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Antecedents and Consequences of User Co-Production in Information System Development Projects

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Abstract

A significant number of information system development (ISD) projects fail to achieve their predefined goals on time and/or within budget. Many organizations recognize that users can engage in projects to minimize the difficulties in effectively controlling the project and maximize the value created; therefore, user co-production is a crucial for organizations to enhance the effectiveness of ISD project. This study attempts to understand the antecedents and consequences of user co-production in ISD project. As a key contribution, we posit that user co-production is influenced by social capitals between users and developers. We then postulate that user co-production determines the project outcomes, which are shaped by system quality, user satisfaction and project performance. Data were gathered from a questionnaire survey of 103 pairs of user representatives and developers. Our results show that project outcomes are significantly influenced by user co-production. Furthermore, social capitals between user representatives and developers have positively significant influence on user co-production.

Keywords

User participation, Information system development project, User co-production, Social Capital, Project outcomes

1. Introduction

The management information system department of an organization has long been considered as a support function. In addition, information system development (ISD) work is regarded as an artifact to support business operation. However, researchers repeatedly report that a significant number of ISD projects fail to achieve their PREDEFINED goals on time and/or within budget (Highsmith & Cockburn, 2001; Rubinstein, 2007). Extra financial and time costs are incurred when the final systems fail ultimately to meet the users' desired functionalities and requirements (Procaccino & Verner, 2009; Wallace, Keil, & Rai, 2004a). To prevent such additional costs, it is important for users to engage in the design, development and even consumption process so as to minimize the difficulties in effectively controlling the project and maximize the value created (He & King, 2008; Wallace et al., 2004a).

Service-dominant logic, an emerging concept, also indicates that co-production is one of the key activities in service delivery. Customers contribution to the service-delivering process is as vital as that of the service providers for the maximization of the value delivered (Bettencourt, Ostrom, Brown, & Roundtree, 2002). This implies that, in an ISD context, users should be more active in identifying the significant value to them as well as in helping providers to customize and deliver the appropriate service. The quality of the final system is a function of the extent to which users and developers are able to work together smoothly to co-produce a system capable of supporting business operation. Empirical studies have shown that user co-production benefits ISD project team performance by enhancing knowledge co-production and coordination between developer and users (Hsu, Lo, Lin, & Cheng, 2010; Shim, Sheu, Chen, Jiang, & Klein, 2010).

Given the importance of user co-production, understanding how to enhance the effectiveness of co-production becomes a critical question to address. The lack of systematic examination of the co-production concept and its antecedents in the extant literature has resulted in poor understanding of this question. Drawing on the issues mentioned above, this study attempts to explore: (1) the direct impacts of co-production on project outcomes, and (2) the critical determinants of effective co-production from a social capital perspective, adopted because ISD co-production is a process in which users and developers work closely to maximize value.

The next section review prior literature. Subsequently, conceptual model and hypotheses are presented, followed by a description of the research methodology and data collection procedure. After the data analysis results and related discussions, the paper ends with conclusions and the implications of the study for future research.

2. Literature Review

2.1 Social Capital Theory

Social capital, initially appearing in sociology studies, may be viewed as "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition" (Bourdieu, 1986). With social capital, individual actors in one social structure can obtain resources that they do not possess but are needed in order to perform certain actions. In this way, the performance of the individual actor can be improved.

Nahapiet and Ghoshal (1998) first classified social capital into structural, cognitive and relational social capital. While structural social capital depicts the interaction pattern between actors, relational social capital refers to the quality of personal relationships such as trust and trustworthiness, norms and sanctions, obligations and expectations. Cognitive social capital reflects the extent to which members in the same community have shared representation, shared language, shared interpretation, and shared mental models (Nahapiet & Ghoshal, 1998) . In the IS field, social capital theory has been widely adopted to investigate knowledge sharing (Chiu, Hsu, & Wang, 2006), knowledge transfer (Rottman, 2008), knowledge management system usage (He, Qiao, & Wei, 2009), and continuance intention of online auction (Wang & Chiang, 2009). We therefore follow the main research stream and attempt to examine the impact of the user-IS social capitals on co-production. In this study, structure capital is described as frequent interaction between user representatives and developers; relational capital is referred to as the mutual trust between user representatives and developers; and cognitive dimension is referred to as shared understanding and shared mental model.

2.2 From Goods-Dominant Logic to Service-Dominant Logic

The traditional perception of value as being generated through a change in form during the manufacturing process is referred to as goods-dominant (G-D) logic and is based on the value-in-exchange meaning of value (Vargo & Lusch, 2004). During the last century, the marketing field grew to encompass the study of positive issues (how firms and customers go to market) and normative issues (how firms should market to customers) (Vargo & Lusch, 2008). These changes have resulted in a shift toward a new economic environment－a service economy, an outcome of which is the replacement of G-D logic with service-dominant (S-D) logic.

From a S-D perspective, marketing is a continuous process in which consumers should participate in the production of value (Vargo & Lusch, 2004). Co-production may be viewed as “buyer-seller social interaction and adaptability with a view to attaining further value”

(Wikström, 1996). In contrast to G-D logic, S-D logic emphasizes the importance of the service provider coordinating with the client, who actively participates in product design and development. Customers provide a complement to the knowledge, resources and equipment provided by the company. Higher new value can be generated jointly through effective coordination of those complementary resources (Wikström, 1996).

2.3 From User Participation to User Co-production

For decades, user participation, referring to the participation of target user groups in the system development process, has received considerable attention from researchers (Aladwani, Rai, & Ramaprasad, 2000; Cavaye, 1995; He & King, 2008; Lynch & Gregor, 2004; Olson & Ives, 1981; Swanson, 1974). Although many studies assert that software projects benefit from involving users in the development process, the actual effect of such participation is debatable. Researchers continue to report that project performance is undermined by user-IS conflicts, communication gaps, and frequent modifications to requirements (Maruping, Venkatesh, & Agarwal, 2009; Shim et al., 2010). This implies the need to redefine the role of user. Different from the traditional notion of participation, this study adopts the S-D logic concept and applies it in the ISD context. We argue that when information systems are co-produced by users and developers, the final value is determined by the effectiveness of the co-production. Users should actively involve in the development process to maximize the value created and to ensure that the developed system meets their needs.

By viewing ISD as an internal service in which IS developers as service providers and users as client, we adopt the concept proposed by Bettencourt et al. and treat information system development (ISD) as a value co-production process. Bettencourt et al. (2002) proposed co-production as a concept that included seven major behaviors: Communication openness is regarded as the extent to which client and developer openly share with each other information about the project; Shared problem solving refers to users acting on their own initiative and sharing responsibility for developing solutions as well as resolving issues and problems arising in projects; Involvement in project governance implies the importance of users taking an active role in monitoring project progress toward predefined project goals and of their determining jointly with the developers the milestones of the project; Personal dedication reflects a sense of personal obligation towards project success , in which users are occupied not only by their routine work, but also by project work; Tolerance refers to users' ability to respond with understanding and patience to minor project encumbrances, glitches and inconveniences; Advocacy refers to a vocal advocate who acts as a salesperson for the project, promoting its merits; and lastly, accommodation refers to the extent to which users demonstrate the willingness to accommodate the desires, approach, and expert judgment of the developers.

3. Research Methods

3.1 Hypotheses development

The Relationship Between User Co-production and Project Outcomes

System quality refers to reliability, response time, ease of use, and ease of learning of system (Belardo, Karwan, & Wallace, 1982). It can also be viewed as the efficiency, reliability, accuracy, ease of using, and ability to generate the information that users need (He & King, 2008). System quality can be assured through the information exchange between users and developers in the co-production process (Hsu, Chan, Liu, & Chen, 2008). For example, users' needs can be assured through open communication between users and developers. User representatives may help by providing possible solutions to solve problems, which may in turn enhance the system's reliability (Moorman & Blakely, 1995). Conflicts emerging during the development process not only destroy the relationship but also lead to a low quality of teamwork.

H_1: *User co-production is positively associated with system quality.*

User satisfaction is defined as the extent that users feel the systems or systems deliverables meet their needs, requirements, and expectations (He & King, 2008). Users are more satisfied when they participate in the co-production process for the following reasons. First, users have a better understanding of the functions, limitations, and strengths of the system can be obtained through the process. Second, according to Locke and Schweiger's (1979) research, a high level of engagement increases satisfaction. User representatives take a project as part of their life through the joint decision-making and problem-resolving process; through helping project governance; and through devoting their individual time to the project. Third, through the co-production process, users' requirements are assured and the developed system can better reflect their actual needs. Higher satisfaction is, therefore, expected. Therefore, we hypothesize that

H_2: *User and developer's co-production is positively associated with user satisfaction.*

Project performance is defined as the efficiency of system development work (He & King, 2008). Project performance can be improved with user co-production for the following reasons. First, information exchange between users and developers allows developers to acquire real business needs in the early stage and avoid rework in the later stage. The project is more likely to be accomplished within the budget and schedule. Second, project performance is enhanced when user representatives are involved in problem resolving (Tesch, Sobol, Klein, & Jiang, 2009). Third, users involved in project governance drive developers to accomplish predefined goals on time (Jones & Harrison, 1996). In addition, empirical study also showed a significant relationship between co-production and development project outcome (Shim et al., 2010). Therefore, we hypothesize that

H_3: User and developer's co-production is positively associated with project performance.

The Relationships from Social Capital to User Co-production

Structural social capital refers to the frequency of interaction between users and developers in an ISD context. It is the basis for information exchange (Wasko & Faraj, 2005) and knowledge sharing(van den Hooff & de Winter, 2011). Previous study indicated that structural social capital is the means to ensure that things are done and goals are achieved (Adler & Kwon, 2002; Atuahene-Gima & Murray, 2007) and significantly affects information transfer (Bolino, Turnley, & Bloodgood, 2002; Hanson & Krackhardt, 1993). The informal interaction mechanism serves as a complementary channel which allows users to openly communicate with developers. With the formal interaction mechanism, such as participating in review meetings, users are allowed to jointly solve problems and involve themselves in project governance. Therefore, we hypothesize that:

H_4: Structural social capital is positively associated with co-production.

Co-production requires users and developers to communicate with each other, and the effectiveness of communication is determined by the extent to which a shared understanding exists (Bettencourt et al., 2002; Moorman & Blakely, 1995). By having the same understanding toward the goal and the procedure to reach that goal, developers can accommodate themselves to users' needs, and users can adjust themselves to fit the developers'. Good communication can possibly reduce conflicts and enhance joint problem solving. IS developers can modify the system design to fulfill users' special requirements, or users can abandon some irrational requirements (Bettencourt et al., 2002). Therefore, we hypothesize that:

H_5: Cognitive social capital is positively associated with co-production.

Trust can improve communication and information exchange (Duhan & Sandvik, 2009; Heide & John, 1992) and also can enhance interaction and shared problem solving (Duhan & Sandvik, 2009; Kaufmann & Stern, 1988). When problems occur, a high level of trust allows users and developers to possess an open attitude to solve problem jointly. Users and developers can adjust themselves to align with each other when they trust each other (Bettencourt et al., 2002; Heide & John, 1992). Moreover, trust also allows both parties to ignore minor issues, such as deviation from predefined plans, and leads to commitment, which is the basis for resource devotion (Bettencourt et al., 2002; Borman & Motowidlo, 1993). Finally, successful system development requires not only developers but also users to dedicate themselves to the development work. User representatives are more willing to spend time on the project when they have a strong trust with the developers. Therefore, we hypothesize that

H_6: Relational social capital is positively associated with co-production.

3.2 Sample and Data Collection

A field survey was conducted to empirically test the hypotheses. The target sample consisted of projects, including an in-house system project and outsourcing system project in Taiwan. Data were collected through a matched pair survey of user representatives and developers from each project. Given that co-production is the process used to engage in the development process, there is a need to obtain data from both developers and users to comprehend their respective viewpoints. The survey instrument was pretested with 3 academic field experts and 3 practicing IS developers, and a pilot test was conducted at the information department of a steel company in southern Taiwan. The pretest and pilot test were used to measure validity and reliability of the operational measures of the survey.

Data collection was conducted from March to June 2011. Since the study focuses on information system project development, the data were collected from 103 pairs of respondents based on the most recently completed system development project. Of the users, 49% were male and 51% were female. In terms of the tenure, 2.9% of the users work less than 1 year, 51.5% of them 1-10 years, 30.3% of them 11-20 years and 12.6% of them over 21 years. Moreover, of the developers, 65% were male and 35% were female. In terms of the tenure, 7.8% of the developers work less than 1 year, 69.9% of them 1-10 years, 19.4% of them 11-20 years and 2.9% of them over 21 years.

Among 103 projects, the major industry types are manufacturing, service, and education. Most of projects (87.3%) have less than 10 members and 83.5% of projects have less than 5 million budget. In terms of duration in project, 17.5% of the projects are less than 3 months, 36% are 3-12 months, 32% are 1-2 years, and 14.5% are over 2 years.

3.3 Constructs and Measurement

The measurement items were adopted from past studies and revised based on pretest results. Both user representatives and developers were asked to provide information for social capitals and co-production. With respect to the dependent variables, excluding project performance, which had to be assessed by project managers, user representatives were asked to detail their perceptions of system quality and levels of satisfaction with the developed system. All items were on a five-point Likert scale to measure the constructs. Constructs and their corresponding measurements were shown in Table 1. In addition, variables may influence project performance, including project size, duration, and budget, are also controlled.

Construct	Definition	#	Source
Structural social capital	The interaction between user representatives and developers	3	Patnayakuni, Rai, and Tiwana (2007)
Cognitive social capital	The shared understanding existed between user representatives and developers	6	Simons and Peterson (2000)
Relational social capital	The level of trust between user representatives and developers	5	Ko et al. (2005)
Communication openness	The willingness of user representatives to exchange information with developers without reservation	4	Heide and Miner (1992)
Shared problem	The willingness of user representatives to share the responsibility for resolving the problems	4	Heide and Miner (1992)
Personal dedication	The measurement of whether users worked above and beyond their defined duties	4	Moorman and Blakely (1995)
Tolerance	The willingness of user representatives to tolerate less than ideal conditions without complaint	3	MacKenzie, Podsakoff, and Fetter (1993)
Advocacy	User representatives encouraged other users to utilize the system	4	Moorman and Blakely (1995)
Accommodation	User representatives adjusted their behavior to meet the needs of developers	4	Heide and Miner (1992)
Involvement	User representatives' capacity to keep abreast of changes in the project team	4	MacKenzie et al. (1993)
System quality	The reliability, adaptability, and ease of use of the end users	5	Wallace, Keil, and Rai (2004b)
User satisfaction	The perceptions of end users about the completed information system	3	Chan, Yim, and Lam (2010)
Project performance	The measurement of system development work adhered to the predefined budget and schedule	5	Wallace et al. (2004b)

Table 1: Operational definition of constructs

3.4 Reliability and Validity

The reliability of all constructs is well above 0.7 and factors loadings of each measure item are above 0.5 as well. Through the reliability test, this questionnaire can be assumed to be reliable. The item-total correlation (ITC), composite reliability (CR), and average variance extracted (AVE) values indicate high convergent validity (Fornell & Lareker, 1981). Discriminant validity is also assured because the correlations coefficients among variables are less than 0.90 and the square root of AVE are greater than inter-construct correlation coefficients (Fornell & Lareker, 1981).

4. Hypothesis Test: Structural Model

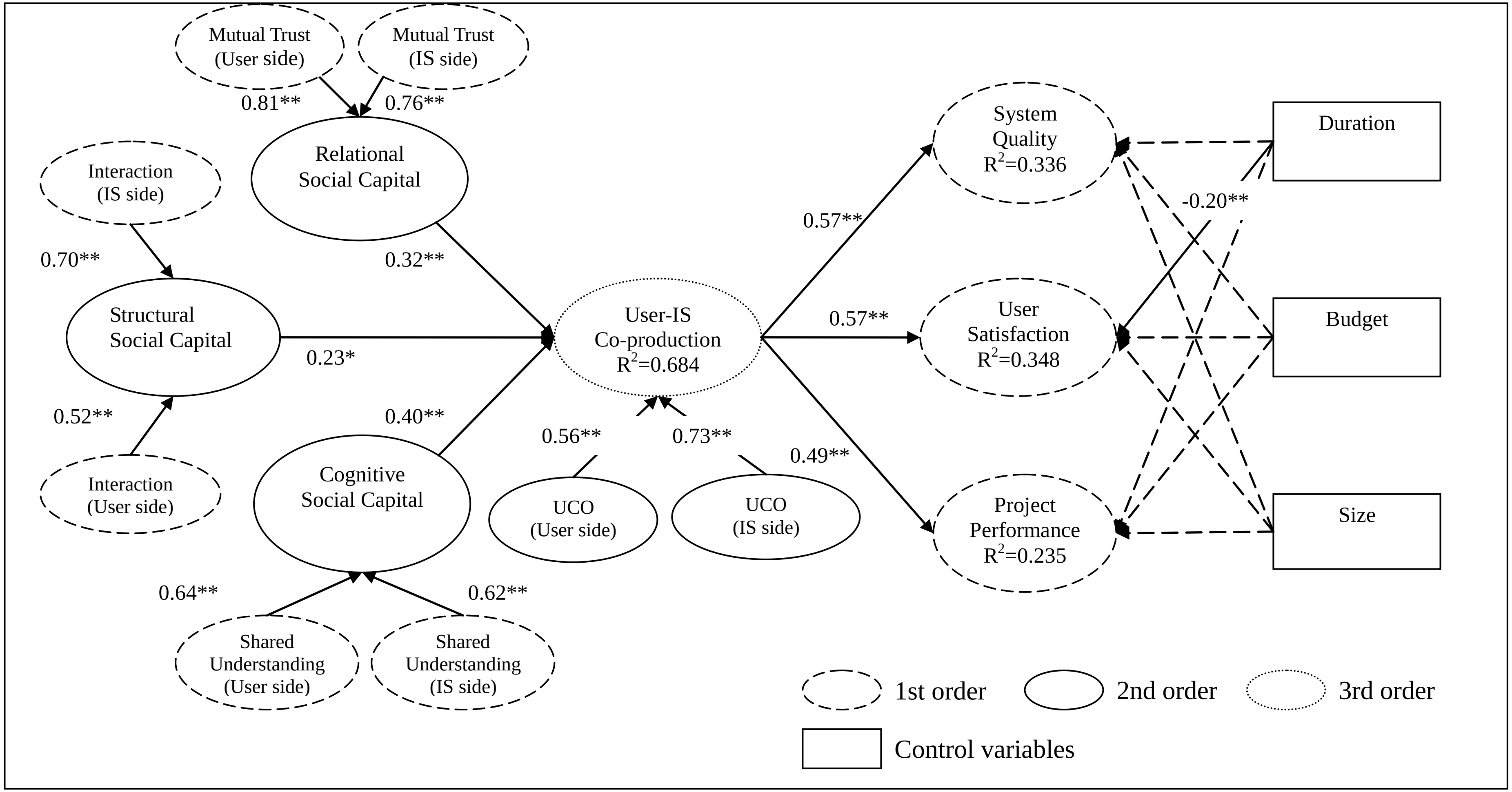
We applied partial least square (PLS) with bootstrapping technique to examine the proposed model (Chin, 1998). Since the three social capitals are a second-order formative construct and co-production is a third-order formative construct, a two-step approach was adopted for the structural model analysis. We first transferred each first-order construct into factor scores, which then served as indicators of the relevant second-order formative construct. The same approach was used to create the third-order formative construct – co-production.

Based on the significant path coefficients (Figure 1), all hypotheses were supported ($p<0.01$). The path coefficients from user co-production to project performance, system quality and user satisfaction ($\beta=0.49$; $\beta=0.57$; $\beta=0.57$), indicate that user co-production can effectively promote project outcomes. The path coefficients from three social capitals to co-production ($\beta= 0.32$; $\beta= 0.23$; $\beta= 0.40$) indicate that all three types of social capital contribute to co-production. Furthermore, three types of social capital explain 68.4 per cent variance of user co-production. User co-production explains 33.6 percent variance of system quality, 34.8 percent variance of user satisfaction and 23.5 percent variance of project performance.

5. Discussion and Conclusion

The purpose of the research has been to (1) examine the influence of user co-production on different project outcomes (including project performance, system quality, and user satisfaction); and (2) explore the critical determinants of co-production based on social capital theory. A total of 103 data pairs from both developers and user representatives on the same project in Taiwan confirmed our proposed hypotheses. The results indicate that user co-production can effectively promote project outcomes and that all three social capitals have effects on co-production. This finding produces several implications for academic researchers and practitioners, as indicated below.

Although user participation has been widely studied, this is one of the few studies based on service-dominant logic to understand the important role of user representatives in ISD projects. We followed the concept proposed by Bettencour et al. (2002) and provided empirical evidence to confirm the importance of co-production. We successfully demonstrated that user co-production can lead to higher project performance, better system quality, and higher levels of user satisfaction. Our results imply that users should regard themselves as service receivers and act as active co-producers to ensure that value is maximized. For social capital research, this study provides further empirical evidence to show how social capitals between users and developers encourage users to adopt co-production behaviors. Finally, we examined our proposed ideas by collecting responses from both developers and users. Since social capitals exist between users and developers, exclusive reliance on one party only is insufficient to depict the whole picture. We believe our result, based on a more comprehensive perception, is able to generate a more robust and precise result.



*: p<0.05, **: p<0.01

Figure 1: Structural Model and Path Coefficients

For practitioners, the significant and positive impacts of co-production on project performance, system quality, and user satisfaction affirmed its critical role. In addition, the importance of social capitals in co-production implies that (1) managers should pay more attention to user representative selection; and (2) action should be taken when social capitals are low or even absent. Specifically, relevant experience and knowledge is required for representatives to engage in project governance and joint problem-solving activities. On the other hand, users who have strong relationships with developers should be chosen as representatives. Lastly, it is not uncommon for new employees or users without any ISD experience or IT knowledge to be selected to participate in projects. Workshops or training programs may be provided to strengthen representatives' knowledge and understanding of ISD to facilitate their engagement.

6. Limitations and Suggestions for Future Research

As with most empirical studies, there are limitations to this study. First, regional data were collected from Taiwan only. Second, a cross-sectional study was used to verify the proposed relationships. Third, we included only one variable in each type of social capital. Future research may extend the current study by including other potential variables (such as identification, norms, or shared language) mentioned by Nahapiet and Ghoshal (1998). Finally, we included only one user representative and one developer for each project. Since more than one user may participate in a single project, future studies are encouraged to collect data from more than one respondent from each side to truly reflect actual co-production.

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