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# AN INVESTIGATION OF PERSON-TASK-TECHNOLOGY INTERACTION AND ICT ADOPTION IN CONSTRUCTION

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Information and communication technology (ICT) has been identified as key to enhancing information processing in construction. However, the use of ICT is not always effective due to individuals' resistance to use the ICT. Effective technology use is the interaction of three elements: the competencies and motivations of users, the nature and purpose of technology, and the characteristics of tasks. This research positions task requirements at the center of person-task-technology interaction. Both individuals' capability and technology's functionality need to fit task requirements. The aim of this research is to explore the influence of task-technology fit and person-task fit on individuals' ICT adoption behavior. This research extends the traditional task-technology fit model by combing it with the construct of person-task fit from person-environment fit theory. The research model proposes that both individuals' capability and technology's functionality to carry out the task are crucial in ICT adoption. ICT managers should not overlook human factors during ICT implementation.

*Keywords*: Information and communication technology, Task-technology fit, Person-task fit, Person-environment fit.

## 1 INTRODUCTION

Information and communication technology (ICT) has been identified as key to enhancing information processing in construction. Although ICT is accepted by both academics and practitioners as a source of competitive advantage, merely having an ICT will not necessarily guarantee success in the organization's ICT adoption. Peansupap and Walker (2006) claim that while many construction organizations attempt to gain ICT use benefits, these may be limited when few people actually adopt and use ICT because this requires user acceptance. Jacobsson and Linderoth (2012) find on the one hand, the employees perceived that a further development of ICT systems would increase the company's competitiveness, but on the other hand, they did not want to increase their own use of ICT. Organizations are not likely to recognize the full benefits of ICT unless users are willing to adopt the technology thus, the issues regarding the adoption of ICT must be explored.

Effective technology use comprises three elements: the competencies and motivations of users, the nature and purpose of technology, and the characteristics of tasks (Burton-Jones and Grange 2012). Existing research has found that each component has effects on individuals' adoption of ICT. For example, Coombs (2015) finds that the technical related factors include readability and response of the information system, task related factors include mapping, redesign, and documenting of existing processes, while person related factors include staff's ability to carry out tasks with new patterns. Ding *et al*. (2015) also find that that architects' motivation and technical defects of BIM will affect architects' BIM adoption.

However, research seldom considers the interaction between person, task and technology. Some research indicates that the fit between person, task and technology impacts individuals' ICT adoption behavior (Finneran and Zhang 2003, Bani-Ali 2004, Liu *et al.* 2011). This research positions task requirements at the center of person-task-technology interaction. Both individuals' capability and technology's functionality need to fit task requirement. This research aims to explore the influence of task-technology fit and person-task fit on individuals' ICT adoption behavior. A literature review is conducted on person-task-technology interaction, person-task fit and task-technology fit. Hypotheses on task-technology fit, person-task fit and person's intention to adopt ICT are developed with a proposed methodology.

## 2 PERSON-TASK-TECHNOLOGY INTERACTION

A number of researchers have attempted to develop a person-task-technology interaction model, such as person-artefact-task (PAT) model (Finneran and Zhang 2003), task-technology-person fit model (Bani-Ali 2004) and task-individual-technology fit model (Liu *et al.* 2011).

Finneran and Zhang (2003) develop a person-artefact-task model to explain the flow experience in a computer mediated environment. Their model consists of person (P), artifact (A), and task (T), as well as the interactions between them, including person-task interaction, person-artifact interaction and task-artifact interaction. They propose that these three components and their interactions influence the flow experience in the computer mediated environment. Bani-Ali (2004) develops a so-called task-person-technology-fit model, which combines computer self-efficacy and task-technology to examine whether computer skills empower individuals to achieve higher performance, handle more sophisticated systems and engage in more challenging tasks. Liu *et al*. (2011) divide the concept of task-individual-technology fit into three dimensions: task-technology fit, individual-technology fit, and individual-task fit. The importance of these three dimensions depends on technology implementation situations. In the unstructured task setting, individual-technology fit as well as individual-task fit significantly affect user's attitude toward decision support system. However, in the structured task setting, task-technology fit (but not individual-technology fit and individual-task fit) plays a more important role.

These models concern three types of fit: person-task fit, task-technology fit and person-technology fit. However, compared with task-technology fit (a mature construct in task-technology fit theory) and person-task fit (a mature construct in person-environment fit theory), person-technology fit in these models is not well defined. Liu *et al*. (2011) define person-technology fit as the degree to which characteristics of technologies fit the needs of individuals to solve problems. Finneran and Zhang (2003) see person-technology fit as the perceived ease of use of the technology, which is, essentially, the person's perceived skills required to face challenges of the technological artefact. The above analysis shows that the definition and scope of person-technology fit are not clear and consistent and overlap task-technology fit and person-task fit. Consequently, this research does not incorporate person-technology fit and the model proposed contains only the key constructs of task-technology fit and person-task fit.

## 3 PROPOSING A PERSON-TASK-TECHNOLOGY INTERACTION MODEL

For most cases, the aim of implementing ICT is to support the accomplishment of tasks, so researchers highlight the need for the capabilities of technology to be suited to their tasks. Theory of task-technology fit has been applied extensively to understand the use of technology and the consequences of this use in various personal and professional contexts. Task-technology fit theory has gained insights from prior work highlighting the importance of a suitable fit between the representation of a problem and the tasks that must be performed to solve the problem. Vessey (1991) suggests that representing a problem in a manner that is ill-suited to the solution process tends to increase cognitive demand and undermine the problem-solving performance. Therefore, there has to be a fit or alignment between task characteristics and the capabilities of an information system to enhance the adoption of ICT. Correspondence between task needs and system functionality are strongly related to information system use and performance (Goodhue 1998). Thus, it is hypothesized that the higher the extent to which ICT fits the task requirement, the more likely a person will adopt ICT.

The impacts of person-task fit and ICT adoption remain inconsistent. Ammenwerth *et al*. (2006) claim that, often, the problems of low user satisfaction, or even user boycott problems, are often attributed to the ICT system. In fact, the problems arise mostly from a more fundamental ill-acceptance of the new task to be done. If the fit between individuals and task has already been problematic before ICT introduction, it will deteriorate more after ICT introduction, as applying ICT to their work involves acquiring new knowledge and skills. Liu *et al*. (2011) find that high person-task fit is related to negative attitude to decision support system and low task-individual fit is related to positive attitude towards decision support system. This suggests that when decision makers' individual characteristics (e.g., cognitive style) fit the needs for completing tasks, they may have little interest in the technology available to provide decision aids. However, when the individual-task fit is low, they tend to use the technology to facilitate decision-making.

Although person-task fit is less commonly discussed in the field of ICT adoption, several researchers have explored the role of person-task fit in the context of organization change. Since the introduction of ICT also brings organizational change, these findings in regard to change management also lend some explanations. Zatzick and Zatzick (2013) find that employee perceptions of person-job fit following the implementation of change influence attitudes towards a specific change. Further, a lack of perceived person-task fit is stressful for individuals (Yang *et al.* 2008), and a greater amount of stress results in more negative attitudes towards change (Vakola and Nikolaou 2005). Thus, the second hypothesis is that the higher the extent to which a person fits the task requirement, the more likely she/he is to adopt ICT.

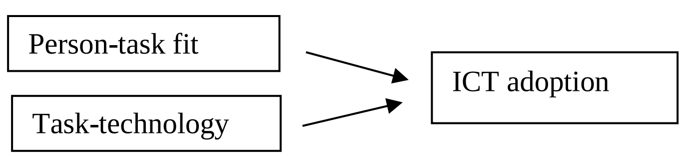


Figure 1. Proposed model of person-task-technology interaction.

### 3.1 Task-Technology Fit

The theory of task-technology fit has been applied extensively to understand the adoption of technology in various personal and professional contexts. Task-technology fit model assumes that information systems yield value by being instrumental in some task or collection of tasks, which is reflected in users' evaluations of the systems (Goodhue 1998). Regarding the organizational conceptualization of task-technology fit, task characteristics and technology characteristics are essential factors that influence task-technology fit. Some researchers put forward quantitative relationships between task characteristics, technology characteristics and task-technology fit. When task characteristics are operationalized as task requirements, they are usually negatively related to task-technology fit. This means that task-technology fit will decrease when the complexity or interdependence of tasks increase. On the contrary, when technology characteristics are operationalized as technology functions, they are found to be positively related to task-technology fit (Dishaw and Strong 1999, Goodhue 1995).

Certain types of task require certain forms of technology, and their effects on task-technology fit should be considered in the specific context. For example, Zigurs and Buckland (1998) argue that the communication support, process structuring and information structuring provide different levels of fit depending on the task nature. They find that communication function fits simple tasks; information processing fits problem tasks, information processing and process structuring fit decision tasks, and communication support and information processing fit judgment tasks.

### 3.2 Person-Task Fit

Person-task fit is derived from the research fields of organization psychology and organization behavior. This research defines person-task fit as the congruence between individual competencies and the job requirement (Caldwell and O' Reilly 1990). The outcomes considered in person-task fit research include job satisfaction, motivation, job stress and vocational choice. These outcomes are usually emphasized as dependent variables in organizational psychology and organizational behavior research (Edwards *et al.* 1991).

There are two classes of person and job constructs. The first class concerns supply-need fit, which emphasizes whether jobs are available to meet employees' desires. Constructs of supply-need fit are often used to predict job satisfaction, job stress, vocational choice and motivation. The second class concerns demand-ability fit, which emphasizes whether employees' abilities are available to meet job requirements. Constructs of demand-ability fit are closely related with job stress, performance, retention and promotion. Person-task fit is usually assessed by commensurate measures. Among the above two classes of person-task fit, this research focuses on the "demand-ability fit", arguing that task demands and individuals' abilities play a key role in ICT adoption. Task-relevant capabilities are individual abilities pertaining to the to-be-accomplished focal task(s) by using a technology. Individual abilities are developed independently of technology use. Few studies have explored the role of task-relevant user capabilities in ICT adoption and the role of person-task fit.

## 4 PROPOSED METHODOLOGY

In order to test the hypotheses, it is proposed that a quantitative survey approach be taken where:

1) The measurement constructs for 'person-task fit', 'task-technology fit', and 'intention to adopt ICT' is defined.
2) The type of ICT is identified.
3) Target respondents are sampled from professional disciplines.

This way, the 'task' can be delineated by professional disciplinary functions. Lu *et al*. (2014) provide a recent categorization of ICT used in the field of architecture, engineering and construction, i.e., web-based, VR/AR, wireless/digital, EDI/EDMS, and BIM. There are three widely recognized ways to measure task-technology fit, including user evaluation (Goodhue 1998), ideal profile (Zigurs and Buckland 1998), and interaction between technology functions and task requirements (Dishaw and Strong 1999). Their relationships can be analyzed by structural equation modeling (SEM). The measurements of person-task fit are operationalized into subjective measures (Saks and Ashforth 1997) and objective measures (Caldwell and O'Reilly 1990) and the measurement of behavioral intention to use the system is well developed in the technology acceptance model (Davis 1989), which is extensively used in individual acceptance research.

The hypothesized relationship on task-technology fit and individuals' intentions to adopt ICT is consistent with the arguments of previous researchers. Technology will be used only if the functions available to the user fit the activities of the user, because rational, experienced users will choose only the tools that help them to complete the task with the greatest net benefit (Dishaw and Strong 1999). Other researchers, although not directly mentioning the construct of task-technology fit, demonstrate that some dimensions of task-technology fit (e.g., perceived usefulness) influence ICT adoption (Venkatesh and Davis 2000). For ICT adoption in construction, Hartmann *et al*. (2012) advocate that effective adoption of BIM is influenced by the alignment between existing work processes and the functionality of the BIM.

The hypothesized relationship on person-task fit and individuals' intention to adopt ICT supplement previous findings on the effect of knowledge and skill on technology adoption. A lack of knowledge and skill to use ICT is frequently considered as one of the major barriers for new ICT adoption in construction projects (Adriaanse *et al.* 2010). Peansupap and Walker (2005) find that individuals influence ICT diffusion through the ICT knowledge that individuals possess. Lack of basic knowledge of ICT may lead to negative perceptions of ICT use. This research shows that, in addition to the knowledge and skill to use ICT, the knowledge and skill to conduct the task is also crucial in ICT adoption. When individuals' knowledge and skill fits the task requirement, they will be more willing to adopt ICT.

## 5 CONCLUSION

This research model proposes that both individuals' capability and technology's functionality to carry out the task are crucial in ICT adoption. This research extends the traditional task-technology fit model by including the construct of person-task fit from person-environment fit theory, which lends a new perspective to examination of the interaction between person, task and technology. This research also has practical implications. Task-technology fit is helpful to develop a diagnostic tool of information systems and services in a particular company to enable managers to identify gaps between systems capabilities and users' needs. In order to increase person-task fit, relevant training should be provided for employees to improve their competency in combing ICT use into their tasks. As for improving task-technology fit, either the working process or the ICT may need to be re-designed to make them compatible with each other.

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