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Culture Dynamics of Information and Communication Technology (ICT) Adoption in Construction Companies

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CULTURE DYNAMICS OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) ADOPTION IN CONSTRUCTION COMPANIES

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ABSTRACT

Innovation is essential in enhancing organizational efficiency and performance, particularly in a rapidly globalizing market. Substantial hidden innovations exist in the construction sector, such as information and communication technology (ICT), which has been identified as a key to enhance information processing in construction. However, technology does not necessarily bring success to an organization. Innovation adoption processes are embedded in organizational culture, which varies from organization to organization. Due to the dual nature of technology and the dynamic nature of culture, the relationship between technology and culture is bidirectional. The technology interacts with organizational culture when an individual attempts to perform their tasks by adopting the technology. This sheds light on the importance of investigating the fit between technology, culture, person and task in ICT adoption in construction.

Based on the literature review, a conceptual framework is developed for the interaction between technology, culture, task and person. The framework includes two levels: organizational level and individual level. The organizational level interaction is technology centered, focusing on the fit between the values embedded in organizational culture and in the technology. The individual level interaction is task centered, which focuses on the fit between the technology and task requirements, and the fit between competency of an individual and the task requirements. The various key constructs are also identified: i) culture–technology fit, ii) task–technology fit, iii) person–task fit, iv) person–culture fit and v) information behavior. Based on the study, a subset of empirical framework is developed for further analyses, and two propositions are put forward based on the framework: i) Technology-culture fit at organizational level is associated with task-technology fit at individual level, and ii) Individual value preference, information behavior and person-task fit influence task-technology fit.

KEYWORDS: construction, technology-culture fit, information and communication technology, innovation, task-technology fit

INTRODUCTION

Information and communication technology (ICT) has recently been identified as an essential innovation improving communication in the construction processes. ICT has been found to add values to information management in construction, including shortened project duration, enhanced processing of progress claims, contract administration, organizational image and user satisfaction (Stewart and Mohamed 2003). Previous research works on ICT adoption in construction mainly focus on integration of technology and management process (e.g. Zhu and Augenbroe 2006), system functions and task requirements (e.g. Sacks et al. 2010), values created

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by ICT (e.g. Stewart and Mohamed 2003), the effect of organization culture and human factors (e.g. Peansupap et al. 2003, 2005), and the problematic ICT implementation issues such as lack of information technology (IT) infrastructure, lack of IT staff, investment cost, lack of ICT business requirements, unclear benefits of ICT use, and behavioral barriers (Love et al., 2001). However, there is a lack of focus on the association between culture and technology. In fact, the adoption processes of ICT are embedded in organizational culture which varies between organizations. The long-term success of information systems in collaboration-oriented projects, construction projects in particular, depends on trust, collaboration, and information sharing among participants (Nuntasunti and Bernold 2006), which are all culture-driven. On the other hand, high ICT diffusion of an organization requires an open-discussion environment, support from colleagues, and support from supervisors (Peansupap et al., 2003), which are again, culture-driven. Hence, focusing on adaptation of technologies alone, while ignoring or underestimating the importance of organizational culture, change, and the cognitive level and behavioral habits of people, can hardly bring successful outcomes (Erdogan et al. 2008).

The gap between technology and culture is noteworthy in the construction industry. Although there are various innovative technologies diffused in the construction sector, due to the perception of conservatism in established practices and the values of uncertainty avoidance, the application of Building Information Modeling (BIM) in the construction sector is still low and limited to the technical level (e.g., RICS 2011). In fact, culture has been identified as the root of innovation (e.g., Patterson et al., 2009). However, innovation culture is lacking in the construction sector, and the sector has been perceived as having low innovation (e.g., Dulaimi and Ling, 2002). Research investigating information technology in construction tends to ignore the important role of culture on information technology, let alone the fit between them. For example, Sacks et al. (2010) identified the requirements for BIM based lean production management system for construction, which cover the areas of maintenance of work flow stability, enabling negotiation and commitment between teams, lean production planning with sophisticated pull flow control, and effective communication and visualization of flow. However, a culture fostering the adoption of such information technology is the key. The influence of culture on innovative information technology adoption has been indicated in previous studies conducted in the general sector (e.g., Cabrera et al., 2001; Hoffman and Klepper, 2000). To advance theories and knowledge in this area, the causal relationship should be pushed forward the next level, that is the bi-directional culture-technology fit.

The notion of fit in the research of culture and technology sheds light on the bidirectional relationship between technology adoption and organizational culture (Leidner and Kayworth, 2006). Organizational culture is a system of shared values and norms, which not only defines what is important, and guides attitudes and behaviors of organizational members (O'Reilly & Chatman, 1996: 160), but also influences individuals' perception and adoption of ICT. Meanwhile, information technology is not value-neutral; rather, it is inherently symbolic and value laden (Robey and Markus 1984; Scholz 1990). ICT does not only adapt to existing organizational culture, but also transforms and changes organizational culture. According to Leidner and Kayworth (2006), technology-culture fit refers to the congruence between the general values of a given group and values embedded in a given system. A lack of fit will lead to negative perceptions and behaviors regarding the system while a better fit will lead to positive and favorable outcomes (Cabrera et al. 2001, Dube 1998).

In addition to the technology-culture fit, previous research has identified other kinds of fit as various organizational and technology elements interact when individuals attempt to perform their jobs using the technology, including, task-technology fit (Zigurs and Buckland 1998, Goodhue and Thompson 1995), person-task fit (Caldwell and O' Reilly 1990), and person-culture fit (O' Reilly et al. 1991). The abovementioned 'fits' lay ground to the development of a comprehensive system which links culture, technology, task and person in a two-level context. Technology-culture fit is the organizational level fit, while person-culture fit, and person-task fit are at the individual level, while task-technology fit cross organizational level and individual level. The conceptual relationships between culture, technology, task and person are shown in Figure 1.

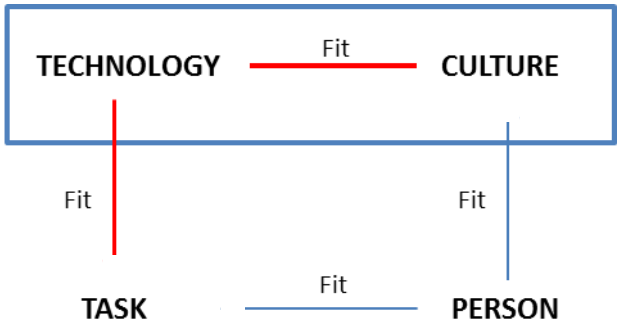

Figure 1 Conceptual Model of the Fit between Culture, Technology, Task and Person

The above two-level interaction model adopts Olikowski's (2000) practice lens for studying technology in organization, in which human action (rather than the traditional view of technology as objects), and its enactment of emergent structures (practices, rules, resources, etc.) through recurrent interaction with the technology are of concern. Instead of viewing technology as stabilized, external entities, the conceptual model focuses on agents' regularized engagement with a particular technology in particular ways in particular conditions (e.g., task and culture). The engagement can then enact a set of rules and resources which structures their ongoing interactions with that technology.

The fit between the technology and culture manifest the material and cultural properties that transcend the experience of individuals and particular settings through recurrent social action. In this aspect, it is what we may call a technological artifact. At the same time, use of the technology involves a repeatedly experienced, personally ordered and edited version of the technological artifact, being experienced differently by different individuals and differently by the same individuals depending on the time or circumstance. In this aspect it may be termed a technology-in-practice. The person-task fit and person-culture fit shows the differences between individuals, and these individuals will experience the technology differently even under the same organizational culture context.

The conceptual model lays ground to the following research questions regarding the underlying relationships between these fits:

1) How does technology fit culture and task?

2) What is the role of person in the fit between technology, culture and task?
3) What is the relationship between organizational level fit and individual level fits?

In response to the above research questions, this paper ***aims*** at i) developing a comprehensive theoretical model for the fit between culture, technology, task and person; and ii) deriving propositions based on the theoretical model for future testing.

SOCIO-TECHNICAL APPROACH TO TECHNOLOGY

Before introducing the socio-technical approach to technology, the duality nature of technology should be acknowledged. From the duality perspective, technology is not only an objective force, but also a socially constructed product. That is, technology is physically constructed by actors working in a given social context, and technology is socially constructed by actors through different meanings they attach to it and the various features they emphasize and use (Orlikowski 1992). Based on the understanding of the duality of technology, the socio-technical theorists recognized that information technology is both shaping of, and shaped by, its working environment. Orlikowski (2007) argues that the material aspects of organizational life, of which technology is a prime example, are 'constitutively entangled' with the social aspects – 'there is no social that is not also material and no material that is not also social' [p. 1437]. Leonardi (2011), also suggests that coordinated human agencies (social agency) and the things that the materiality of a technology allow people to do (material agency) become interlocked in sequences that produce the empirical phenomena we call "technologies," on the one hand, and "organizations" on the other. Technology contains a script that influences not only people's perception of the world but also human behaviors, and there is no fundamental distinction between humans and non-humans, including technological artifacts (Akrich 1992; Latour 1992; Latour 1993; Ihde and Selinger 2003). Some researchers claim that technology enables (or even invites) and constrains (or even inhibits) certain human actions and the attainment of certain human goals and therefore is, to some extent, value-laden (see e.g. Illies and Meijers 2009; Peterson and Spahn 2011).

Previous research indicates that information technology is not value-neutral; rather, it is inherently symbolic and value-laden (Robey and Markus 1984; Scholz 1990). For example, Feldman and March (1981) contend that, in bureaucratic organizations, information is highly symbolic, representing the values of competency and legitimacy. These particular values might be used to explain why some organizations conduct excessive information searches beyond what is necessary in order to reflect these values. Likewise, Scholz (1990) argues that firms' computerized information systems are highly symbolic, representing such values as equality versus subordination, progressivism versus conservatism, community versus isolation, sympathy versus antipathy, and emotionality versus insensibility. Robey and Markus (1984) argue that information system development and user involvement activities represent organizational rituals symbolizing the underlying value of rationality that people attribute to information technology. These values are formed over time through an individual's use of technology and lead to standardized ways of organizational data collection and processing, communication, and information and knowledge distribution. Understanding these information technology values may provide a much clearer picture for predicting how technology interacts with culture and individuals in organization.

ORGANIZATIONAL CULTURE DYNAMICS

Although organizational culture studies began early in the 1970s, it was not until the 1980s that management scholars widely adopted the concept of culture. Researchers perceive and define it in different ways (Hatch, 1993). According to Schein (1990), culture is "the pattern of basic assumptions that a given group has invented, discovered, or developed in learning to cope with its problems of external adaptation and internal integration, and that have worked well enough to be considered valid, and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to these problems." Schein (1990) proposes that culture exists simultaneously on three levels: artifacts on the surface, values lie underneath artifacts, and basic assumptions at the core. Basic assumptions represent what members of a culture believe about their reality; however, since they are typically taken for granted, it is hard for cultural members to state the basic assumptions of their culture. Basic assumptions influence what members of a culture perceive, think and feel. Values are the social principles, goals, and standards that cultural members believe have intrinsic worth. They define what members of a culture care about most and are revealed by their priorities. Artifacts are manifestations or expressions of the same cultural core that produces and maintains the values and norm. Among the various elements of culture, Alvesson (2012) argues that meanings and symbolism are more useful in cultural analysis. He claims that culture is not primarily 'inside' people's heads, but somewhere 'between' the heads of a group of people where symbols and meanings are publicly expressed. Therefore, culture is not simply a resource for managerial manoeuvre, but is understood to be a system of common symbols and meanings. However, culture is not statics. Alvesson (2012) described traffic of culture as dynamic cultural repositioning. Culture system is dynamic, it will experience not only guided evolution, but also natural evolution due to the change of the organization environment, such as the adoption of technology.

The term cultural dynamics originated in cultural anthropology. It refers to such issues as the origins and evolution of cultures, enculturation processes, and the problem of change versus stability. Schein (1990) describes four stages of culture, namely creation, preservation, natural evolution and guided evolution. Culture is constituted by local processes involving both change and stability. Hatch (1993) developed a culture dynamics model, reformulating Schein's original organizational culture model in procedural terms. Four processes are examined, namely manifestation, realization, symbolization, and interpretation. These processes are defined and presented in a new model called culture dynamics. All of the processes co-occur in a continuous production and reproduction of culture in both its stable and changing forms and conditions. In other words, numerous instances of the cultural processes occur and recur more or less continuously. Hatch's model shifts the research focus of culture from elements (assumptions, values, artifacts, symbols) to cultural processes (manifestation, realization, symbolization, interpretation).

Previous studies indicated the prominent role of culture dynamics in technology adoption process. For instance, Von Meier (1999) reveals that different organizational subgroups (i.e., operators and engineers), due to different cultural interpretations of proposed technologies, have different resistance to technology innovations, resulting in intra-organizational conflict. The dynamic nature of culture explains how organizational assumptions and values are manifested in symbols and artifacts, referred as technology in this paper, and how symbols and artifacts in turn strengthen or modify the assumptions and values of an organization.

BIDIRECTIONAL RELATIONSHIP BETWEEN ORGANIZATIONAL CULTURE AND ADOPTION OF INNOVATIVE TECHNOLOGY

Organizational Culture Affecting Adoption of Innovative Technology

Studies investigating the relationships between culture and information technologies mainly focus on two levels of culture: national and organizational culture. At national level, the applicability of traditional western-based management theories to non-Western cultures and the influence of national culture on the development and use of ICT were investigated (Myers and Tan 2002; Straub 1994; Walsham 2002). However, national culture is out of the scope of the current study, which focuses on organizational culture. At organizational level, the seminal works by Robey and Azevedo (1994) and by Robey and Boudreau (1999) have concentrated on theories of organizational culture as a means to explain the contradictory consequences of information technology within firms. An important contribution of such school of thought is the view that IT is symbolic (Feldman and March 1981; Robey and Markus 1984; Scholz 1990) and is, therefore, subject to the various cultural interpretations of those using it.

Previous studies, investigating various types of organizational culture, provide empirical support to the influence of organizational culture on the adoption and outcomes of innovative technology. For instance, Hoffman and Klepper (2000) found that organizations with high mercenary cultures (low in sociability and high in solidarity) experience more favorable outcomes from technology assimilation than those with networked culture (high sociability and low solidarity). Kitchell (1995) found that organizations with flexible, open and long-term orientation culture have a greater propensity to adopt advanced manufacturing technology. Ruppel and Harrington (2001), drawing on the competing values framework, concluded that intranet adoption is much more likely to succeed in development cultures (values emphasizing flexibility and innovation). Harper and Utley (2001) found that organization with people-oriented culture tended to result in greater levels of implementation success than those with production-oriented culture. These research results show that organizational culture has significant influence on the innovation adoption process.

Adoption of Innovative Technology Affecting Organizational Culture

The above researches on culture-innovation relationship mainly focus on "how [can] culture affect the innovation process" (i.e. an assumption of instrumentality and unidirectional flow: culture affects innovation) (e.g. Ahemd, 1998). It is erroneous to adopt this approach without considering the underlining ontology and epistemology assumptions. The theoretical framing here appears to have its origins in the monolithic practitioner-orientated literature from the 1980s, which advocates that culture can be managed and channeled to support high performing organisations (for example, Ouchi, 1981, Peters and Waterman, 2004). However, these organizational studies examined the impact of culture on IT outcomes with little consideration of possible cultural transformation, treating culture as being stable, persistent, and difficult to change. In fact, as indicated in the culture dynamic theory, culture could develop, change and, more importantly, be shaped by innovative technology. Schein (1990) points out that culture developed in organizations are both adapted externally and integrated internally. Organizational culture is shaped by multiple factors, including external environment, industry,

size and nature of the workforce, technology adopted by the organization, and history and ownership of an organization. Johnson (1988) also identified a number of elements that can be used to describe or influence organizational culture, such as the paradigm, control systems, organizational structures, power structures, symbols, rituals and routines, stories and myths. New technology may bring changes to paradigm, control systems, organizational structures, power structures, and so on, resulting in a culture change.

The potential of technology-driven cultural transformation is also supported by some of the previous studies (Coombs et al. 1992; Weick 1990). For example, Doherty and Doig (2003), by examining the influence of new ICT on organizational culture, found that improvements in a firm's data warehousing capabilities led to changes in customer service, flexibility, empowerment, and integration values. On the other hand, Doherty and Perry (2001), through examining the influence of a new workflow management system on organizational culture, found that implementation of the system strengthened organizational culture values related to customer orientation, flexibility, quality focus, and performance orientation. Adoption of large-scale ICT, such as enterprise resource planning systems, can not only impose their own logic on organizational structures, but also change the business processes (Davenport 1998). Hence, ICT has been found to have the potential for re-engineering organizational culture and that different types of technology artifacts may influence certain types of values (Leidner and Kayworth, 2006).

TECHNOLOGY-CULTURE FIT

The concept of 'fit' emerges along with the studies on the bidirectional relationship between technology and culture. Technology-culture fit refers to the level of congruence between the general values of a given group of members and the values embedded in a given system, and the fit will determine how the social group perceives and ultimately uses the system (Leidner and Kayworth, 2006). The concept of 'fit', rooted in the population ecology model and in the contingency theory tradition (Van de Ven, 1979), has served as the central thrust to the development of middle range theories in many management disciplines, especially in the organization theory and strategic management fields.

A poor fit will lead to negative perceptions and behaviors regarding the system while a better fit will lead to more favorable responses. For example, in a study about internet diffusion across nations, Loch et al. (2003) found that the degree of similarity in values with respect to technology between adopting and host countries influences the level of adoption of information technology. In a similar organizational study, Cabrera et al. (2001) concluded that successful technology assimilation requires either the technology to fit the organizational culture or the culture to be shaped to fit the behavioral requirements of the technology. Another study indicates that implementation of a new process evokes a wide variety of cultural interpretations from organizational stakeholders (Dube and Robey 1999). The authors deduced that the success of such projects depends on the degree to which the values of various subgroups fit with the particular values embedded in the new software development innovation. Another study conducted by Dube (1998) demonstrates that a good fit between the values embedded in the software development process and the overall organization's values will lead to a more successful implementation. Ngwenyama and Nielsen (2003) found that cultural assumptions built into the process methodologies could be in conflict with the cultural assumptions of developers, leading to difficulties in implementing the process improvements. Leidner and

Kayworth (2006) investigated information technology-culture conflict, the opposite side of technology-culture fit, and suggested that the reconciliation of these conflicts results in a reorientation of values.

In traditional organizational culture and information technology research, organizational culture is considered as human-related or social entity, while information technology is considered as technological entity. However, the concept of technology-culture fit stands on the view that information technology is also laden with certain values as in the organizational culture, and considers that culture and technology have some common properties to 'fit' each other.

THE INDIVIDUAL LEVEL FITS AND BEHAVIORS

In addition to the abovementioned technology-culture fit, fit and /or misfit can also arise as various organizational and technology elements interact when individuals attempt to perform their jobs by adopting an innovative technology. The introduction of a new ICT into a work setting affects competencies of members in the work unit. Meanwhile, the perception of members towards such ICT also affects their adoption of it in their tasks, which may then re-shape the organizational culture by changing the work values and practices. Based on the conceptual model (refer to Figure 1), fits at the individual level comprise i) task-technology fit, ii) person-task fit and iii) person-culture fit.

Task-technology fit is defined as the alignment between task and technology, focusing on complexity of group task and information processing ability of the technology specifically (Zigurs and Buckland 1998). A group task is defined as the behavior requirements for accomplishing stated goals, via some process, using given information. ICT can be seen as information processing tools that are designed to work together to support the accomplishment of group tasks. Information processing refers to manipulating and structuring information (Huber 1990). The task-technology fit can be assessed by the measures created by Goodhue and Thompson (1995), which contain 8 factors: quality, locatability, authorization, compatibility, production timeliness, system reliability, ease of use/training, relationship with users.

Person-culture fit is defined as the congruence between individual's values and those of an organization (O' Reilly et al. 1991). Basic values may be considered as internalized normative beliefs which guide behavior. When members in a social unit share values, they form the basis for social expectations or norms; hence, when these values are further shared amongst a larger social group, an organizational culture or value system comes to exist. Values, acting as the cornerstone of the selection (i.e., a set of procedures undergone by an organization to choose its members) and socialization (i.e., a process undertaken by individuals to understand the values, abilities, expected behaviors, and social knowledge, which are essential in playing a role in the organization) processes, are the key component of person-organization fit (Chatman 1989). Person-organizational fit has been found to predict job satisfaction and organizational commitment. O'Reilly et al. (1991) developed the organizational culture profile (OCP), an instrument for assessing person-organization fit, which covers seven factors, namely innovation, stability, respect for people, outcome orientation, attention to detail, team orientation, and aggressiveness.

Person-task fit refers to the congruence between individual competencies and the job requirements (Caldwell and O' Reilly 1990). The job competency include priority setting, knowledge of accounting, responsiveness, fact finding, goal oriented, value on time, technical typing. The degree to which individuals are suitable for a job depends on their motives, needs and job's requirements (Hackman and Oldham, 1980). Previous study indicates that specific job tasks can be perceived as competence-enhancing or competence-destroying (Burkhardt and Brass 1990). Results of a series of studies have shown that person-job fit predicts efficiency, effectiveness, quality, and overall performance improvement (Thompson et al. 1991).

In addition to individual competencies, the behaviors of an individual in adopting an innovative ICT when conducting their tasks should also be considered. Information behavior is the totality of human behavior in relation to sources and channels of information, including both active and passive information seeking, searching and use. Information seeking behavior refers to the purposive seeking of information as a consequence of a need to satisfy some goal, while information searching behavior is the 'micro-level' of behavior employed by the searcher in interacting with information systems of all kinds. Information use behavior consists of the physical and mental acts involved in incorporating the information found into the person's existing knowledge base (Wilson 1999). In general, information behavior is "how people need, seek, give and use information in different contexts" (Pettigrew et al. 2001; p.44). Scholz (1990) proposes 6 dimensions to describe information-oriented behavior: centralized versus decentralized, high standardization versus low standardization, hierarchic versus non-hierarchic, closed versus open, suspicious versus confident, and high specialization versus low specialization.

DEVELOPMENT OF THEORETICAL MODEL

Interaction Model of Culture, Technology, Task and Person

Based on the above literature review, a theoretical interaction model of culture, technology, task and person is developed (refer to Figure 2). "Culture is not itself visible, but is made visible only through its representation" (Van Maanen 1988, p.3). Culture is expressed only through the actions and words of its members and must be interpreted by a fieldworker (Maanen 2011). Technology is symbolic and subject to the various cultural interpretations of those using it (Feldman and March 1981; Robey and Markus; Skolz 1990). It is the tools used by individuals in carrying out their tasks, tasks are the actions carried out by individuals in turning inputs into outputs, and individuals use technologies to assist them in the performance of their tasks (Goodhue and Thompson 1995). Hence, there are intimate interactions between technology, culture, person and task.

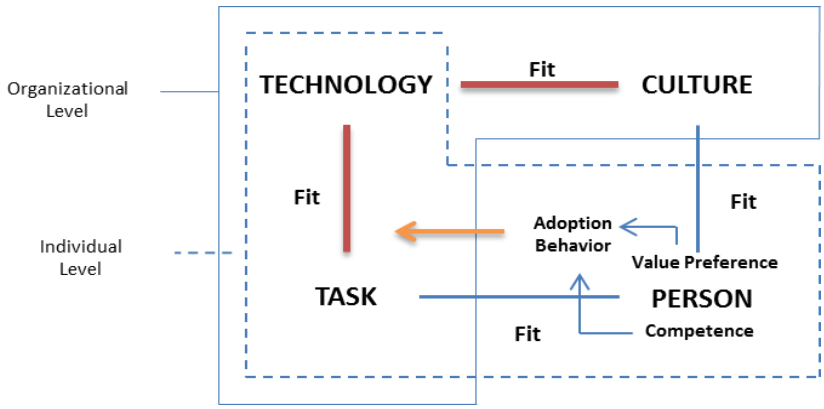

Figure 2 Interaction Model of Culture, Technology, Task and Person

At the organizational level, the congruence between values embedded in organizational culture and values laden in technology determine how the social group perceives, and, ultimately uses the technology (Leidner and Kayworth 2006). Contradictory sets of cultural assumptions embedded in a particular initiative may lead to implementation problems (Ngwenyama and Nielsen 2003). Meanwhile, variance in these sub-groups' value orientations results in different cultural interpretations of proposed technologies, which further leads to intra-organizational conflict and resistance to technology innovations (Von Meier 1999). On one hand, organizational culture shapes people's values, beliefs, meanings, and expectations towards technology at the organizational level (Hatch and Cunliff 2013). On the other hand, individuals' interpretations towards technologies influence their adoption of such technology, creating changes to organizational norms and culture.

At the individual level, technology is used by individuals to complete their tasks, so task-technology fit is the correspondence between task requirements, individual abilities, and functionality of the technology (Goodhue and Thompson 1995). Technology is the tools used by individuals in carrying out their tasks, but individuals' behavior is guided by their values preference (Schein 1990). Person's competency as well as the value laden behavior may affect their technology information processing capacity, which further affects the task-technology fit.

Development of Theoretical Propositions

In order to validate the theoretical model (refer to Figure 2), a subset of the theoretical model is developed for empirical studies to be conducted in the next stage. The relationships hypothesized between these key constructs are illustrated in Figure 3 and in three propositions developed as below.

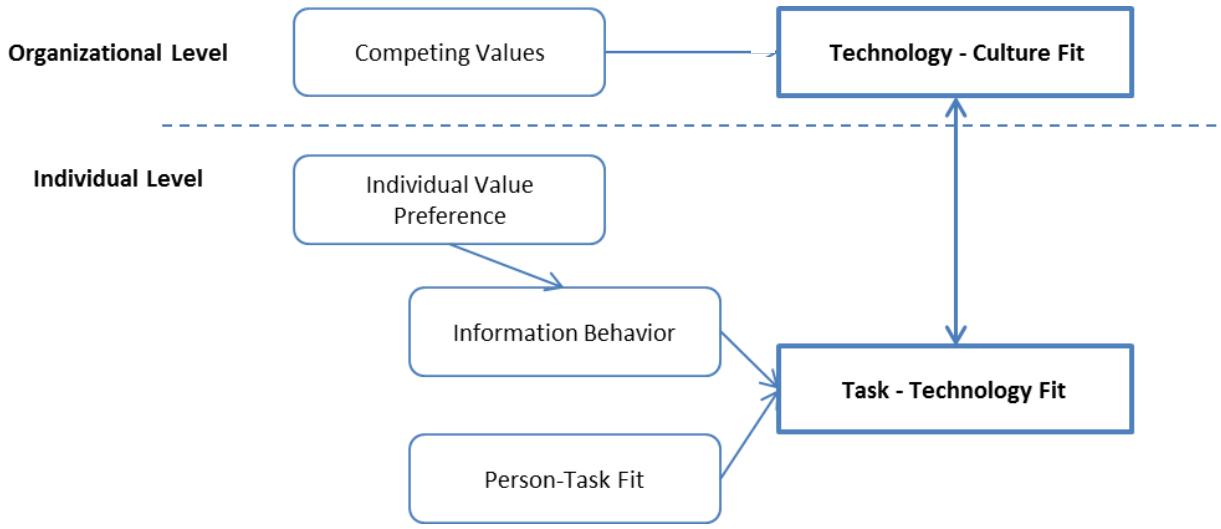

Figure 3 Subset of Theoretical Model for Further Validation

i) Technology-culture fit associating with task-technology fit

The rich literature on organizational effectiveness indicates that the effectiveness of organizations can be fostered by different, or even contradicting/competing cultural characteristics, including flexibility, adaptability, stability, control, and competitive external positioning (Cameron, 2006; Cameron and Quinn, 2011). These competing characteristics represent the different ends of the dichotomous cultural values, each with opposing anchors, and these dimensions constitute the rudiments of the competing values framework (i.e., flexibility and discretion versus stability and control, and external focus versus internal focus; Cameron and Quinn, 2006). The framework highlights the inherent tensions and contradictions that face organizations and leaders as they navigate their complex and changing environments. Since technology is value-laden, the value orientation of the adopting organization may contradict with the values embedded in technology. Therefore, it is anticipated that competing values can be adopted to determine technology-culture fit.

Based on Hatch's culture dynamic framework (1993), manifestation permits cultural assumptions (the essence of culture in Schein's theory) to reveal themselves in the perceptions, cognitions, and emotions of organizational members. Cultural realization makes values real by transforming expectations into social or material reality and by maintaining or altering existing values through the production of artifacts. The technology-culture fit at organizational level is derived by value comparison under cultural assumptions, which should be manifested into reality. The manifestation would then be realized at the individual level, across the interactions between person, task and technology, resulting in different individual information behavior, person-task fit and task-technology fit.

ii) Individual value preference, information behavior and person-task fit influencing task-technology fit

All new technologies have material properties, 'which afford different possibilities for action, based upon the contexts in which they are used' (Leonardi, 2011; p. 153). Such 'affordances' are clearly based upon the unique set of features and functions, that a particular technology offers, but it is through the situated interaction of a user and a technology, that new goals can be achieved. Articulated by Goodhue and Thompson (1995), "task-technology fit" has been used to provide a conceptual basis for user evaluation instruments for organizational assessment and decision making of information systems. The core of the task-technology fit model is the assumption that information systems give value by being instrumental in some task or collection of tasks and that users will reflect this in their evaluations of the systems. The antecedents of task-technology fit are the interactions between task, technology, and person. Here, the interactions between task, technology and person are separated into two operational constructs: the interaction between an individual and technology (i.e., the information behavior for ICT) and the interaction between an individual and a task (i.e., person-task fit).

Instead of influencing task-technology fit directly, individual value preference is predicted to influence it via information behaviors. As demonstrated by previous studies, information behaviors of individuals are guided by their values and assumptions regarding the information processes (e.g., Scholz, 1990). However, previous research indicates that behaviors are guided not by the priority given to a single value but by tradeoffs among competing values that are implicated simultaneously in a behavior or attitude. Indeed, values may play little role in determining behavior except when there is value conflict-when a behavior is promotive of one (or more) value but opposive to others. It is in the presence of conflict that values are likely to be activated, to enter awareness, and to be used as guiding principles. In the absence of value conflict, values may draw no attention. Instead, habitual, scripted responses may suffice (Schwartz 2001). The above sheds light on the importance of person-culture fit in influencing individual behaviors under the interaction between task and technology.

DISCUSSION

This research adopted the socio-technical approach to study the ICT adoption process in construction companies. For construction research field, although researchers has addressed the importance organization culture and human factors of in the ICT adoption (e.g. Peansupap et al. 2003), research focusing on the underpinnings of ICT adoption and implementation, and theories that reveal the integrated relationship between culture, technology, task and person is rare. Socio-technical approach provides a new lens to look at culture, technology, task and person, and also offers thorough explanations for their recursive relationship.

In this research, the relationship between organizational culture and technology is explained from the perspective of values, and is also further manifested in the task-technology fit, which depicts the whole picture of culture dynamics in ICT adoption. The ICT adoption process in this research is considered as the interaction between technology, culture, task and person across individual and organizational levels, instead of linear stage by stage process as in the traditional ICT adoption research approach. In this interaction framework, the technology-culture fit, task-technology fit, person-task fit and person-culture fit are all linked together, which supplements the previous fragmented findings and acts as a foundation for further studies on the relationship of these fits. These fits also further elaborate the relationship between culture, technology task

and person in socio-technical theory to an operational level, which allow the empirical validation of the theory.

CONCLUSION

A conceptual framework is developed for the interaction between technology, culture, task and person. The framework is developed across two levels: organizational level and individual level. The organizational level interaction is technology centered, focusing on the fit between values embedded in organizational culture and in technology. The individual level interaction is task centered, which focuses on the fit between technology and task requirements, and the fit between competency of an individual and task requirements. The various key constructs under these fits are also identified: i) technology-culture fit – respect for individual, fairness, innovation, risk taking, experimenting, team-oriented, collaboration, aggressive, tolerance, people oriented, and rule-oriented, etc.; ii) task-technology fit – quality, locatability, authorization, compatibility, production timeliness, system reliability, ease of use/training, and relationship with users, etc.; iii) person-task fit – priority setting, knowledge, responsiveness, fact finding, goal-oriented, value on time, etc.; iv) person-culture fit – innovation, stability, respect for people, outcome orientation, attention to detail, team orientation, and aggressiveness; and v) information behavior – information seeking, information searching and information using. A subset of an empirical framework is developed for further analyses. Under this framework, two propositions are put forward: i) Technology-culture fit at the organizational level is associated with task-technology fit at the individual level, and ii) Individual value preference, information behavior and person-task fit influence the task-technology fit.

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