

# INTERACTIONS OF CULTURE AND PERSON-TECHNOLOGY FIT IN ICT ADOPTION IN CONSTRUCTION

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## Abstract:

*Substantial hidden innovations exist in the construction sector, such as information and communication technology (ICT), however, innovation adoption processes are embedded in organizational culture, which varies among organizations. ICT innovation in this research is considered as the interaction process between technology, culture, task and person across individual and organizational levels, instead of a linear stage-by-stage process as in traditional ICT adoption research. Technology-culture fit, task-technology fit, person-task fit and person-culture fit are all interlinked in an interaction framework. Due to the dual nature of technology and the dynamic nature of culture, the relationship between technology and culture is also bidirectional. This paper develops a conceptual framework for the interaction between technology, culture, task and person across 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. Based on the deductive inferences of theories and empirical findings, two propositions are put forward: i) technology-culture fit is associated with task-technology fit ; ii) person-culture fit and person-task fit influence individuals' adoption behaviour through the mediation effect of task-technology fit.*

KEYWORDS: CONSTRUCTION, INFORMATION AND COMMUNICATION TECHNOLOGY, INNOVATION, TASK-TECHNOLOGY FIT, TECHNOLOGY-CULTURE FIT

## 1. INTRODUCTION

Information and communication technology (ICT) has recently been identified as an essential innovation for improving communication in construction processes. ICT has been found to add value to information management in construction through shortened project duration, enhanced processing of progress claims, contract administration, organizational image and user satisfaction (Stewart and Mohamed 2003). To keep up with the technology development and to enhance sustainability, many organizations in the construction industry have adopted ICT. However, in practice, many construction enterprises differ greatly in performance of using ICT. Technology adoption problems remain in the construction industry such as users' resistance because people are change-averse toward new technologies (Love et al., 2001), but "sustainability enabled"

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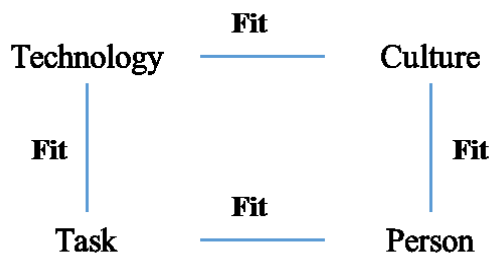
organizations need the capacity for change and the related process of continuous innovation and organizational transformation. Therefore, the key question is how to ensure that expected users accept and use ICT in their work processes.

The relative invisibility of the ICT implementation process is also identified as the major cause of ICT implementation failures. Markus and Robey (1988) attributed such invisibility to the unpredictably complex social interaction of ICT and organization. Socio-technical system theory provides a perspective to understand the invisible process of ICT implementation. Socio-technical system theory is used to study the interaction between people and technology in workplaces, or the interaction between society's complex infrastructure and human behaviour. The socio-technical system contains several components, including technology, task, actors, culture and structure. These elements are highly interdependent and a change in any one of them results in a compensatory (or retaliatory) change in the other elements so that the system maintains equilibrium (Lyytinen and Newman 2008). Therefore, these elements should be considered jointly.

In the socio-technical system, the elements should fit each other to maintain the system equilibrium. The impacts of these 'fits' on technology adoption have been considered individually by researchers. For example, technology-culture fit (e.g. Leidner and Kayworth, 2006) and task-technology fit (e.g. Zigurs and Buckland, 1998) have been shown to affect technology adoption. Person-culture fit and person-task fit are two mature constructs in human resource management theory (Caldwell and O' Reilly 1990). Although these two constructs are not directly related to technology adoption, they are found to be related to commitment for organization change (Meyer et al. 2010) and creativity (Livingstone et al. 1997), both of which play key roles in technology adoption.

The above-mentioned 'fits' lay ground for the development of a comprehensive system which links culture, technology, task and person. 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 conceptual model lays ground for 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.

The research method adopted is critical review of theory and literature. The topic covers the themes of socio-technical system, organizational culture, strategic fit, organizational behaviour and innovation adoption, so literature is selected according to the following criteria: 1) the literature should mention the above themes, especially in the scope of ICT adoption; 2) the literature appearing in top-ranking journals is prioritized.

## **2. DUALITY OF TECHNOLOGY**

Before introducing the cultural 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 the different meanings that they attach to it and the various features they emphasize and use (Orlikowski 1992).

Previous research has also indicates that information technology is not value-neutral; rather, it is inherently symbolic and value-laden (Robey and Markus 1984; Scholz 1990). 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 individuals' 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.

According to the cultural approach, technology contains a script that influences not only people's perception of the world but also human behaviours, and there is no fundamental distinction between humans and non-humans, including technological artefacts (Latour 1992, 1993). 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.

## **Organizational Culture Dynamics**

Researchers perceive and define organizational culture 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: artefacts on the surface, values lie underneath artefacts, and basic assumptions at the core.

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 development, 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.

## **Technology-Culture Fit**

Due to the dual nature of technology and the dynamic nature of culture, the relationship between technology and culture is bi-directional. Which means that the organizational culture will influence the ICT adoption and, in turn, the ICT adoption will also change organizational culture to some extent. Previous studies, investigating various types of organizational culture, provide empirical support for 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 favourable outcomes from technology assimilation than those with networked culture (high sociability and low solidarity). 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). Research on backward influence from ICT adoption to organizational culture is comparatively less and conducted later than the forward influence from organizational culture to ICT adoption. ICT has been found to have the potential for re-engineering organizational culture and that different types of technology artefacts may influence certain types of values (Leidner and Kayworth, 2006).

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; 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, 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 behaviours regarding the system while a better fit will lead to more favourable responses (Cabrera et al. 2001, Leidner and Kayworth, 2006) In traditional organizational culture and information technology research, organizational culture is considered as a human-related or social entity, while information technology is considered as a technological entity. However, the concept of technology-culture fit stands on the view that information technology is also laden with certain values according to the organizational culture, and considers that culture and technology have some common properties to 'fit' each other.

### **Task-Technology Fit**

A group task is defined here as the behavioural requirements for accomplishing stated goals, via some process, using given information. Information technology can be seen as information processing tools that are designed to work together to support the accomplishment of group tasks (Zigurs and Buckland, 1998). There are different definitions of task-technology fit. For example, Zigurs and Buckland (1998) define task-technology fit as ideal profiles composed of an internally consistent set of task contingencies and technology's elements that affect group performance. Dishaw and Strong (1998) operationalized task-technology fit as a computed interaction which predicts utilization. Goodhue (1995) operationalized task-technology fit as user evaluation, which is predicted by the interactions.

From these definitions, the differences between these three kinds of operationalization of task-technology fit are clearly demonstrated. In Zigurs and Buckland's (1998) model, task-technology fit is a matched fit profile. For example, simple tasks should result in the best group performance when done using a technology that emphasizes communication support, while decision tasks should result in the best group performance when done using a technology that emphasizes information processing and process structuring. In Dishaw and Strong (1998) model, fit was conceptualized as an interaction and is computed as product of tool functions and task activities. There are two dimension of fit: production fit and coordination fit. However, in Goodhue's (1988, 1995) model, task-technology fit is conceptualized as user evaluation, and it mainly assess eight aspects: quality, locatability, authorization, compatibility, production timeliness, system reliability, ease of use/training, relationship with users. The heart of the task-technology fit model are the assumptions 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 focus of this research is on individuals' adoption behaviour, and individuals' perceptions and evaluations of the technology as more relevant with the adoption behaviour, therefore, Goodhue's definition was adopted.

## **Person-Culture Fit and Person-Task Fit**

The match, or compatibility, between employees and various aspects of their workplace environment (person– environment fit) has proven to be a useful concept for explaining a variety of employee and organizational outcomes (O'Reilly, Chatman, & Caldwell, 1991). Person-culture fit and person-task fit are two mature constructs in the theory of the person-environment fit. 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 behaviour. Person-culture 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-culture 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). Results of a series of studies have shown that person-job fit predicts efficiency, effectiveness, quality, and overall performance improvement.

Previous researches on person-culture fit and person-task fit focus on organizational entry, early socialization of employees, and work performance. However, less is known about the role of person-culture fit and person-task fit in the technology adoption process. The introduction of a new ICT may change the values of organizational culture and task requirement, so individual's person-culture fit and person-task fit is also changed. Although these two constructs are not directly mentioned to affect technology adoption, they are found to be related to commitment to organization change (Meyer et al. 2010) and creativity (Livingstone et al. 1997), which have close relationships with ICT adoption. Therefore, the role of person-culture and person-task fit in ICT adoption process is worth investigating.

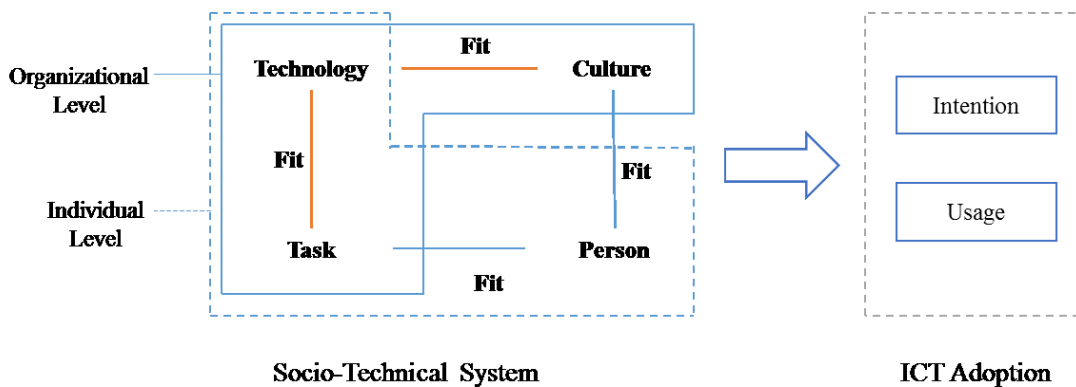
### **3. DEVELOPMENT OF THEORETICAL FRAMEWORK AND PROPOSITIONS**

From the above review, it is evident that technology, culture, task and person are linked with each other and technology-culture fit, task-technology fit person-culture fit and person-task fit are all pointing to ICT adoption. It means that the whole socio-technical system affects the adoption of ICT. The socio-technical system operates at two levels. It is clear that technology-culture fit is an organizational level construct, while person-culture fit and person-task fit are individual level constructs. Here, task-technology fit is across two levels: at the organizational level, it means the fit between the technology and organizational task design, but at the individual level, it means the individual's perception of task technology fit. Since each of the sociotechnical components can become the source of the system's misalignment, these 'fits' depend on each other.

Drazin and Van de Ven (1985) argue that the overall effect of multiple fits is not the sum of their individual effects and so, is not additive, but geometric/synergetic. They advance

a model of combination of multiple fits as being a system fit. In a system fit, the effect of multiple fits on organizational performance is not just the sum of the effect of each fit on performance. Instead, there is some holistic property that is not captured by an atomistic analysis of each fit separately that just combines them. Thus, they argue, the effect of multiple fits cannot be calculated by simply adding up the effect of each fit on the performance. In the social-technical system of ICT adoption, how technology-culture fit, task-technology fit, person-culture fit and person-task fit interact with each other, and affects the system's performance together needs to be explored.

Figure 2: Theoretical framework of socio-technical system and ICT adoption



In order to validate the theoretical model (shown in Figure 2), a subset of the theoretical model is developed for empirical study to be conducted in the next stage. The relationships hypothesized between these 'fits' and ICT adoption are illustrated in Figure 3 and two propositions are developed as below.

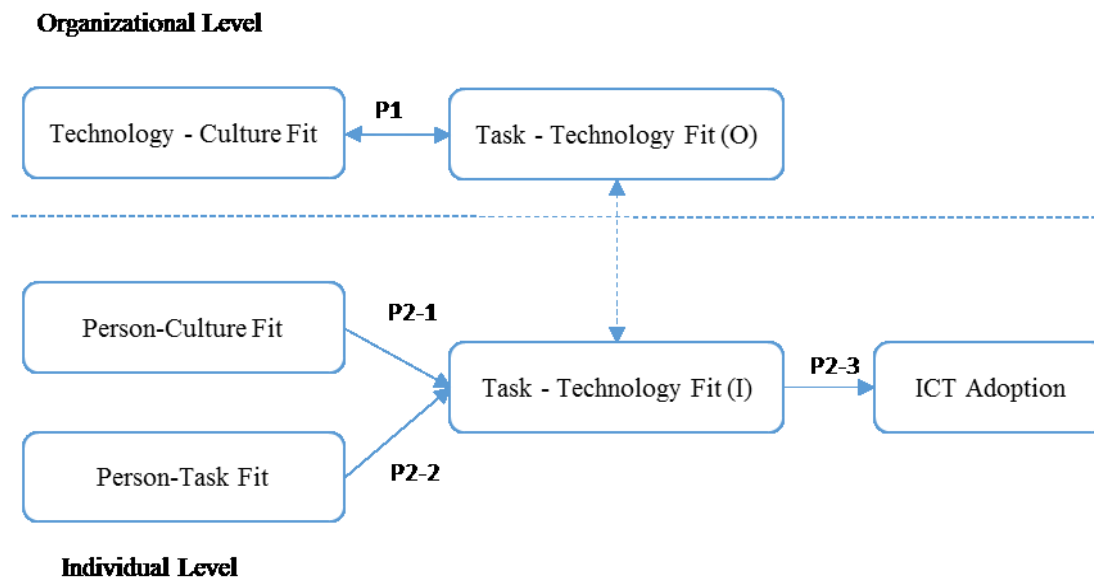
*Proposition 1: Technology-culture fit associating with task-technology fit*

Based on Hatch's (1993) culture dynamic framework, 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 artefacts. The technology-culture fit is derived by value comparison under cultural assumptions, which should be manifested into reality, demonstrated in the task design. Therefore, it could be proposed that technology-culture fit is associated with task-technology fit. Task-technology misfit is, apparently, caused by vague task requirements or insufficient technology capability, but simple redesign of task or technology is not sufficient for task-technology fit and changing the values of organizational culture may be the root.

*Proposition 2: Person-culture fit and person-task fit influence individuals' adoption behaviour through the mediation effect of task-technology fit.*

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 in 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. Person-culture fit and person-task fit are two important organizational attributes of individuals so, they could be seen as the antecedents of 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’ occur through the situated interaction of a user and a technology so, different individuals may have different interpretations of affordance and, further, have different evaluations of task-technology fit. Since previous research work has shown that task-technology fit affects individuals' adoption behaviour, it is proposed that person-culture fit and person-task fit influence individuals' adoption behaviour through the mediation effect of task-technology fit.

*Figure 3: Logical links between the propositions*



## **4. DISCUSSION**

This research adopted the socio-technical approach to study the ICT adoption process in construction companies. For the construction research field, although researchers have addressed the importance that organization culture and human factors have in 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. The socio-technical approach provides a new lens to look at culture, technology, task and person, and also offers thorough explanations for their recursive relationship

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.

In future study, the theoretical framework will be tested by mixed methods. At the organizational level, the relationship between technology-culture fit and task-technology fit will be analysed by qualitative study, because the technology-culture fit is an abstract phenomenon and cannot be assessed by measurement instruments directly. However, at the individual level, the person-task-technology interactions are more observable and will be analysed through a quantitative approach.

## **5. CONCLUSIONS**

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. Under this framework, two propositions are put forward: i) technology-culture fit at the organizational level is associated with task-technology fit ; ii) person-culture fit and person-task fit influence individual's adoption behaviour through the mediation effect of task-technology fit.

## 6. ACKNOWLEDGEMENT

The work described in this paper was fully supported by a grant from the Research Grants Council General Research Fund (Project No. HKU 715111).

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