into system specification [11]. User partnering activities provide an opportunity for users to recognize potential problems, clarify roles and responsibilities, allocate resources, and develop procedures for cooperation [27]. In addition, empowered users who know their roles and responsibilities can better control their own progress [48]. Users might have their own opinion regarding system features that do not meet their needs. Users need power to influence the direction of a project goal if a conflict surfaces. User influence empowers users to exercise their right to work with others and to ensure their needs are deliver in the system [17]. Responsibility of users enhances the motivation of users to collaborate with IS personnel, which in turn promotes communication and strengthens the organizational learning process required to acquire technology. Thus, empowerment and responsibility are regarded as facilitating conditions that increase the odds of IS success [48]. Although user influence and user responsibility are apparently pertinent to project performance, the IS literature related to user participation often overlook these topics.

This study proposes that IT project managers must also be aware of user responsibility and user influence. The exploration of a potential mediation may help explain exactly how user influence (or user responsibility) affects the ability of an ISD project team to achieve successful project management. Since user participation reshapes the process of product development [15], this study adopts three ISD processes as mediating factors to reveal the effects of user influence and user responsibility on project success. The adopted ISD processes include organizational technology learning, project control, and user–IS interaction [41]. Fig. 1 shows the relationships of the proposed model.

This study applies coordination theory, trust theory, and organizational learning theory to clarify the relationships in the proposed model. Coordination theory requires that tasks be allocated across organizational members, and communication and control mechanisms must facilitate the necessary information exchanges and decisional autonomy required for effective collaboration and decision-making [53]. Users with responsibility have greater motivation to communicate with IS personnel and to monitor the progress toward project success. Trust theory indicates that environmental or task uncertainty requires a greater degree of trust among individuals or groups [35]. User responsibility reflects the common goal of project success among users and IS personnel. A common goal is one of the attributes that create a propensity to trust [35] in dealing with uncertainty. Adopting the outcome perspective, Anderson and Narus [2] defined trust as a party's belief that another party will perform actions that will create positive outcomes for the party as well. Trust-based interaction helps different parties achieve the same project goal. Finally, organizational learning theory has considerable relevance to the practice of IS development [3]. Organizational learning occurs constantly through different phases of the software development life cycle. For example, requirement analysis is a typical organizational learning activity that occurs in the initial planning and analysis phases. The following sections use coordination theory, trust theory, and organizational learning to present the hypotheses of this study.

2.1. Effect of user influence and user responsibility on project performance

Requirement specification is a chaotic and iterative process among stakeholders. IS project team members must continuously solicit feedback from other team members to refine system requirements and features until an agreement is reached [33]. The various perceptions of stakeholders involved in an IS project often hinder the development of mutual understanding, and ultimately, the ability to achieve project success [43]. IS developers have difficulty reconciling requirements and specifications with user needs due to the perception gap. Granting users the authority

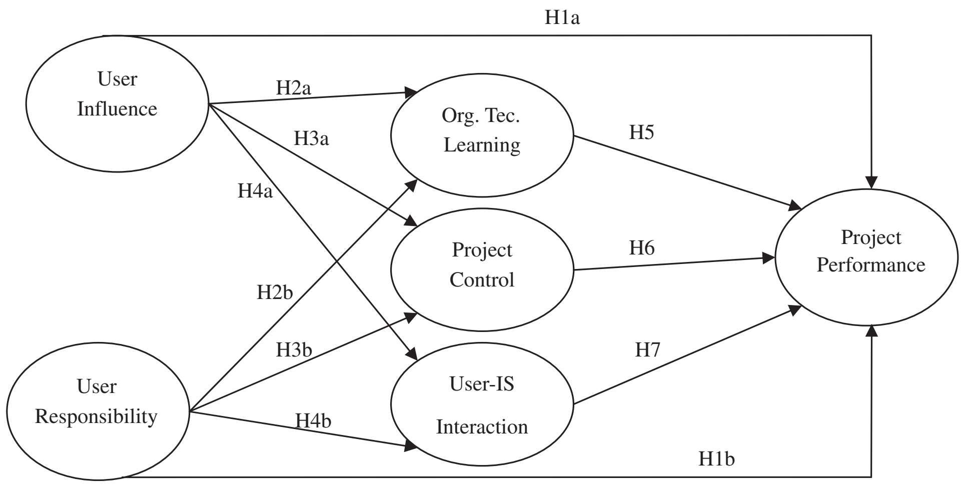

Fig. 1. Proposed research model.

to implement their opinions on IS projects can ensure that the resulting product addresses user needs [7]. Through decision-making, users have the opportunity to understand clearly how the project can be improved. Previous research shows that a high degree of participation by project stakeholders, specifically user influence, improves the success rate of ISD outcomes [30]. Therefore, project managers should ensure that users are actively involved in the requirement determination process to avoid project failure. Based on this background, this study proposes:

H1a. User influence is positively related to project performance.

Uncertainty is one of the primary risks of IS project success [29]. A lack of user participation in the ISD process is one of the factors that lead to uncertainty [27]. Vested with responsibility, users would continue to develop more complex relationships with the adopted system via inspection. User inspection during the ISD process reduces requirement uncertainty and improves system responsiveness [33]. User responsibility ultimately makes users accountable for specific elements of project success. Responsibility and common goals are two factors that not only contribute to a general experience of trust, but also create a propensity to trust [35] between users and IS personnel. Trust enables individuals to deal with task uncertainty, and reduce the uncertainty [35]. Individuals or parties that trust each other are likely to subjugate their own needs and egos in pursuit of a common goal [28]. The positive attitudes characteristics of trust promote knowledge sharing, which in turn clarifies system requirements and project goals. Sharing responsibilities with users, which enables users and IS personnel to work effectively as a team, is positively associated with project outcomes [45]. However, early findings of negative effects associated with user participation dispute the assumption of the positive effects of user participation on ISD projects. Empirical research on user responsibility in the IS field is limited. According to the trust theory and limited IS literature, this study proposes:

H1b. User responsibility is positively related to project performance.

2.2. Effect of user influence and user responsibility on organizational technology learning

Organizational technology learning refers to the technology knowledge or skill acquired by the interaction or activities of a firm [13]. Requirement analysis is a typical organizational learning activity that occurs in the initial planning and analysis phases. Within the user influence, IS personnel would provide information via intensive interaction to help users make proper decisions. Intensive user–IS communication is a necessary activity for improving the effectiveness of analysis and design in high technology development projects [7]. This process treats IS professionals as knowledge disseminators, spreading both technology and functional knowledge in an organization [43]. Many IS developers view system development in a technical way, but users view it in a functional or organizational way. Both IS developers and users can provide valuable insights on how to implement and use systems. These distinct perspectives provide opportunities for learning in a user-influenced environment [50]. Therefore, this study proposes:

H2a. User influence is positively related to organizational technology learning.

The extent of user responsibility is a good indicator of the degree of organizational technology learning. For instance, a user is more likely to examine work in progress and incorporate their comments into the design of a system if that user feels responsible for the quality of the adopted system. A clear user role and responsibility help users perform their assigned roles and get involved with design activities during system development. The execution and discussion of design activities lead to organizational technology learning. Research shows that increasing user responsibility can help an organization successfully develop cross-functional integration [16]. Cross-functional integration provides users the opportunity for technology learning in an organization. Based upon the organizational learning theory [3] and characteristics of user influence and user responsibility, this study proposes the following hypotheses:

H2b. User responsibility is positively related to organizational technology learning.

2.3. Effect of user influence and user responsibility on project control

Project control is the manager-initiated continuous improvement process that prevents deviations from desired outcomes to achieve the project goal, including cost, schedule, and performance. Most ISD projects involve interdependent parties, including users, IS staff, managers, and vendors. Each party has its own domain knowledge, interests to represent, and goals to achieve.

Different parties or stakeholders perceive software projects in different ways [46], and have different perceptions of project risk [27]. Project managers might consciously ignore certain risks due to conflicts of interest. Compared to project insiders (IS personnel), project outsiders can identify more risks and make better decisions to continue, stop, or radically restructure the project [29]. Given the authority of decision-making, users have opportunities to continuously provide their opinions and feedback to IS developers and managers to refine the course of implementation or system features until consensus is reached. Iterative inspections allow users and managers alike to develop realistic expectations of the technologies, schedule, budget, and performance, fostering effective project control. Based on this background, we expect:

H3a. User influence is positively related to project control.

Effective management of project control must adequately consider user needs and opinions [40]. In addition to considering IS personnel, who make decisions in private to fulfill their interests, the project control management requires active collaboration among stakeholders to reach project goal consensus. Encouraging user participation by assigning them responsibilities for system development results might create a sense of ownership of the IS project. The sense of project ownership energizes users to communicate with IS personnel and be involved in design activities during system development. Specifically, users are more likely to actively participate in controlling the project by critiquing, reviewing, and checking development progress to ensure consistency between practical execution and original planning in terms of project goals, quality, budget, and schedule. The implementation of project control relies on assigning the appropriate users to control the schedule and budget, and encouraging them to take responsibility for the project [38]. Therefore, we expect:

H3b. User responsibility is positively related to project control.

2.4. Effect of user influence and user responsibility on user–IS interaction

In most IS projects, stakeholders must work together as effectively as possible to maximize the attainment of shared organizational goals. However, the user–IS chasm exists in most IS projects because of inherent knowledge and skill gaps between users and developers [17]. As a result, most users are unmotivated to engage in discussions with IS personnel, and vice versa. IS developers often play a dominant role, while users play a dependent role, resulting in poor user–IS interaction. To improve the quality of user–IS interaction, IS management must shift the dominance/dependence roles among users and analysts [7]. User influence stresses adopting user opinions and user decisions, and is one way to switch dominance/dependence roles between users and IS personnel. In this case, IS personnel would actively discuss with users to better understand their decision points and achieve common goals. Similarly, to make decisions, users need to understand problems and solve them with IS developers. Solving problems together forces active interaction as a part of a formal or informal process, and facilitates knowledge exchange and integration in IS development teams. Knowledge exchange and integration enhances technology learning and user–IS interaction quality [14]. Based on this background, this study proposes:

H4a. User influence is positively related to user–IS interactions.

As mentioned above, sharing responsibility with users is a process approach for systems development. This approach creates a propensity to trust that overpasses inherent relationships [28] between users and IS personnel. Trust theory asserts that trust can lead to behavioral expectations among individuals and groups, improving their communication and encouraging them to manage uncertainty or risk through their interactions [28]. Thus, sharing the responsibilities of project success with users and IS personnel encourages cooperative behavior and quality communication, which enables them to work together to achieve consensus for project success. Based upon trust theory and the limited IS literature, this study proposes:

H4b. User responsibility is positively related to user–IS interactions.

2.5. Effect of organizational technology learning, project control, and user–IS interaction on project performance

Technical knowledge is essential in any IS development project. A lack of required knowledge among project personnel poses a significant risk to project success [29]. Users that lack the required knowledge for a project hardly contribute useful ideas during ISD processes [31]. As project stakeholders gain familiarity with required knowledge, they become aware of relevant technical support and problem solving needed for a project [36]. Effective technology learning enriches user knowledge, helping them transform their needs into formal system requirements and communicate their needs to the development team. Jiang et al. [26] showed that organizational technology learning plays a mediating role in minimizing the risk of lack of skill on project performance. Vandenbosch and Higgins [52] showed that IS success depends upon IS members' learning effectiveness, and encouraged future research to examine the direct relationship between learning and product success. In fact, many IS researchers and practitioners conclude that organizational technology learning has a positive effect on IS outcomes and organizational outcomes [8,33,51]. Based on the literature, this study expects:

H5. Organizational technology learning is positively related to project performance.

Control theory is extensively adopted in the literature, and specific controls are essential to IS development [25,55]. Here, project control refers to management attempts to influence IS project team members to make progress in accordance with project goals. Software projects that are well planned and controlled are likely to be within budget and schedule. Many firms deploy information systems to support their business strategies in today's competitive environment. In order to deliver a system to meet business goals despite rapidly changing business strategies, proper controls for IS projects are essential [55]. An effective control system must address the multi-dimensional criteria of project performance [47] such as cost, schedule, regulatory compliance and user requirements. Control mechanisms can help project managers assess project progress vis-à-vis overall project goals, as well as quality, budgetary, and scheduling targets. Henderson and Lee [23] suggest that project performance is significantly related to project goals and outcome standards established by managers. Proper control mechanisms are important to IS project implementation [55]. Thus, this study hypothesized that project control is an antecedent of project performance and a possible mediator between user influence (or user responsibility) and project performance:

H6. Project control is positively related to project performance.

The quality of user–IS interaction is critical for improving software project management performance [4]. System development depends heavily on users to actively contribute their opinions and domain knowledge to the IS developers [26]. However, users and IS personnel in most IS projects often have different knowledge and interests [27]. The uncertainty resulting from differences in understanding between users and IS personnel is one of the major risks in an IS project [29]. IS project managers must strive to reduce this gap to achieve a consonant view among stakeholders. User–IS interaction enables the exchange of perceptions, interests and objectives among users and IS personnel and also reduces gaps in mutual understanding during communication. Such interaction is regarded as horizontal coordination [41]. Boehm suggested that effective interaction between users and IS personnel is important for defining project scope and controlling project changes [9]. Therefore, effective user–IS interaction is needed for a common understanding of system requirements and project goals, and considered a prerequisite of project success. Based on the literature and the horizontal coordination theory [41], we propose the following hypothesis:

H7. User–IS interaction is positively related to project performance.

Table 1
Demographic information.

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
	15-Aug	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.

3. Research design

This section presents the specifics of our research design, including sample population and survey measurements.

3.1. Sample

Questionnaires were mailed to 500 IT managers in the US, who were randomly selected from the membership records of the Project Management Institute (PMI) Information Systems Special Interest Group (http://www.pmi-issig.org/). Members of the group were expected to be familiar with software project activities and outcomes. Postage-paid envelopes for each questionnaire were enclosed. All respondents were requested to respond the survey based on their recent experience in an IS project, and all were assured that their responses were confidential. Of the initial surveys mailed, 85 valid responses were received. In order to increase the response rate, two follow-up mailings were conducted. The total number of responses obtained from the three rounds of surveys was 151.

Non-response bias occurs when the survey respondents do not represent the overall target sample. One test for potential non-response bias is to compare demographic data between early and late respondents [49]. The *t*-test scores were calculated for the means of key demographics (work experience, project duration, and team size) obtained in the first and third mailings to test for significant differences. Since no significant differences were found, all respondents were combined in subsequent analyses. Table 1 shows the demographic features of the sample. Project duration and team size, which are widely believed to affect project performance, were included as control factors in the analysis.

3.2. Measures

User influence refers to the extent to which members of an organization affect decisions related to the final design of an information system [37,46]. Three items adopted from Barki and Hartwick [22] were used to measure this construct: (a) the influence of users in decision-making, (b) the user opinions considered, and (c) the overall user influence on a system. The questionnaire asked the respondents to indicate the extent of the influence that users generate during the system development. Each item was presented such that the greater the score, the higher the extent of the particular item, from "not at all" (1) to "a complete extent" (5). Table 2 shows the items used to measure this and other constructs.

User responsibility refers to the assignment and activities reflecting a user's overall accountability or leadership for the ISD project [22]. Many items of user responsibility have been suggested in the literature, including having responsibility for system success, being a project team leader, selecting hardware or software, estimating costs, or requesting additional funds [22]. A subset of these items was used to measure user responsibility, listed in Table 2. Each item was presented such that the greater the score, the higher the extent of the particular item, from "not at all" (1) to "a complete extent"(5).

Organizational technology learning indicates the ability of an organization to adapt technology and acquire knowledge to changing business needs [13]. The original instrument was developed by Cooprider and Henderson [13] and further examined by Nidumolu [41]. Four questions measured acquired knowledge in using key technologies, using development techniques, supporting user businesses, and overall knowledge obtained through the project. Respondents were asked to indicate the extent the items typically occurred when developing information systems in their organizations. Each item was presented such that the greater the score, the higher the extent of the particular item, from "never" (1) to "always" (5).

Project control describes the extent of control over project outcomes and processes. Measurement items, which were adapted from Nidumolu [41], included effective control over project costs, effective control over project schedule, adherence to audit and control standards, and overall control exercised over the project. The control is achieved using methods, tools and procedures of well structure and formalism to deal with the complex and uncertain task of IS development. Respondents were asked to indicate the extent of the items typically occurring when developing information systems in their organizations. Each item was presented such that the greater the score, the higher the extent of the particular item, from "never" (1) to "always" (5).

User–IS interaction represents the interactions between users and IS developers during systems development. Items adopted from Nidumolu [41] measured: complete training provided to users, quality communication between IS unit and users, feelings of users' participation, and overall high quality of interaction. Respondents were asked to indicate the extent the items typically occurred when developing information systems in their organizations. Each item was scored using a five-point scale ranging from "never" (1) to "always" (5).

Table 2
Measurement model – confirmatory factor analysis results.

Construct/indicators	Factor loading	ITC	*t*-Statistics
User influence (CR = .87; AVE = .69; CA = .77)			
1. How much influence did users have in decisions made about his system during its development	.78	.60	10.43
2. To what extent were user opinions about this system actually considered by IS personnel?	.85	.55	27.11
3. Overall, how much personal influence did users have on this system?	.86	.70	16.81
User responsibility (CR = .78; AVE = .55; CA = .60)			
1. Did users have responsibility for requesting additional funds to cover unforeseen time/cost overruns?	.68	.36	7.54
2. Did users have responsibility for the success of the new system?	.87	.45	17.11
3. Did users have main responsibility for the development project during system definition and system implementation?	.65	.43	6.19
Learning (CR = .88, AVE = .64; CA = .8)			
1. Knowledge is acquired by your organization about use of key technologies	.83	.69	25.20
2. Knowledge is acquired by your organization about use of development techniques	.78	.66	14.44
3. Knowledge is acquired by your organization about supporting users activities	.81	.62	21.70
4. Overall knowledge is acquired by your organization through the project conducted	.78	.57	15.37
Project control (CR = .90; AVE = .69; CA = .85)			
1. Effective control over project costs	.82	.66	22.87
2. Effective control over project schedules	.87	.72	35.11
3. Adherence to audit and control standards	.72	.57	10.19
4. Overall control exercised over projects	.91	.81	52.94
User–IS interaction (CR = 0.917; AVE = 0.736; CA = .88)			
1. Complete training provided to users	.70	.56	11.99
2. Quality communication between IS units and users	.88	.75	32.91
3. Users' feelings of participation	.91	.80	48.74
4. Overall high quality of interactions with IS users	.93	.84	50.39
Project management performance (CR = 0.90; AVE = 0.61; CA = .87)			
1. Ability to meet project goals	.79	.69	18.66
2. Expected amount of work completed	.77	.67	16.77
3. High quality of work completed	.75	.62	17.65
4. Adherence to schedule	.82	.73	23.20
5. Adherence to budget	.78	.68	18.11
6. Efficient task operations	.79	.68	17.01

Note: CR: composite reliability; CA: Cronbach alpha; ITC: item-total correlation.

Project Performance contains at least three dimensions: staying within budget, adherence to the schedule, and satisfying user requirements [36]. Others suggest additional dimensions such as the amount and quality of the work produced and the ability to meet project goals [23]. The measurement items employed in this study were adapted from Henderson and Lee [23]. Similar items were also used by Beck et al. [8]. Respondents were asked to indicate their satisfaction towards the project performance for the information systems considered. Each item was scored on a five-point scale ranging from "total disagreement" (1) to "total agreement" (5).

4. Data analysis and results

We applied the method of Partial Least Squares (PLS) to examine constructs and hypothesis, by using PLS-Graph Version 3.01 [10]. The PLS method was chosen because it has minimal demands on sample size and residual distribution and is widely used in IS research [57]. The PLS assesses the measurement model within the context of the structural model by estimating the loadings of indicators on constructs and then by iteratively estimating causal relationships among constructs [12].

The reliability, convergent validity and discriminant validity of the model were tested. Individual item reliability was 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 [24]. Factor loadings should exceed .70 and should be statistically significant (*t*-statistics in Table 2) to confirm reliability [12]. Item-total correlation (ITC) refers to the correlation between an individual item and the total score of all other items in the same construct. The ITC reveals the internal consistency of a construct. Items with extremely low ITC (e.g., <0.3) should be eliminated before further analysis. Thus, the measures for User Responsibility with extremely low loading factor (<0.4) and low ITC (<0.3) were eliminated for the user responsibility construct.

Convergent validity of a construct must be confirmed when the construct is measured by multiple indicators. Convergent validity can be examined by construct reliability, composite reliability (CR), and average variance extracted (AVE) by constructs [5]. Construct reliability can be verified by Cronbach alpha (>.7 recommended) [5]. To obtain the composite reliability 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. The AVE reflects the variance captured by indicators, and a value greater than 0.5 is recommended [5]. Table 2 shows the statistical results, which confirmed that the constructs adopted in this study had acceptable convergent validity.

Discriminant validity indicates whether the measures of constructs differ from each other. It is assessed by testing whether the square root of the AVE exceeds the correlation coefficients [11]. For each construct in this study, the square root of AVE exceeds the correlation between each pair of constructs (see Table 3). The skewness and kurtosis of each construct were small, which indicated a normal distribution in the constructs [19]. Discriminant validity can also be examined by testing whether each indicator has a higher loading on the construct of interest than on any other constructs [10]. This study includes exploratory factor analysis to evaluate the discriminant validity of the considered variables. EFA was performed on the indicators of the variables using SPSS 18.0. All cross loadings in the analysis results are equal or lower than 0.5. The loading analysis results confirmed the discriminant validity and convergent validity of observed indicators.

Multicollinearity is indicated by very strong correlations (>.80) among independent variables [1], by VIF exceeding 4.0, or by toler-

Table 3
Descriptive analysis and correlations.

Variables	Mean	SD	M3	M4	H%	Correlations (and AVE square root)					
						UI	UR	L	PC	UII	PP
User influence (UI)	3.75	0.83	−1.09	1.52	58.3	**.83**					
User responsibility (UR)	2.70	0.94	−0.02	−0.73	13.2	.33*	**.74**				
Learning (L)	3.58	0.76	−0.40	0.36	40.0	.37*	.24*	**.80**			
Project control (PC)	3.34	0.89	−0.42	0.10	27.2	.46*	.28*	.46*	**.83**		
User–IS interaction (UII)	3.49	0.86	−0.44	−0.16	37.6	.46*	.47*	.34*	.54*	**.86**	
Project performance (PP)	3.65	0.78	−0.24	−0.61	40.4	.47*	.29*	.40*	.68*	.53*	**.78**

Note: AVE square roots appear on the correlations diagonal; M3: skewness; M4: kurtosis.
* $p < .01$; H%: percentage of high scores (i.e., ⩾4).

ance less than 0.2 [19]. Table 3 shows that correlations between constructs ranged from 0.24 to 0.55. To further examine multicollinearity, SPSS was used to examine PLS output for collinearity. All VIF values ranged from 1.33 to 1.78, and tolerance values ranged from 0.56 to 0.75, which indicated that multicollinearity was not problematic in the data analysis (see Table 6 in Appendix A). User influence revealed correlations of 0.46 with project control, 0.37 with learning, and 0.47 with project performance, which were stronger than the correlations of user responsibility with project control (0.28), learning (0.24), and project performance (0.29). The percentile of "high score" listed in Table 3 shows the extent of user influence and user responsibility in the project teams considered.

Table 4 shows the results of the structural equation model. All hypotheses except H1b, H2b and H5 were supported. Non-significant paths indicate full mediation or dominance by the mediators which show significance to project performance. The *t*-statistics for these supported hypotheses were all significant at the .05 level. The total variance explained for user–IS interaction quality reached 0.33, which indicated that user influence and user responsibility play important roles for improving the interaction between users and IS staffs. The total variance explained for project performance in the examined model was 0.52, which is considered reasonably high in social science studies. Both user influence and user responsibility positively impacted interaction quality with path coefficients of 0.35 and 0.36, respectively. The path coefficients of user influence to learning and project control were 0.32 and 0.41, respectively, which significantly differed from those of user responsibility to learning (0.14) and project control (0.14).

For the considered processes, both project control and user–IS interaction positively impact project performance, with path coefficients of 0.48 and 0.17, respectively. Table 3 shows that user influence and user responsibility were positively correlated with project performance (0.47 and 0.29, respectively). Table 5 summarizes the hypotheses testing results.

5. Discussion

This survey of 151 IT project managers confirms the positive relationship among user influence and user responsibility on project performance. The analysis results show that user influence and responsibility can produce better quality ISD processes for IS project teams. Specifically, the practice of user influence and responsibility significantly improves the quality of user–IS interaction. Interestingly, the processes that they improve are substantially different in degree. User responsibility prompts interaction quality but not learning or project control. Interaction quality can be improved even more by user responsibility together with user influence. A possible explanation is that the responsibility to users induces users' intention to communicate with IS personnel, but not vice versa. On the other hand, user influence significantly affected all processes considered, especially project control, which had the largest effect on project performance.

Accordingly, project managers should note that requesting user responsibility may not enable IS personnel to provide users with sufficient knowledge and information for improving learning and project control. On the other hand, user influence prompts IS personnel to communicate with users in order to obtain a consensus when making a decision for system requirements and project goals. The communication intention of IS personnel thus significantly improves learning and project control significantly.

In addition to confirming the effect process quality on project success, the analysis results show that ISD processes (i.e., organizational technology learning, project control, and user–IS interactions) have a fully mediating effect between user responsibility and project performance and a partially mediating effect between user influence and project performance. This indicates that user influence and user responsibility significantly improve process performance and therefore benefit project management. These findings clarify the inclusive result about the impact of user participation on project performance reported in the literature and have important implications for both practice and research.

5.1. Managerial implications

This study presents two major implications for IT project managers. For IT project managers, a major implication of this study is that user influence should be more emphasized than user responsibility. Inviting users and requesting them to take responsibility for the results of the system development is not sufficient to reach

Table 4
Path analysis results (hypothesis testing).

Independent variables	Dependent variables			
	Learning	Project control	User–IS interaction	Project performance
User influence	.32**	.41**	.35**	.14*
User responsibility	.14	.14*	.36**	.01
Learning				.07
Project control				.48**
User–IS interaction				.17*
R^2	.15	.23	.33	.52

One-tailed: * $p < .05$; ** $p < .01$.

Table 5
Summary of hypothesis tests.

Hypothesis	Test results
H1a: User influence is positively related to project performance	Supported
H1b: User responsibility is positively related to project performance	Not supported
H2a: User influence is positively related to organizational technology learning	Supported
H2b: User responsibility is positively related to organizational technology learning	Not supported
H3a: User influence is positively related to project control	Supported
H3b: User responsibility is positively related to project control	Supported
H4a: User influence is positively related to user–IS interactions	Supported
H4b: User responsibility is positively related to user–IS interactions	Supported
H5: Organizational technology learning is positively related to project performance	Not supported
H6: Project control is positively related to project performance	Supported
H7: Effective user–IS interactions is positively related to project performance	Supported

an effective IS development. User influence can be exerted through formal procedures or informal practices. Development methods that heavily empower users are more likely to promote user–IS interactions. For example, a large scale e-bank reportedly used unsolicited feedback to promote user influence and user–IS interactions [39]. Project managers can also employ internal auditors to conduct project health checks (PHCs) periodically to assess whether inherent risks are under control [42]. The employment of internal auditors is a form of user influence for improving project control and effective user–IS interactions.

Second, project control is more significant to project management among the system development processes. Continuously monitoring and controlling the system implementation process is essential for improving project performance. Project control techniques, such as control charts and process sigma, can help in fine-tuning the system development life cycle [20]. Vendor-based sponsors also play control roles in project performance by protecting project quality and resourcing the project [32]. Efficient management controls, including management review and change control, can enhance software flexibility and maintainability as well as project performance [54]. An IT project manager needs to employ effective control techniques to increase the success of system development.

5.2. Research implications

One implication of this study is that evaluating the overall practice of user participation cannot clarify how users affect IS project performance. The significant components of user participation must be evaluated separately to explore their effects on ISD process performance. User influence and user responsibility can provide further insight into user participation. Second, user influence associated with user responsibility can effectively improve IS process quality. User responsibility improves project control and promotes user–IS interactions. Compared to user responsibility, user influence has a greater effect on overall processes, especially on learning and project control. This implies the significance of user influence on the research of IS projects for improving process performance.

Finally, the system development process has significant mediating effects on the impact of user participation to project performance, particularly project control and user–IS interactions. User influence directly impacts project performance whereas user responsibility indirectly impacts project performance through quality ISD process. These findings clarify the relationships among user influence, user responsibility, and IT project performance.

5.3. Limitations

The first limitation of the study is that project mangers, rather than users, were asked about user influence and responsibility based on their perception. This survey is an indirect measure, and is widely adopted in the literature, e.g., [27,55]. However, single IT managers were the only source of the survey instrument for each project considered, which raises the possibility of single respondent bias. Second, self-perception of project performance may be a possible bias. However, self-appraisal is regarded as a valid predictor of performance because individuals often judges their own performance in a complete aspect for the dimensions of performance [27]. Third, this study considered only a set of dimensions for the measure of project performance. Several dimensions of system success are not included, such as system usage, user satisfaction, impact to individuals, and to organization. The fourth potential limitation is that the questionnaire asked IT managers to recall their recent experiences. Because the measures required perceptive evaluations after project completion, memories may have faded or may have become confused with memories of other projects and processes. However, recall is the only viable way to conduct data collection in a survey.

6. Conclusion and outlook

The contribution of this study is threefold. First, it provides researchers with a new avenue of examining the effects of user participation – for example, user influence and user responsibility. Second, it provides researchers with a larger picture of how users influence the final project outcomes, in addition to user participation. Third, this study explores the effects of user influence and user responsibility on the system development process. Results of the analysis show that the management practice of user influence and responsibility can encourage quality processes, which in turn improves project management performance. This study makes a case for not treating user participation as a single activity to manage. More general user participation does not necessarily contribute to the improvement of project performance. Although user participation is a specific construct of ISD theory, the findings in this study stress the importance of further decomposing this construct into user influence and user responsibility due to their different effects on mediating factors and project performance.

An effective IT project manager needs to delicately manage user participation by balancing user influence and user responsibility across the system development life cycle. This study highlights the importance of increasing user influence in an attempt to increase organizational technology learning, project control, and user–IS interaction. Improving these three areas can lead to improved project performance. User influence has a direct effect on increased project performance. However, overemphasizing user responsibility cannot produce the same coordination or close ties with project performance as user influence. This might be because user responsibility cannot significantly improve project control and organizational technology learning. Thus, the exercise of user responsibility alone cannot directly increase project performance.

Table 6
Statistics for multicollinearity.

	Standardized coefficients			Correlations			Collinearity statistics	
	Beta	*t*-Test	Sig.	Zero-order	Partial	Part	Tolerance	VIF
(Constant)		.018	.986	.461	.151	.106	.697	1.435
UI	.127	1.822	.071	.290	.040	.028	.751	1.332
UR	.032	.473	.637	.403	.075	.052	.746	1.340
OL	.061	.901	.369	.684	.490	.390	.590	1.694
PC	.507	6.696	.000	.521	.164	.115	.562	1.778
UII	.154	1.982	.049					

The merit of considering user influence in terms of influencing project performance can be examined in the virtual project context where users have less influence on project outcomes than they do in face-to-face projects. Global IT projects often transcend country boundaries and involve users and developers with varying cultural backgrounds. For instance, the directive control of top management on the system development process may fail to earn trust from Korean system developers [44]. User influence in JAD meetings plays a more important role for Korean developers in enhancing user–IS communication and project performance. In contrast, unmet project goals rather than user participation play a more important role for US and Japanese developers. How will cultural factors influence the effect of user influence on user–IS interactions, organizational technology learning, and project control? What kinds of influence can a user exert to effectively manage a project? The isomorphism between user influence and project performance may be weaker in virtual, global IT projects. Future research should replicate this study in virtual, global IT projects and examine if the effect of mediating factors between user influence and project performance still exist. If not, what other factors are more relevant in the virtual, global context? This study provides an impetus for continued discussion on the importance of assessing user participation as a multi-factor, consisting of user influence and user responsibility, in different IT project management contexts.

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Appendix A

See Table 6.

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