TASK-TECHNOLOGY FIT IN THE WORKPLACE

AFFECTING EMPLOYEE SATISFACTION AND PRODUCTIVITY

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Preface

With this thesis I am finalizing a great period of studying at the Rotterdam School of Management, Erasmus University, by obtaining my master in Business Administration (programme specialization Business Information Management). Especially the master went by in a blink of an eye, it's said that time flies when you’re having fun. One year ago I joined the New Worlds of Work (NWoW) research team as student-assistant to specialize in the field of new workplace practices, and to write my thesis on a related subject. Since September 2009 I investigated the technology dimension of NWoW in cooperation with TopForce. In this light I would like to thank some people who made it possible to write this thesis.

First I would like to thank my coach and member of the NWoW team Peter van Baalen for the trust he showed in me during the project, and feedback and support while I was writing this thesis. I would also like to thank my co-reader Johan van Rekom very much for his valuable support on especially the methodological issues I encountered while writing this thesis, even when I would sometimes just walk by his office to ask something. Furthermore I would like to thank Nick van der Meulen with whom I spend many hours at ‘T9’, for the fun and keeping each other sharp on the research projects. Also I would like to thank Wouter Vermeer very much for the feedback he gave me on my thesis. The other NWoW team members Eric van Heck, Frank Go, and Marcel van Oosterhout I would like to thank for working together on this project, and giving direction in my thesis. From TopForce I would like to thank Arnoud Kouwenhoven and Elisabeth de Leeuw for their close interest and cooperation in this project.

While working on my thesis, it sometimes became a challenge writing it. Throughout my study and beyond, my mother supported me unconditionally for which I am most grateful. He who I would like to be able to show my gratitude to, but whom I can only thank for the jumpstart he gave me in my childhood, is my father.

Pim Baas

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Executive Summary

The rise of new information and communication technologies (ICT tools) has changed the workplace, employees use multiple tools to conduct their work. The use of these ICT tools and its design aims to increase employee satisfaction and productivity. Many studies addressed the effect of technologies from the point of view of system quality and utilization. These studies focused on one technology to address its success in a specific context. However, nowadays workplaces inhabit multiple tools for conducting work. These ICT tools are related to each other, and therefore the effectiveness of the total set of ICT tools one has at his or her disposal should be investigated. It is therefore questioned whether employees show increased satisfaction and productivity when the ICT tools they use exhibit a ‘fit’ with their daily task portfolio.

For this purpose the task-technology fit model is applied, which suggests that the ICT tools one uses should fit with the work one conducts. Based on two independent studies, it was found that people who have a high variety of tasks generally exhibited lower levels of task-technology fit. People with more difficult tasks also experience lower levels of task-technology fit, but this effect is smaller than for task variety. In other words, people whose work is characterized as non-routine (i.e. high on variety and difficulty) experiences less supportive value of their ICT tools. No relation was found for task interdependence. If ICT tools are perceived to be personalizable, and if the tools exhibit characteristics which enable people to collaborate, higher levels of task-technology fit are reported. For mobility this relation was not consistently found. When the total set of ICT tools people have at their disposal exhibited higher degrees of fit with their tasks, higher employee productivity was found. A more specific measure of productivity is ICT performance impact, which was found to be even stronger affect by task-technology fit. Employee satisfaction was not consistently found to be related with task-technology fit.

The findings of this thesis implicate not to invest in better or more technologies, but to invest in ICT tools that fit the task portfolio of the employees. The contribution to theory I made is reexamining the task-technology fit model in a broader context. Moreover, the technology characteristics dimension is explicitly operationalized with three concepts; personalization, mobility and collaboration. Two of these concepts showed to be relevant in the task-technology fit model. The role of collaboration requires further research, because this concept also a had direct relation with ICT performance impact, and therefore violating the mediating role of task-technology fit.
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Introduction

In today’s workplace multiple information and communication technologies (ICT tools) are employed for conducting work. ICT tools became more and more compatible because of technological developments. For example, at the office someone works on a document and saves it on a shared workspace for remote access and collaboration. On the way home the latest emails are checked and short replies are send with a PDA. After dinner the document of that day is finalized based on the comments a colleague left meanwhile. This example demonstrates someone’s digital workspace (Overbeek et al., 2005), which is comprised of information and knowledge items and computer based tools for performing one’s job. This concept is also known as the high performance workplace (Austin, 2005). The common goal of these concepts is to enable people to carry out their private and work related activities pleasantly, effectively, and efficiently in every context (Overbeek et al., 2005). But is this so?

One of the characteristics of the digital workspace is that there is a potentially large set of ICT tools people can work with. Organizations invest heavily for developing good technologies, but the macro economical effect of these investments was not consistently positive and therefore lead to the IT productivity paradox (Brynjolfsson, 1993), best described by Robert Solow’s (1987) well known quote ‘you can see computers everywhere but in the productivity statistics’. Striving for good technologies is reasonable considering the fact that system and information quality have shown to be of great importance in explaining employee productivity (Delone and McLean, 2003). Other studies have proposed to address productivity from the viewpoint of the utilization of technologies and employee’s attitudes toward technologies (Venkatesh et al., 2003). Instead, it is also argued that ‘better’ tools not necessarily increase productivity, but that the ICT tools must show fit with someone’s task portfolio (Goodhue and Thompson, 1995). Employees with different task portfolios exhibit different demands on ICT tools. Then, heavily investing in technologies which are not utilized because they show no fit with the user’s tasks, will not result in increased productivity. Therefore, the effects of IT investments are contingent upon the tasks employees have to conduct and the corresponding ICT tools they have at their disposal.

What follows is the question; when will people exhibit task-technology fit? To date the task-technology fit model was applied for studying one tool at a time. However, the digital workspace
comprises multiple ICT tools. These tools are interrelated (as in the example) because they should all support a respective part of someone’s task portfolio. Therefore the total set of ICT tools should be investigated instead of one system or technology in isolation. If assessing the total set of ICT tools instead of one tool at a time, the question arises if the task-technology fit model is still able to explain individual employee productivity. Moreover, since the digital workspace should also enable people to conduct their work pleasantly, employee satisfaction as second dependent variable is investigated.

Employee satisfaction and productivity are two dependent factors in the New Worlds of Work (NWoW) research by the Rotterdam School of Management, Erasmus University (RSM). The NWoW project strives to address broad visionary future workplace concepts into more narrowed down empirical research (Baalen et al., 2007). The technology dimension has thus far not explicitly been addressed in NWoW research. This technology dimension is investigated on initiative of TopForce, an IT consultancy firm specialized in business solutions and systems integrations.

Research goal
The purpose of this thesis is to address the effectiveness of ICT tools used by individuals in organizations for carrying out their daily task portfolio. The theory of task-technology fit (Goodhue and Thompson, 1995) is employed, which suggests that ICT tools must show a ‘fit’ with the working conditions of individuals in order to result in higher employee satisfaction and productivity.

Research question

*Will employees show increased satisfaction and productivity when the ICT tools they use, exhibit a fit with their daily task portfolio?*

Several sub questions can be formulated to provide a more detailed focus;

- Which task characteristics should be assessed?
- Which technology characteristics should be assessed?
- What is task-technology fit?
- Will task and technology characteristics predict task-technology fit?
Contribution to theory and management

To date the task-technology model has been tested in experimental settings (Fuller and Dennis, 2009; Junglas et al., 2008), or highly contextual specific empirical situations (e.g. mobile information systems (Gebauer et al., 2006), group support systems (Zigurs et al., 1999), or software maintenance tools (Dishaw and Strong, 1998)). This thesis takes a broader perspective and assesses the total set of ICT tools individuals use for conducting their task portfolio. The task-technology fit model will be re-examined, modified, and tested to address its applicability in a broader context. Technology characteristics, an independent dimension in the task-technology fit model, is explicitly conceptualized and operationalized on the same abstract level as task characteristics (the second independent dimension), something that to my knowledge has not yet been done in a similar way. Moreover, I expand the dependent dimension with the two general variables employee satisfaction and productivity, in addition to the standard dependent factor in the task-technology fit model which addresses the performance impact of ICT tools directly.

With this thesis I try to raise managerial awareness not to invest in better or more technologies, but to invest in an individual’s digital workspace which best fits with someone’s task portfolio. In case organizations would conduct a study based on this thesis, they will be able to address if their employees have proper ICT tools at their disposal for conducting their job. Moreover, this study will address for which type of task characteristics it is harder to achieve task-technology fit, and which technology characteristics can ease obtaining task-technology fit.

Thesis outline

The first chapter presents theory and corresponding concepts, starting with the digital workspace, followed by the task characteristics, and technology characteristics and their effects. Next, the dependent dimension including employee satisfaction and productivity is discussed. From there on hypotheses are build. The methodology chapter discusses the division of this thesis in two studies, one pretest and one pilot test. Study 1 (pretest) further addresses the methodology used for testing the conceptual model and improvements are suggested for pilot testing. Study 2 (pilot test) then addresses the results from the task-technology fit study at TopForce. Finally the results from both the first and second study will be analyzed and conclusions will be drawn at the end of this thesis.
1. Theory

In this chapter I will first introduce the digital workspace concept to position this thesis, including ICT tools and their users. Next, task characteristics are introduced including task non-routineness and task interdependence. Then a review is presented about technologies and their effects, followed by the dependent factors in this thesis; employee satisfaction and productivity. Next, I will introduce the task-technology fit model and several competing models to address their effect on the dependent factors. While doing this, I will discuss some limitations and shortcoming of the task-technology fit model as propose by Goodhue and Thompson (1995), and from there on build the hypotheses which are visually represented in a conceptual model at the end of this chapter.

1.1. Digital workspace

The use of information and communication technologies (ICT) changed the way work is organized. Terms like telework (working outside the conventional workplace (Bailey and Kurland, 2002)), and virtual teams (workgroups who use technology to work across locational, temporal and relational boundaries (Martins et al., 2004)) are commonplace nowadays.

The role of information technology and other workplaces innovations have been found to lead to increased labor productivity (mainly in manufacturing environments) (Black and Lynch, 2004), thereby partly counter arguing the IT productivity paradox. Workplace innovations, also termed as ‘high performance workplace practices’, include team working, training, employee participation (employee voice or involvement in decision making), profit sharing or incentive compensation, and flexible work arrangements (Combs et al., 2006). However, the role of information technology in the study of Black and Lynch was limited to ‘computer use’. Also, their data originates from 1993-1996. Since then the role of information technology in organizations has become even stronger, and continuous development has enabled new workplace practices. A more in-depth analysis about the role of IT in the workplace is thus needed. The integration of human resource practices and information technology is captured by high performance workplace concept from Gartner, which however mainly focuses on the role of ICT.

Gartner introduced the high performance workplace (HPW) concept, which they defined as a strategy to make people (workers, suppliers, customers, etcetera) as effective as possible, by balancing investments along the four dimensions of people, processes, physical environment...
and technologies (Austin and Knox, 2007). An earlier version of their definition specifically addressed the HPW as being ‘a physical or virtual environment, designed to make workers as effective as possible’ (Austin, 2005). This older definition has a more narrow focus. Whereas people in the new definition are either employees, customers, suppliers, agents, etcetera, workers in the older definition are specifically employees of an organization. Since the research goal is to address the effectiveness of ICT tools in the workplace environment, I will build further on the technological and virtual component for individual employees.

The virtual environment where someone conducts its job is composed of a wide range of digital services. Digital services can be defined as “any computer based tool which supports the performance of applications, activities, or actions such as knowledge generation and knowledge transfer” (Overbeek et al., 2005: 2). This definition was initially developed to apply to knowledge workers and information workers, those who respectively produce, process, store, transfer and compare information; and create, distribute and apply knowledge based on the available information (Davenport, 2005). However, digital services apply equally well to functions that would not be termed as knowledge worker (i.e. those who ‘think for a living’), for example back office employees. These workers are also dependent on digital services for conducting their job. It is thus not specifically the knowledge worker which is central in this study, but an employee in general who is dependent on digital services for carrying out its task portfolio. A more traditional term would be a white-collar worker, because I will not focus on employees working in manufacturing environments.

A digital workspace is composed of digital services, digital information items and knowledge items (Overbeek et al., 2005). Information items can either be structured (e.g. document with standard structure for storage and processing) or unstructured. When information is processed in the mind of individuals, it becomes knowledge and one increases its capacity for effective action (Alavi and Leidner, 2001). Therefore, knowledge items in the digital workspace are by definition explicit, since tacit knowledge items are “deeply rooted in action, commitment, and involvement in a specific context” (Nonaka, 1994: 16), and thus hard to formalize and communicate. Explicit electronic information and knowledge items could also be referred to as digital artifacts.
ICT tools

Digital information and knowledge items are part of the digital workspace, these items are produced, stored, transferred and processed by means of digital services. Since the term ‘digital services’ imply SaaS related technologies, this study explicitly refers to ICT tools as computer based tools in support of the performance of an employee’s daily task portfolio. The digital workspace in this thesis is therefore defined as the total set of ICT tools, and digital information and knowledge items one has at his or her disposal for conducting its job. Some other terms were coined as well, such as a virtual workspace (Keahey et al., 2005), adaptive workspace (Rasmus, 2002), and e-workspace (Bafoutsou and Mentzas, 2002). In the following two sections, I will further elaborate on the concepts of task characteristics, and technology and its effects.

1.2. Task characteristics

Tasks are defined as the actions carried out by individuals in turning inputs to outputs, or in other words, the work that needs to be done in organizations (Perrow, 1967). ‘Turning inputs to outputs´ implies that work is physical. Considering the research scope of Perrow it is reasonable to believe that tasks as physical actions. He studied the degree of routineness of workers with physical machines, which added value to physical objects. However, the same principle of turning inputs (e.g. tacit business problems) to outputs (e.g. solutions) also applies in a broader set of organizational studies, such as in mere knowledge intensive jobs (Hage and Aiken, 1969). As their study only considered work routinization, several other studies investigated work with more comprehensive models, such as the job diagnostic survey (Hackman and Oldham, 1980) and the multimethod job design questionnaire (Campion, 1988). To overcome limitations from these earlier models, Morgeson and Humphrey (2006) developed the work design questionnaire (WDQ).

The WDQ addresses work characteristics according motivational, social and contextual categories. Higher levels of motivational work characteristics enriches one’s job, higher levels of social characteristics denote that work is performed in a broader social environment, and contextual characteristics reflect within which context work is performed. There were two primary purposes for developing a comprehensive work design model (Morgeson and Humphrey, 2006); first for being able to address characteristics that are important in explaining organizational, group, and individuals outcomes. Second, when one has a full picture of the set of work characteristics, more fine-grained changes in the work environment can be made.
Mainly this second objective offers a starting point in this thesis for analyzing how tasks are characterized. The original task-technology fit model used task non-routineness (Perrow, 1967) and task interdependence (Thomas, 1957) for conceptualizing the task dimension, and will therefore also be used in this thesis. In WDQ, task routineness is a motivational characteristic and task interdependence is a social characteristic used for predicting employee satisfaction. In this thesis I will use these concepts for explaining task-technology fit.

Task routineness can be split up in task variety and difficulty. Task variety is the degree to which one has to conduct exceptions or a wide range of operations (Morgeson and Humphrey, 2006; Sims et al., 1976), and therefore different methods or procedures are needed for conducting the work (Van de Ven and Delbecq, 1974). It is also referred to as the stability, rigidity, or repetitiveness. Task difficulty is the degree of analyzability of work and the extent to which the procedures for conducting the work are known (Van de Ven and Delbecq, 1974). It is also referred to as task complexity. In case of difficult tasks, one needs a considerable amount of thinking time to solve work related problems, and there is not much knowledge about the procedures for performing the job. Task difficulty should not be confused with job complexity from Morgeson and Humphrey. They focus on the positive aspect of complexity in order to predict motivational outcomes, because they posit that more complex jobs are mentally more demanding and challenging, thus resulting in higher motivational outcomes. This is in contrast to task difficulty which focuses on well-defined structured procedures for conducting work.

A task can therefore be characterized as routine when one has few exceptions (i.e. low variability), and the when the work is analyzable (i.e. not difficult). Task routineness thus refers to the extent one works on repetitive and analyzable issues (Goodhue and Thompson, 1995). However, it was found that these two concepts were hard to distinguish because of their lack of discriminant validity, and therefore task variety and difficulty were converged into one construct of task routineness (Hage and Aiken, 1969; Lynch, 1974; Van de Ven et al., 1976). Several studies especially used the concept of task routineness because of this parsimonious operationalization (Karimi et al., 2004; Majchrzak et al., 2005).

Task interdependence is the degree to which completing tasks requires interaction with other people (Liden et al., 1997). Task interdependence consists of two types (Kiggundu, 1981); initiated and received interdependence. When someone is dependent on the work of others, it is
referred to as received task interdependence. In case someone affects the workflow of others, it is referred to as initiated task interdependence. It is all together the degree of ‘interconnectedness’ between jobs (Morgeson and Humphrey, 2006) in which the success of one depends on the performance of others (Kiggundu, 1981; Kiggundu, 1983). These two concepts were also converged into one construct (Pearce and Gregersen, 1991) based on the studies of Van de Ven and Delbecq (1976) and Kiggundu (1983), because these constructs were respectively not able to measure perceived task interdependence and showed high intercorrelation, denoting a lack of discriminant validity.

1.3. Technology and its effects

Above in the digital workspace section has been made clear that ICT tools are computer based tools which support the performance of an employee’s daily task portfolio. ICT tools are both hardware and software technologies. Examples of hardware are personal computer (PC), laptop, or personal digital assistant (PDA). Some widely used software technologies are information systems (HRM, inventory, administration), email, office applications (word and spreadsheet processors), communicators (chat, IP phone), and online shared workspaces. Throughout literature, the terms ICT, IS, and technology are often used interchangeable. Technology is the highest denominator which includes terms like ICT and IS. In general IS refers to information systems (i.e. software based tools) and ICT refers to both hardware and software tools. These terms could be used interchangeably in this thesis because of discussing relevant streams of research. Leonardi and Bailey (2008) taxonomized technology in terms of communication, storage, and transformational technologies. Communication technologies primary serve as conduits for messages containing information and knowledge, such as a phone, email or chat. Storage technologies can hold, retrieve and share digital artifacts, such as knowledge management systems or database repositories. Transformational technologies afford the creation, modification and manipulation of digital artifacts, such as spreadsheets or word processing applications.

An attempt to offer a taxonomy of technologies is welcome, since a wide range of applications have been developed and studied in isolation, such as mobile information systems (Gebauer et al., 2006), group support systems (Zigurs et al., 1999), or software maintenance tools (Dishaw and Strong, 1998). However, as can be derived from these examples, it is hard to classify a tool according one of the categories. Moreover, the rapid development of new technological
solutions, which for example offer both storage and transformation capabilities, will make it even harder to categorize technologies. The concept of information and communication technologies itself already denotes an integration of these technological capabilities. For example, online shared workspaces offer both functionalities to communicate messages and modify the content of digital artifacts. This development towards further integration and compatibility of ICT tools in the digital workspace in order to improve people’s performance will continue. Then it will become even harder for people to experience explicit differences between the technologies and evaluate their corresponding capabilities. The taxonomy as proposed byLeonardi and Bailey (2008) is therefore not widely applicable for studying technology success and its effects. A different approach is offered by the D&M Success model (DeLone and McLean, 1992; Delone and McLean, 2003).

“The measurement of information systems (IS) success or effectiveness is critical to our understanding of the value and efficacy of IS management actions and IS investments” (Delone and McLean, 2003: 10). The original ‘I/S Success model’ provided a good overview of studies conducted in the field of information systems success; the search for a taxonomy of IS success research was needed because there were as many measures of IS success as studies conducted in the field of MIS research (DeLone and McLean, 1992). The D&M model is a strong basis for studying system or technology success, because it provides a structured overview of general concepts and relations between these concepts. The field of systems research is extensive. Each study labeled its concepts with other names, yet the basic meanings were similar. The updated ‘D&M IS Success model’ is an improved and comprehensive taxonomy of many studies conducted on systems success. The original model from 1992 was a review of to that date conducted studies, the updated model from 2003 reviewed empirical studies that explicitly or implicitly tested the D&M model. It is posited that higher system quality, information quality, and service quality results in higher user satisfaction and the intention to use a system, which in turn leads to higher actual system use and ultimately in increased individual and organizational performance (i.e. increased net benefits).

Systems quality is a general concept that was measured by various studies in terms of ease-of-use, functionality, reliability, flexibility, data quality, and integration. The concepts of accuracy, timeliness, completeness, relevance, and consistency apply in the same manner to information quality. Service quality was added in the updated D&M model because not only the system
characteristics but also the services of the IT (support) department in general was found to be an important determinant of user satisfaction. For this reason the SERVQUAL instrument (Parasuraman et al., 1985; Parasuraman et al., 1988) was adjusted and applied to measure service quality in the IS field; it was found to be a valid measurement tool (Jiang et al., 2002). The concepts which reflect the SERVQUAL measure are reliability, responsiveness, assurance, and empathy. *Net benefits*, that is the impact of a technology, were measured as quality of work environment and job performance. These measures of quality were found to be important indicators of system success and performance impacts on organizational, group and individual level. As Delone and McLean kept the net benefit dimension as general as possible for model parsimony, further granulating it for specific studies is needed in order to be able to draw specific conclusions. Therefore in this thesis employee satisfaction and productivity are addressed as dependent factors, which will be further elaborated in the following section.

1.4. Employee satisfaction and productivity

The effect of technology has been studied extensively on different levels of analysis such as work group productivity, organizational and inter-organizational performance, and consumer and societal impacts (Delone and McLean, 2003). In order to address technology success, various researchers have developed technology impact measures such as user evaluation satisfaction (Ives et al., 1983), usability measure (Bevan, 1995), output quality (Venkatesh and Davis, 2000), flexibility of information technology infrastructure (Byrd and Turner, 2000), end-user computing satisfaction (Doll and Torkzadeh, 1988), and performance impact of computer systems (Goodhue, 1995). These concepts have in common that a direct link between the technology and the dependent factors is made. For example, output quality directly refers to the capability of a system to produce a certain product (Venkatesh and Davis, 2000). ‘Performance impact of computer systems’ makes a direct link between the employed technologies and the resulting perceived performance impact of this technology (Goodhue, 1995). This conceptualization assesses someone’s judgment if a technology further increases one’s performance in comparison to when the technology would not have been employed (i.e. overall net benefit of a technology).

The goal of a digital workspace is that people can carry out their work and private related activities pleasantly, effectively and efficiently in every context (Overbeek et al., 2005). When studying the effect of a phenomenon on employee productivity, one can make a direct link
between the phenomenon and productivity, as in the above mentioned examples. Following the extensive number of examples such as reviewed by DeLone and McLean (2003), and Ramírez and Nemhhard (2004), I will also use the concept of performance impact of computer systems as one of the dependent factors (Goodhue and Thompson, 1995). Since the focus of this study is on ICT tools, I refer to this concept as ICT performance impact, to address the effects of ICT tools employed for carrying out one’s daily task portfolio.

By using productivity concepts separate from IS research and at a higher level of abstraction, it is possible to benchmark the impact of a technology based on different streams of research and therefore address the technology performance impact from a broader perspective. In organization research, human resource management research, and other research streams, employee productivity and satisfaction are highly studied concepts applied to address organizational outcomes (Combs et al., 2006; Evans and Davis, 2005; Godard, 2001; Huselid, 1995; Judge et al., 2001).

Productivity is a very broad concept that could be conceptualized according 13 dimension, such as efficiency, effectiveness and quality (Ramirez and Nemhhard, 2004; Staples et al., 1999). Measuring and monitoring employee productivity is helpful in addressing the impact of new technologies (Ramirez and Nemhhard, 2004). Many productivity measures are based on quantitative data, such as total output divided by the sum of all input. It is often not possible to gather this type of data, because the inputs and outputs are hard to quantify. This applies especially for knowledge-intensive professions. Therefore subjective productivity measures can be applied, which is defined as “a method for acquiring productivity information by gathering and analyzing the assessments of relevant stakeholders regarding direct or indirect productivity of the measurement object” (Kemppilä and Lönnqvist, 2003: 3). Indirect productivity measures include assessing unused capacity, poor atmosphere, long waiting times, etcetera. Direct productivity measures relate to assessing dimensions such as efficiency, effectiveness and quality. The measurement object is a person’s own subjective assessment of its productivity. Perceived employee productivity is thus defined as a respondent’s belief about its effectiveness, efficiency, and work quality (Staples et al., 1999).

In the field of organization research, human resource management, or job design studies, job satisfaction has been studied extensively (Locke, 1976; Morgeson and Humphrey, 2006;
Schleicher et al., 2004). It has been studied mostly in combination with productivity, profitability, employee turnover, and loyalty (Harter et al., 2002). Especially the relation between satisfaction and productivity gained a lot of attention, some studies suggesting that satisfaction leads to performance, some suggesting the other way around, or even other suggesting there is no relation (Judge et al., 2001; Schwab and Cummings, 1970). On organizational level of analysis, employee satisfaction was found to lead to higher organizational performance (Ostroff, 1992).

Addressing employee satisfaction and productivity in this thesis is appropriate for complementing other studies which investigated their effects as either dependent or independent concept. Moreover, since employee satisfaction and productivity are such highly studied subjects, it validates the earlier given argument that next to ICT performance impact, these concepts are appropriate for addressing the effectiveness of ICT tools in the workplace.

Job or employee satisfaction has been defined as one’s positive or negative attitudes towards their job (Greenberg and Baron, 2008). It is the general feeling of an employee’s happiness and contentedness, and if one can fulfill their desires and needs at work (Heathfield, 2010). It has also been defined as one’s cognitive and affective evaluation of their job (Schleicher et al., 2004; Tett and Meyer, 1993), or more simply “the feeling a worker has about his job” (Smith, Kendall and Hulin, 1969: 100 from Kinicki et al., 2002). A dominant view on satisfaction in HRM is the two-factor theory of job satisfaction, which suggests that satisfaction can be grouped in two types; hygiene factors (supervision, physical working, salary, etc.) and motivators (challenging assignments, recognition, professional growth, etc) (Herzberg, 1957). Hygiene factors can lead to dissatisfaction (but not satisfaction) and motivators can lead to satisfaction (but not dissatisfaction).

In recapitulation; in order to explain the effects of ICT tools employed for carrying out someone’s daily task portfolio, employee satisfaction, employee productivity, and ICT performance impact are investigated. ICT performance impact is used because of the direct link between the tool’s effect on productivity. Employee satisfaction and productivity are employed as separate and general concepts as opposed to ICT performance impact because of the possibility to being better able to benchmark with and complement to other studies and research streams.
Now referring back to the D&M model, when solely assessing the qualities (e.g. system quality) in abstract, a technology’s features and services are evaluated. In case a certain technology has particular features, it might be that these features are best-of-bread. A best-of-breed technology is a tool which is generally considered to be the best available solution for a particular purpose. One would thus expect that when developing a technology with higher quality features, the performance factors introduced above would increase positively. However, if these features do not meet the user’s requirements for their daily task portfolio, using the technology does not add value to their working environment. Hence, the task-technology fit should be assessed rather than assessing technology or IS systems quality in isolation in order to address ICT tool’s effects (Goodhue and Thompson, 1995).

1.5. Task-technology fit
The linkage of technology to individual performance in MIS research resulted in two mean streams: the task-technology fit model (Goodhue and Thompson, 1995) and utilization or behavioral focused models (Davis, 1989; Venkatesh et al., 2003).

Utilization focused studies predict that the utilization of a technology is the result of a user’s belief about and affect toward a technology. A typical example is the Technology Acceptance Model (TAM) (Davis, 1989). TAM theorizes that a person’s perceived usefulness and perceived ease of use (two beliefs) of a technology predict one’s behavioral intention to use the technology. The intention to use a technology has shown to predict actual usage (Davis, 1993). Actual utilization resulted explicitly or implicitly in higher user performance (Goodhue and Thompson, 1995; Venkatesh et al., 2003). TAM is studied extensively and several model extensions were proposed, most notable TAM2 (Venkatesh and Davis, 2000) and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003). These behavioral models however are all based on user’s belief about a technology. The use of a technology is not always voluntary and thus the performance impact is to an increasing extent dependent on the supportive and instrumental value of a technology instead of the degree of utilization (because one has to use the technology anyway). Therefore, as Goodhue and Thompson (1995) argue, if the employed technology does not fit with the user requirements, higher utilization will not increase one’s productivity.
Hence, the task-technology fit perspective should be considered when studying the digital workspace (which addresses productivity factors as dependent upon the fit between three dimensions; task, technology and individual (Goodhue and Thompson, 1995)). First the task-technology fit is presented in a broader context of general fit perspectives, second the task-to-performance chain which includes the task-technology fit model is presented, followed by a discussion about fit factors, comments on the original fit measures, and finally a hypothesis is formulated about the relation between task-technology fit and employee satisfaction and productivity, and ICT performance impact.

Fit

Task-technology fit is “the degree to which a technology assists an individual in his or her portfolio of tasks” (Goodhue and Thompson, 1995: 216). “The heart of the task-technology fit model is the assumption that [ICT tools] give value by being instrumental in some task or collection of tasks and that users will reflect this in their evaluation...” (Goodhue, 1998: 107). Task-technology fit is conceptualized according to ‘fit as profile deviation’ (Venkatraman, 1989). A profile is an ideal specified situation; the less a real situation deviates from the profile, the higher the fit. Since the ideal digital workspace situation is different for each individual, task-technology fit is a normative construct (Fuller and Dennis, 2009) which is reflected by a user’s evaluation of correspondence between the task requirements and technology capabilities to support their tasks. It was found that users are able to evaluate their degree of task-technology fit (Goodhue, 1995). In order to position the task-technology fit in a larger theoretical model, the task-to-performance chain (TPC) is discussed below. This model integrates both the fit perspective and utilization perspective in order to predict employee productivity.

Task-to-Performance Chain

The combination of the utilization focused models and the task-technology fit model results in an integrated task-to-performance chain (TPC). This model posits that a technology must be utilized and must fit with the tasks it was designed for in order to have positive performance impacts (Goodhue and Thompson, 1995). According the TPC, tasks, technology and individual characteristics predict the level of task-technology fit. In many aspects the task-technology fit model is in line with the D&M model. The main difference is that the technology or system quality is the starting point in the D&M model, whereas the task-technology fit model makes an explicit link between the task and technology, and starts at these respective concepts. It is thus
the TPC which posits that the task, technology and individual characteristics predict the task-technology fit. The task-technology fit then predicts utilization (via theories of attitudes and behavior such as TAM and UTAUT) and finally performance impacts. Figure 1 on the next page provides a visual representation of these propositions. Another interesting point that can be derived from the TPC, is the feedback loop. Feedback in the TPC can function as input for important interventions to increase productivity. These interventions can focus on discontinuing or redesigning technology, training of individuals and/or redesigning tasks individuals need to carry out in their work given the fixed set of ICT tools they have to use (Goodhue, 1988; Goodhue, 1997). When conducting a longitudinal research design, a first measurement is a diagnostic to examine the degree of task-technology fit. Based on these results interventions could take place where needed, and, based on a second measurement, the intervention effects would be assessed. The feedback loop from the TPC is thus not operationalized as explicit measurement, but would implicitly be studied when choosing for a longitudinal research design. As presented above, the task-technology fit model is a specific part of the larger task-to-performance chain. Here I will further elaborate on the fit model.

Task-technology fit factors

The theory of task-technology fit has been developed and fine-tuned in a number of articles (Goodhue, 1988; Goodhue, 1995; Goodhue and Thompson, 1995; Goodhue, 1997; Goodhue, 1998). Several extensions have also been proposed, such as integrating task-technology fit and fitness-for-use models (Dishaw and Strong, 1998), and the task-technology fit model with the TAM model (Dishaw and Strong, 1999). The task-technology fit model is an answer to the lack of proper instruments for evaluating system or technology success (Goodhue, 1998). According Goodhue, the to that date available and highly cited models were the user information satisfaction model (Bailey and Pearson, 1983) and end-user computing satisfaction model (Doll and Torkzadeh, 1988). To date more success models have been proposed and published, all being reviewed and taxonomized in the D&M success model as discussed earlier. Below I will elaborate more detailed on the task-technology fit model.
Based on a review of the work processes and task portfolio of knowledge workers and decision
makers, Goodhue (1998) identified that these workers go through a process of identifying,
acquiring and interpreting information. This is exactly in line with Davenport and Beers’ (1999)
information management process of identifying, collecting, distributing and using information.
When stating the definition of task-technology fit in the opposite direction, the level of task-
technology fit would decrease if a technology would not meet the user’s requirements, that is
not being instrumental in conducting the task portfolio as mentioned above. In more detail, a
user could become ‘frustrated’ when he or she is at the stage of identifying information and the
ICT tools do not provide the right information, the right level of information detail, if the
information is confusing, if the meaning of the information is not clear, or if the location of the
information is not clear. For the acquisition of information, accessibility, the ease-of-use of
hardware and software, the lack of training in the use of hardware and software, and poor ICT
tool’s reliability could frustrate the user. Besides, when someone does not have the right
authorization or sufficient authorizations, the user is not able to acquire needed information for
conducting its task portfolio. When finally interpreting the information, the user could get
frustrated in case there is a lack of data accuracy, currency, and compatibility of information, or when the information is not presented in a useful way. It is thus that the information provided by ICT tools should be internally compatible, and in case of multiple tool utilization, the tools should be compatibility.

Comments

The advantage of applying the task-technology fit model is that it could serve as a diagnostic tool, hence it is possible to address specific problematic areas in the digital workspace (for example the ability of indentifying information). A major disadvantage of applying this model is that it is fairly large and therefore costly and demanding for applying it in empirical settings. Besides, throughout time most of the studies that applied this fit perspective developed their own fit factors in order to address a certain technology. Instead, one general and consistent assessment of task-technology fit is needed which is broadly applicable for ICT tools in the digital workspace. Also, the task-technology fit model that was validated by Goodhue (1998) was designed for ‘evaluating the overall information systems and services provided in organizations’, instead of evaluating fit on individual work level. Since the composition of digital workspaces can vary for each individual, there is a model needed to identify fit on individual work level. Moreover, because task-technology fit as presented above is multidimensional, there is not one conclusive answer about the degree of task-technology fit. Therefore, instead of assessing all the factors separately, there is a unidimensional measure needed for assessing task-technology fit for someone’s individual workspace. One study indeed tried to use a unidimensional task-technology fit concept (Pendharkar et al., 2001), but this one-item operationalization is not sufficient for reflecting the latent construct of task-technology fit. A different approach is offered by Moore and Benbasat (1991).

Based on the diffusion of innovations (Rogers, 1983), Moore and Benbasat (1991) developed a model for adopting information technology innovations. The five general attributes of an innovation are relative advantage, compatibility, complexity, observability, and trialability. Compatibility of an innovation is the degree to which an innovation is perceived as being consistent with existing values and needs (Moore and Benbasat, 1991). “Compatibility for determining IT adoption is the degree to which the use of [a technology] is compatible with, or requires change, in one’s job” (Moore and Benbasat, 1991: 215). Compatibility is thus in line with the fit discussion from above; an individual’s ideal profile of correspondence between the task
requirements and technology. I will therefore use this unidimensional concept for assessing the degree of task-technology fit, as opposed to the multidimensional concept from Goodhue and Thompson (1995).

Towards theoretical framework and hypotheses

The frustration with a system or technology resulting from lower levels of fit between the technology and tasks would intuitively lead to lower employee satisfaction and productivity. In case the technology is not able to assist an individual in his or her portfolio of tasks, for example if one cannot find the right information in a timely manner, one is not able to execute its tasks properly. The principle of task-technology fit was initially tested in experimental settings (Jarvenpaa, 1989; Vessey, 1991). Higher levels of task-technology fit resulted in higher levels of team decision quality and satisfaction, and teams were able to complete tasks faster than teams with lower fit levels (Fuller and Dennis, 2009). It was however also found that this effect disappeared after a while, because a team is able to innovate and adapt to lower levels of fit. For mobile locatable information systems, individual performance in terms of time to complete a task was found to be significantly predicted by the level of task-technology fit (Junglas et al., 2008). This study however is also experimental.

The task-technology fit theory has however also been tested in empirical settings, such as in a transportation and insurance company, where the user evaluations of task-technology fit did result in higher levels of performance impacts, over and above the explanatory power of utilization on performance impact alone (Goodhue and Thompson, 1995). Staples and Seddon (2004) also found task-technology fit to be a strongly predicting performance impacts. When studying learning management systems, it was found that student grades were positively influenced by the level of task-technology fit, and that the positive relation between fit and perceived impact on learning was even stronger (McGill and Klobas, 2009).

Many of these studies have an experimental research design and are applied by using a specific technology, e.g. mobile devices, decision support systems or learning management systems. The original starting point of the task-technology fit model is that it could be applied to technology in general, without having to develop adjusted fit and performance impact measures to study the effect of a specific technology in a given situation. Since Goodhue and Thompson (1995) state that performance implies measures of efficiency, effectiveness and/or higher quality (of
something), they however do not make this explicit in their model. Also Staples and Seddon (2004) who tested the task-to-performance chain did not make this distinction and therefore asks for further comparison and detailing of performance factor in future research. Therefore, next to ICT performance impact the two general concepts of employee satisfaction and productivity are assessed as dependent factors, and expected to be positively affected by task-technology fit.

**Hypothesis 1**: higher levels of task-technology fit will result in increased levels of (a) employee satisfaction, (b) employee productivity, and (c) ICT performance impact

1.5.1. Tasks

When one has a fairly routine task portfolio, the demand on ICT tools will be low because there are few exceptions (i.e. low variability) in someone’s task portfolio and the work is fairly analyzable (i.e. not difficult) as well. In this case, a technology can be programmed and standardized to meet the routine task portfolio of its users. However, since the performance of managers and knowledge workers is dependent of the quality and availability of non-standardized information resources provided by a technology (Hinton and Kaye, 1996), their information-processing requirements and thus demand on a technology will increase as their task portfolio will be increasingly non-routine as well (Daft and Macintosh, 1981). For individuals with higher levels of non-routine tasks it will be harder to find appropriate ICT tools for supporting their working actions. Higher levels of non-routine tasks will make the user more aware of possible technology shortcomings and hence result in lower levels of task-technology fit (Goodhue and Thompson, 1995). Task non-routineness was found to have a negative relation with user satisfaction with data (Karimi et al., 2004). Another study found that difficult tasks resulted in lower user satisfactions with the technology, and partial support was found for task variability and user satisfaction (Gelderman, 2002). As task routineness solely refers to the characteristic of a tasks conducted by an individual, cooperation with other individuals is the second important task characterization (Fry and Slocum, 1984) and therefore also needs consideration for explaining task-technology fit levels.

Task interdependence was found to lead to increased levels of group performance and group control (Liden et al., 1997). Here I am interested in the role of task interdependence for
explaining the level of perceived task-technology fit of individuals. With a low level of interdependence, people can work fairly independently and will therefore not require a high level technology capability for interacting with colleagues or clients. Managers have a coordinating function and need to interact with others, the same applies to knowledge workers, decision makers or members of a team which need to exchange information with other people to an increasing degree as they become interdependent. Higher levels of task interdependence were indeed found to lead to a higher degree of collaborative electronic media usage (Jarvenpaa and Staples, 2000). But as the demand on technology increases for the purpose of conducting one’s task portfolio, it is expected that the supportive value of the ICT tools will be lower. That is, the more people are interdependent on one another, the more data and a richer exchange of information is needed to satisfy user needs (Karimi et al., 2004), and thus a user will become more frustrated of the deficiencies and incompatibilities of a technology in offering these capabilities (Goodhue and Thompson, 1995).

Since the ‘demand’ on a technology increases with higher levels of task interdependence, the same applies to higher levels of task non-routineness as discussed above, and thus people with higher levels of these task characteristics are hypothesized to have lower levels of task-technology fit. Hence, the following hypotheses are formulated;

**Hypothesis 2**: higher levels of task (a) non-routineness and (b) task interdependence will result in lower levels of task-technology fit

1.5.2. Technology

The main concepts to consider when studying the fit between tasks and technology, is indeed the task and technology characteristics themselves. However, Goodhue and Thompson (1995) did not operationalize the dimension of technology characteristics. Instead, they described that the respondents in their study had to identify up to five systems (of 20) which they actually used. The ‘technology variable’ in their study was thus fixed. Moreover, as they argue, the simplifying assumption was made that ‘the characteristics of any given system are the same for all who use the system’ (p. 222). This might be applicable in the nineties, but given the large variety of systems and applications developed in the IS field (Petter et al., 2008), ICT tools nowadays could offer very different features for each individual, and thus the assumption all systems are equal
for each individual does not hold. Other studies which applied the task-technology fit model address fit of specific technologies such as mobile information systems (Gebauer et al., 2006), group support systems (Zigurs et al., 1999), or software maintenance tools (Dishaw and Strong, 1998), which means they do not offer explicit concepts for operationalizing the technology dimension either. What is needed instead, are technology characteristics on the same abstract level as the task characteristics. The task non-routineness and interdependence concepts for example do not say anything about the kind of work that is conducted, but how work is organized. Concepts on a similar level of abstraction are needed for analyzing how people perceive the ICT tools they use. These technology characteristics should be widely and generally applicable for assessing ICT tools’ capabilities, so that it is possible to study and benchmark a wide variety of tools. The concepts I propose to use as technology characteristics are; personalization, mobility and collaboration.

The first concept is included in the model because of the increasing technological capabilities of ICT tools to be personalized nowadays. Consider for example the layout of an operating system, the menu from a PDA, or personalized home pages including email and other functionalities. Mobility is proposed to be incorporated in the model because people become more mobile in their work nowadays (e.g. teleworkers), and therefore this technology characteristic should address the degree to which ICT tools support the mobility. Collaboration is included because in nearly every job, people need to collaborate with colleagues, clients, suppliers or other stakeholders. This technology characteristic will therefore assess the degree to which people experience their ICT tools to support them in these tasks.

**Personalization** is defined as “the process of changing functionality, interface, information content, or distinctiveness of a system to increase personal relevance” (Blom, 2002: 540). The concept has also been defined as tailorability, or configurability (Appelt et al., 1998). Personalization in most cases is user-initiated, that is, the user changes a technology to its individual needs. Blom (2000) mentions that there are three motives for personalizing ICT tools, such as being able to (quickly) access information (e.g. bookmarks). Second, personalized tools accommodate individual differences, that is, people like to do the same things in different ways (e.g. one or two mouse clicks for opening a document). Third, personalization accommodates working goals, the same repetitive actions can be automated (e.g. with macro’s). The ability to personalize technology was found to have cognitive (ease of use, improved aesthetics), social
(reflection of personal and group identity) and emotional (feeling of control and ownership, fun, attachment to technology) effects (Blom and Monk, 2003). Perceived personalization of recommendation agents for example increased the degree of ‘we-ness’ feeling between the individual and the agent, and thus increased levels of trust, which in turn leads to higher agent adoption rates (Komiak and Benbasat, 2006). Thus, when ICT tools are personalizable, people will adjust them to their preferences in order satisfy personal relevance. Personal relevance is different for everyone and dependents on the task portfolio one has to conduct. It is thus hypothesized that ICT tools which have higher levels of perceived personalization capabilities exhibit a higher degree of task-technology fit.

**Hypothesis 3 a:** ICT tools with higher perceived levels of personalization characteristics will result in increased levels of task-technology fit

*Mobility* is the degree to which ICT tools enable people to work anywhere, anytime. Mobile devices such as mobile phones, personal digital assistants (PDA), and laptops made it possible to work outside the wired information systems infrastructure (Gebauer, 2008). Mobile devices enabled the rapid increase of teleworkers and their use of ICT tools (Gareis, 2002; Haddon and Brynin, 2005). A teleworker is categorized as someone who mostly works at home or at the office (fixed site worker), who predominantly works in the field (mobile workers), or those who mix both the office and field (flexiworkers) (Garrett and Danziger, 2007). The use of mobile devices and ICT tools which enable the mobility of workers (e.g. externally accessible data repositories) increases worker flexibility, autonomy and independence (Harpaz, 2002). When a worker is more flexible and has more autonomy in the choice where, when and how to work, he or she is able to perform those tasks that best fit a particular situation. For example, when traveling by train someone can prepare a meeting for later that day, or someone want to finish a document at home which he or she started to work on at the office. If ICT tools enable people greater freedom, that is higher degrees of perceived ICT tool’s mobility, one would experience a higher degree of fit between those tools and the tasks that need to be conducted, given their own flexible choice of when and where to conduct their tasks.

**Hypothesis 3 b:** ICT tools with higher perceived levels of mobility characteristics will result in increased levels of task-technology fit
Collaboration as technology characteristic is here defined as the ability of ICT tools to enable cooperation among colleagues, clients or other stakeholders. This includes the ability to use the ICT tools to communicate via text or voice, and collaborate online (e.g. on documents). Technological development increased the ease of working together via ICT tools, more and more tools are compatible. For a specific technology (i.e. groups support systems), three dimensions were identified that need to be present for effective decision making; communication support, information processing support and process structuring support (Zigurs and Buckland, 1998). Communication support is the ability of a technology to support, enhance, or define the way in which group members can communicate. Information processing support is the ability of a technology to support, enhance, or define the process by which group members gather, share, aggregate, structure, or evaluate information. Process structuring support specifically addresses how groups structure their process of group interaction, for example by means of agendas. The focus of this thesis is broader than just group support systems, but the communication and information processing elements are important general features that ICT tools should posses for effective collaboration. When the tools are based on stand-alone features, people cannot work together and thus the ICT tools have no collaboration capabilities. Moreover, communication and cooperation is important for group effectiveness (Campion et al., 1993), so the ICT tools should also exhibit characteristics which support the individual user in conducting its task portfolio in cooperation with its colleagues. Since most jobs require collaboration among colleagues, clients, suppliers, or other stakeholders, it is expected that ICT tools which exhibit collaboration capabilities will result in higher task-technology fit.

Hypothesis 3 c: ICT tools with higher perceived levels of collaboration characteristics will result in increased levels of task-technology fit
1.6. Conceptual Model

Based on the literature review above, the hypotheses are visually represented in the following conceptual model. The next chapter addresses how this model is tested in two different studies.
2. Methodology

Theory is presented and hypotheses are formulated in the previous chapter. There is thus a theoretical basis about the assumptions made and, hence, this study is in general characterized as explanatory (also conclusive or descriptive) in nature. This thesis is split in two parts, Study 1 is a pretest study to mainly validate the questionnaire which is needed to test the hypotheses. Study 2 is a pilot test which empirically tests an adjusted conceptual model based on the pretest results. Here I will further elaborate on this research design.

2.1. Research design

The research method employed to measure the concepts is a survey, because the unit of analysis is the individual as user of ICT tools. The unit of analysis is the level at which data is analyzed (Sekaran, 2003), in this case individuals. A higher number of respondents can be reached when conducting a survey and thus generalizing the conclusions to the domain of interest is based on bigger foundation.

Most of the concepts in this thesis are based on studies that already validated their concept’s operationalizations (i.e. how the theoretical concepts are measured). However, there are also constructs specially developed for this thesis. For new construct development, basic procedures need to be followed to develop good measurements (Churchill, 1979). For MIS research three stages are identified; domain, instrument, and measurement properties (Lewis et al., 2005). Domain specification (i.e. building conceptual model) is covered in the theory chapter. Instrument development and checking measurement properties are combined in an iterative process in Study 1.

In this first study is specifically addressed how the construct are operationalized, and what method of analysis is employed for validating the questionnaire. Next to new construct development, a validation check is needed because questions are translated from English to Dutch, and the questions have never been operationalized together in one questionnaire before. An initial questionnaire was reviewed by an expert panel and based on their feedback several improvements were made in the construct operationalizations. Study 1 also presents a test of the conceptual model, because for Study 2 a low number of respondents completely filled out the questionnaire and therefore additional data was needed. Based on the pretest results, Study 2 uses a completely validated questionnaire to test a slightly adjusted conceptual model.
3. Study 1: Pretest

The goal of this study is to pretest and validate the questionnaire developed for testing the conceptual model as presented in Figure 2 on page 29. First the construct measurement addresses how the concepts are operationalized, then the method of analysis is presented, and finally the pretest is analyzed, discussed and improvements are presented for Study 2.

3.1. Construct measurement

To assure reliability of the construct measurements, as many as possible existing and validated construct operationalizations have been used. The constructs from existing literature are task non-routineness, task interdependence, task-technology fit, employee satisfaction, employee productivity, and ICT performance impact. The technology constructs are developed in this thesis. A construct is a domain of observables, that is, a latent representation of a set of observed variables (Nunnally, 1967 from Lynch, 1974). All constructs are reflective in nature and operationalized on a 7-point Likert scale, unless it is explicitly noted that the constructs used a 5-point Likert scale. The Likert scale was applied for assessing the respondent’s agreement with the statements discussed below, from ‘totally disagree (1) to totally agree (5 or 7). If an original construct from the literature used a 5-point Likert scale, this was replicated. Using 5 and 7 point Likert scales generally increases reliability and validity, but more granular scales (e.g. 10-point) do not further improve reliability and validity (Dawes, 2008). Furthermore, when offering respondents multi-item scales, they do use more response options. However, for the means of analysis it does not matter if a 5 or 7-point Likert scale is employed, because the mean score of responses is similar when recoding variables into either one of these scales (Dawes, 2008). All questions from original constructs were translated from English to Dutch by an interpreter. Next, the question wording was further adjusted to produce a consistent questionnaire in line with the context of this study. The full questionnaire is included in Appendix 1, including construct scales, source(s), and indication of which constructs were randomized together. Next, each construct operationalization is presented per dimension.

Task characteristics

Task routineness is defined as the extent to which one works on repetitive and analyzable issues (Goodhue and Thompson, 1995). For the purpose of intuition and hypothesis development, the degree of tasks routineness is formulated in the opposite direction and referred to as the degree of task non-routineness. The operationalization of Goodhue and Thompson (1995) is used
because they converged the concepts of task variety and difficulty, and thus offered a more parsimony operationalization of the concept. A higher level of task non-routineness thus refers to a higher degree of a exceptions in the work and non-analyzable task portfolio. Other studies also used this operationalization because of the construct parsimony argument (Karimi et al., 2004; Majchrzak et al., 2005). The construct comprises three items.

Task interdependence is defined as the degree to which completing tasks requires interaction with other people (Liden et al., 1997). To stay as close as possible to the original model, the task interdependence operationalization from Goodhue and Thompson (1995) should be used. However, they only used two items which is not good enough for operationalizing latent variables. Besides, the questions do not reflect the definition of task interdependence as discussed above, and therefore the construct does not meet content and face validity. The choice to operationalize task interdependence as one construct (general interdependence), or two constructs (initiated versus received interdependence) is as follows; because the level of task-technology fit is expected to depend on the interdependence of jobs in general, regardless if this interdependence is initiated or received, the operationalization needs to be accordingly. Moreover, since Pearce and Gregerson (1991) found that initiated and received interdependence showed a lack of discriminant validity, task interdependence is operationalized here as one construct. Therefore I also used Pearce and Gregerson (1991) for operationalizing the concept of task interdependence. They developed a new construct based on studies from Van de Ven et al. (1974) and Kiggundu (1981). Although this concept was further developed by Liden et al. (1997), I will use Pearce and Gregerson’s 11 item construct because these questions are directly useable for a questionnaire in comparison to Liden’s 3 item construct which address the questions in general and plural form. Ten of the 11 original questions were translated from English to Dutch. After the Study 1, 4 items should remain for testing the conceptual model in Study 2 because of parsimony reasons.

Technology characteristics

The constructs used to operationalize the technology characteristics are developed for this study, because there is no study, to my knowledge, that has good validated constructs for measuring these concepts. For personalization and mobility, 8 items were defined for pretesting. For collaboration, 4 items were defined for pretesting. These are discussed below.
Personalization is defined as the process of changing functionality, interface, information content, or distinctiveness of a system to increase personal relevance (Blom, 2000: 313). Based on and derived from literature that addresses concepts of personalization, questions have been produced for this study. For example, there are 4 items based on the definition of personalization from Blom (2000). The items cover terms such as personal preferences, ICT-module (based on information content), and aesthetics (based on distinctiveness of a system). Besides, there is one item which questions if the ICT tools can be personalized to such an extent that there is no repetitive action involved in someone’s work (based on the goal to accommodate working goals and thus reduce repetitive actions). Furthermore, one item is used from D’Ambra and Rice (2001) for addressing the extend of control one has over its ICT tools (based on the use control over systems). Moreover, one item builds further upon the former to assess the extent of control. However, this item has the point of view of usability, and asks if one perceives it to be easy to let the ICT tools to do what he or she wants them to do (Palmer, 2003). Furthermore, one item addresses the customizability of the user interface (Appelt et al., 1998), and the final item addresses the module-concept in different wording (i.e. components instead of modules).

Mobility is the degree to which ICT tools enable people to work anywhere, anytime. Two items are based on a study about the corporate culture in relation to telecommuters (Hoang et al., 2008). From part 2 of their questionnaire the concepts of ‘office-centric culture’ and ‘the limit or delay of access to important resources’ are adjusted to the context of this study. Here, the items addressed if ICT tools are office-centric, and if working mobile, the access to the ICT tools are limited or delayed. A third item assesses if the ICT tools enable permanent connectivity (Kobsa et al., 2001), something quite common nowadays for PDAs. Five other items were formulated which address ICT tool’s accessibility when working mobile in different statements, and the perceived degree of being able to work mobile when using the ICT tools.

Collaboration is defined as the ability of ICT tools to enable cooperation among colleagues, clients or other stakeholders. Campion et al. (1993) presented a construct to assess the degree of communication and cooperation in work groups. Their three item construct was adjusted to meet the context of this study. For example, the question “Members of my team cooperate to get the work done” (p. 848), became “because of using the ICT tools I am able to cooperate with
my colleagues”. A fourth item was added to address if people are able to interact with their colleagues by means of their ICT tools.

**Task-technology fit**

*Task-technology fit* is the degree to which ICT tools are supportive and instrumental in conducting one’s daily task portfolio. In other words, it addresses to what extent technology in the digital workspace fits, matches, or is in congruence with the work of an individual. Goodhue and Thompson (1995) and Goodhue (1998) developed an instrument to operationalize the fit constructs. They stated that it might be necessary to adjust the questionnaire (or at least the wording) to comply to the technological development since the construction of the task-technology fit model (Goodhue, 1998). However, as argued in the theory chapter, task-technology fit in this study is operationalized by using only one latent construct, instead of multiple fit factors. Moore and Benbasat (1991) offer a construct which is very close to the definition of task-technology fit as discussed earlier in the theory chapter, and therefore their compatibility construct is used to operationalize task-technology fit. The question wording of their 4-item construct is adjusted to meet the context of this study.

**Performance factors**

*Employee satisfaction* is defined as one’s positive or negative attitudes towards their job (Greenberg and Baron, 2008). The two-factor model of Herzberg (1957) was not employed because of questionnaire parsimony reasons. Instead employee satisfaction is operationalized by using Jun et al.’s (2006) constructs, which also offers the possibility of benchmarking with other NWoW research results. It comprises of 4 items on a 5-point Likert scale.

*Employee productivity* is defined as a respondent’s belief about its effectiveness, efficiency, and work quality (Staples et al., 1999). It is operationalized by using Staples et al.’s (1999) measure of ‘Overall Productivity’. This is a subjective productivity measure. Although it is suggested that there is no ‘best way’ of questions to assess subjective productivity (Smith, 1990), the items incorporated in this measure best covers the dimensions of perceived efficiency, effectiveness and quality of work. Besides, this construct operationalization is also used by the New Worlds of Work research (Baalen et al., 2007), and therefore offers benchmark possibilities. The construct comprises 5 items on a 5-point Likert scale.
*ICT Performance impact* involves addressing the effect of ICT tools employed for carrying out one’s daily task portfolio. Each question will make a direct relation between the ICT tools and one’s performance, that is, to what extent the ICT tools are a net benefit (Goodhue and Thompson, 1995). As this concept is based on Goodhue and Thompson, their operationalization however is not used because it comprised of 2 items only. Instead, 4 items from D’Ambra and Rice’s (2001) performance impact measure is used and adjusted to fit in the context of this study. A 5-point Likert scale was applied.

### 3.2. Method of analysis

Structural equation modeling (SEM) is applied for testing the conceptual model, because of its ability to test relations among multiple independent and dependent variables simultaneously. Another advantage of SEM over other methods is that it also estimates all indicators (also called items) that load on their latent variables (also called factors), and thus include measurement error on item level (Nusair and Hua, 2010). A latent variable is a construct that cannot be observed directly, hence it is operationalized by measuring several items which represent this latent variable (i.e. factor). All latent variables in this thesis are operationalized as reflective constructs, which means that the unobservable latent variable ‘cause’ their items. A reflective construct is unidimensionally represented by several items to explain the same construct. Therefore reliability measures such as internal consistency need to be checked to assure if the items are measuring the same theoretical concept. This is opposed to formative constructs which are caused by their items and serve to measure multiple dimensions from a domain of interest (Petter *et al.*, 2007). When these items have been measured, SEM is used to test the interrelations among factors and between the factors and their indicators (Raykov and Marcoulides, 2006). SEM both includes confirmatory factor analysis (CFA) for testing construct validity (of the measurement model), and path analysis for testing causality (Hair *et al.*, 2006). It seeks to explain the relation between multiple latent variables by fitting a theoretically developed structural model, to the empirical measurement model. Based on fit indices (presented later) it is assessed to what degree the structural model shows a good fit with the measurement model. LISREL 8.8 was used for SEM (Joreskog and Sorbom, 1993). The analyses uses three decimals to reduce rounding error (as in Franke *et al.*, 2008). Since Study 1 is a pretest, respondents were asked to comment on the questions if they did not understand the questions or had feedback for improving the question. The comments are qualitatively analyzed in the ‘general comments’ section.
Model validation process

Several processes were employed to test the construct validity of the concepts presented in Figure 2. “Construct validity is the extent to which the measure, based on a suitable operational definition of the construct, appropriately reflects the concept of interest” (Lewis et al., 2005: 396). In other words, it need to be certain that the constructs used in this study for operationalizing the theoretical concepts of interest are actually measuring the concepts of interest and not something else (Sekaran, 2003). Lewis et al. (2005) discussed a number of measurement properties that need to be assessed to validate a measurement instrument and ascertain good instrument quality, which are; content validity, factorial validity, convergent validity, discriminant validity, and nomological validity. Nomological validity is met when the hypotheses are supported, and will be addressed in the analyses. These properties are assessed in the analyses, results and implications of the pretest as discussed below.

3.3. Data collection

A survey was conducted electronically (using Global Park), which has the advantage over other methods for being able to directly import data for statistical analyses. The questionnaire from this thesis contains 60 questions and statements which was part of a larger questionnaire of 143 questions. The respondents were asked to fill out the questions according ‘their experience with the set of ICT tools they have at their disposal for conducting their daily task portfolio, whether hardware or software technology’. For the technology characteristics, they were specifically asked to evaluate the ‘properties’ of the ICT tools they have at their disposal. For task-technology fit, they were asked to evaluate the ‘supporting value’ of the ICT tools. In the sub-introductions of technology characteristics and task-technology fit questions, was explained that ICT tools are both hardware and software, such a PC, laptop and PDA, and office applications, (management) information systems, e-mail, shared workspaces, and other communication and cooperation tools. The questions were fully randomized per category to increase actual reliability, instead of artificially increasing internal consistency by grouping and labeling questions which would result in anchored and adjusted responses (Goodhue and Loiacono, 2002). Appendix 1 contains the exact wording of the questions and randomization categories. An invitation was send to the respondents with a hyperlink that brought them to the online questionnaire. The sample of respondents is paid panel members, with the characteristics of being employed at commercial organizations with more than 100 employees, and being higher educated (at the levels of ‘hoger beroeps onderwijs’ and ‘wetenschappelijk onderwijs’). While
and after answering the questions, respondents had the opportunity to make comments about the questions. For example, if they did not understand the wording of the question, they could make a comment about this by clicking on a button. A pop-up window would show up with room for open textual comments. The total sample of respondents participated is 481, of which 200 completed the entire questionnaire (response rate of 41.58%). The average response time was approximately 7.3 minutes (the total response time for all 143 questions was 17.5 minutes). The average age of the respondents is 48.5 years, the youngest being 27 and the oldest 66. 4 Respondents filled out the questions too fast (i.e. in less than 5 minutes) or filled out the same answer for all questions. Therefore these respondents are deleted and the pretest analysis is thus based on N=196.

3.4. Analyses
A pretest is a first initiative to test questionnaire validity with external respondents. After developing an initial concept questionnaire a group of experts provided feedback, meeting the content and face validity demands. Amongst others, question wording was adjusted and one construct over the another was chose for operationalization. Finally a pretest questionnaire was developed and tested with external respondents. This data is used for quantitative analysis with confirmatory factor analysis, and qualitative analysis of the general comments. Some constructs have more than 4 items because they are based on earlier validated studies, or the constructs are specially developed for this thesis and therefore have more than 4 items. The reason for defining more than 4 items for new constructs is as follows; in case of cross-loadings, low internal consistency, or unclear formulation of the questions from the point of view of respondents, and an item could need to be deleted or adjusted in order to improve construct validity. In short, the items should properly reflect their latent variable. Therefore an excess number of items have been defined in order to being able to assess their quality by means of a pretest analysis. The goal is to have 4 items per construct after the pretest as input for the second study. A construct with 4 items is the ideal number of items for construct representation (Hair et al., 2006). This means that when one items needs to be deleted in order to improve model fit for causality testing, the construct would not be underidentified but just-identified because there are sufficient known parameters available for equation solving in SEM. Thus, when a construct has four items it is overidentified and offers a good starting point for analysis. First a qualitative analysis is conduct on the general comments, followed by a confirmatory factor analysis.
3.4.1. General comments

A first concern that which was formulated by the respondents is that questions were too similar. For example, for personalization and mobility 8 items were defined for each construct. Also, task interdependence was operationalized with 10 items. Respondents perceive the questions as similar, although careful examination shows that the questions are in fact different. Several questions do have similar meaning, but the terminology used in the questions is different. Based on the confirmatory factor analysis, 4 items of both personalization and mobility will be deleted. This will reduce the perceived number of similar questions. A second concern of the respondents which was expressed via the comments button, was the complexity of questions. Mainly, the concept of task non-routineness was perceived as being quite difficult to understand. For example, the wording ‘business problems’ was translated to ‘bedrijfsproblematiek’. For native English speaking people business problems is a normal term, but the Dutch translation is not commonly used. This means that the terminology should be further adjusted to meet Dutch standards. A third concern was the broad definition of ICT tools presented to the respondents in the introductions for technology characteristics and task-technology fit. Based on the comments it can be concluded that respondents perceived hardware and software tools to be very distinct. Respondents commented that they will therefore answer the questions in general, and will provide ‘an average’ answer. For example; one perceives its PDA to be very high on mobility. However, a data repository which is not externally accessible scorers low on mobility. The evaluation of mobility based on these two tools will thus be neutral, and hence has no explanatory power. In the discussion will be further elaborated on the implications of these results.

3.4.2. Confirmatory Factor Analyses

Confirmatory factor analysis is the first step in analyzing and validating a measurement model according its prior specified theoretical model. Construct validity is assessed by checking convergent and discriminant validity. Convergent validity is the degree to which the items underlying a construct are correlated and thus converge. This indicates that all items reflect the same latent variable and thus the operationalizations of a construct are internally consistent. For convergent validity, item reliability (by means of factor loadings), and construct reliability\(^1\) (by

\(^1\) CR and AVE are calculated according the formulas of Hair et al., 2006: 777
means of composite reliability and average variance extracted) are assessed. Discriminant validity refers to the distinctness of constructs, that is the extent to which constructs that theoretically should not be similar, are indeed statistical not similar as well. For discriminant validity, the square root of the average variance extracted (AVE) is assessed. Next, also overall model fit measures and modification indices are assessed for checking overall model validity. LISREL 8.8 is used for this purpose. The minimum sample size for conducting a confirmatory factor analysis is between 5-10 times the number of constructs (Hair et al., 2006). In this study 9 variables are tested and thus the minimum required sample is 45 to 90. This is met because the pretest is based on 196 samples.

Two models are presented in this analysis. The first model is the full model, which incorporates all items as measured. The second model is the result of deleting 4 items for both personalization and mobility. Appendix 3 contains the correlation matrix of the reduced model with descriptives such as mean, standard deviation, composite reliability, and average variance extracted. The deletion of the items is based on the analysis of construct reliability measures and fit indices. Item reliability is assessed by means of the completely standardized factor loadings (next referred to as ‘factor loadings’), which are not all found to be above the threshold of 0.7 in the full model. A factor loading represents the correlation between the latent factor and its item and should preferably be 0.7 or higher because than it explains more than 50% of its variance (Hair et al., 2006). Task non-routineness, task interdependence, and personalization only have one factor loading above 0.7. All other constructs have 3 or more items with factor loadings of 0.7 or higher, indicated proper factorial validity.

On construct level, the average variance extracted (AVE) denotes the average variance of all items explained by a factor in relation to its measurement error, and assesses the degree of convergent validity. In other words, AVE is the degree to which there is error-free variance in a set of items. An AVE of 0.5 denotes that 50% of all variance in a factor is explained, and is generally considered as the required minimum. The AVEs of task non-routineness (0.394), task interdependence (0.415), personalization (0.397) and employee productivity (0.441) show that there is relatively low variance accounted for by the items. This means that much of the item’s 2

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2 A factor loading of 0.7 squared equals 0.5 total variance of the item accounted for by its latent factor
variance is not explained by its latent factors, but by random measurement error. Composite reliability (CR) assesses the degree of internal consistency of a construct. Except for task non-routineness (0.573), each construct scores higher than the 0.7 threshold. Mobility (0.981), collaboration (0.850), task-technology fit (0.881), and ICT performance impact (0.876) even score higher than 0.8. This indicates that the construct’s items shows good internal consistency.

The square root of the AVE is presented in bold on the diagonal of the correlation matrix in Appendix 3. These values should be larger than any other value on the corresponding rows and columns in order conclude proper discriminant validity (Jun et al., 2006). Given this rule, there is no lack of discriminant validity detected.

The model fit indices are analyzed according the guidelines of Hair et al. (2006) and Raykov and Marcoulides (2006). As Hair et al. discusses, it is difficult to give explicit thresholds for each index because each study is different. Therefore several main fit indices should be assessment together in order to get a full picture of the model fit. Typically the chi-square ($\chi^2$) value addresses overall model fit between the observed measurement model and theoretically developed model. The full model’s $\chi^2$ of 1935.414 (p 0.0) indicates significant model differences, but the $\chi^2$/df ratio is 1.699 and therefore good considered its threshold of 3. Several other fit indices are employed to assess overall model fit as well.

Two absolute fit indices are the goodness-of-fit (GFI) and root mean square error of approximation (RMSEA). GFI is indicates how much variance a model is able to explain in total, analog to the total in normal regression analysis, and should have a minimum value of 0.90 but preferably 0.95 or higher. The RMSEA is a badness-of-fit index, based on the assumption that perfect model fit (which is tested by other fit measures) is not possible and therefore present the degree of model fit approximation. A rule of thumb is that the RMSEA index shows acceptable fit at $\leq .10$ and good fit for values of $\leq .05$. If the left interval value of the RMSEA confidence interval (at 90%) indicates a value of 0.0 this means the model is close to perfect fit (Schermelleh-Engel et al., 2003). The GFI for the full model is 0.736, and therefore shows that about 73.6% of the total model variance is explained by the measurement model. The RMSEA is 0.053, indicating good model fit.
The following two fit indices are incremental indices which compares the estimated model with a base model (null model) that assumes no correlation between any variable (i.e. the worst possible model). The more the measurement model deviates from this null model, the better. The non-normated fit index (NNFI) assesses the ratio difference between the estimated and the null model (baseline model) $\chi^2$. The NNFI indicates acceptable fit with values of 0.90 or higher, but preferably 0.95 or higher. The score for the full model is 0.918 and therefore indicates acceptable model fit. Moreover, the comparative fit index (CFI) is an improved index compared to the NNFI in which it avoids underestimation of the model in case of small sample sizes and is less sensitive for model complexity. The CFI score of the full model is 0.924 which indicates acceptable fit; 0.95 indicates good fit, and 0.90 is acceptable.

Next, the modification indices are assessed to try to improve the overall model fit. Simply adjusting a model based on modification indices to increase model fit can lead to a non-valid study, instead the goal is to improve a measurement model or theory in general (Saghaei and Ghasemi, 2009). This condition is met, because the search mainly focuses on the excess items of task interdependence, personalization and mobility, and therefore no more items are deleted when a construct has 4 items left. As explained above, these excess items need to be deleted in order to remain 4 items per construct which are used for the second study. For example, the modification indices suggest that the $\chi^2$ value could be reduced with approximately 18.189 when deleting either the seventh items of task interdependence or the third task non-routineness item. Since this specific task interdependence item has a negative factor loading and relatively high measurement error, this item is deleted. This process was iterated until the reduced model (2) as presented in Table 1 could be presented. This indicates that the $\chi^2$ value is decreased almost by half, and that the fit indices GFI (0.747), NNFI (0.929), and CFI (0.937) improved slightly. Only RMSEA (0.0554) increased slightly, but because this value is still reasonably well below 0.10 it indicates acceptable model fit. These fit indices are the result of a second CFA after deleting items from the following constructs; task interdependence (5-10), Personalization (2,5,6,8), and Mobility (2,5,7,8). The deleted items are marked with an asterisk in Appendix 1.

### 3.4.3. Structural model

The reduced model (2) that resulted from the confirmatory factor analysis as presented above, is used as input for testing causality with structural equation modeling (SEM). The fit indices all become a bit higher as presented in Table 1, but still indicate acceptable model fit. Figure 3
presents that all but 2 relations in the SEM model (3) are statistically significant in the predicted direction. It was hypothesized (2b) that higher levels of task interdependence resulted in lower levels of task-technology fit, but this relation was not found ($\gamma = -0.025$, $p > 0.1$). The same applies to hypothesis 3b, which said that ICT tools with higher perceived levels of mobility results in higher levels of task-technology fit ($\gamma = 0.089$, $p > 0.1$). The total explained variance ($R^2$ from Table 6 in Appendix 5) in task-technology fit is 53.6%, for employee satisfaction this is 11.1%, for employee productivity 6.2%, and for ICT performance impact 43.4%. Although this model is still based on pretest data, the results are promising. The implications of the confirmatory factor analyses and the structural model are discussed in the next section.

![Figure 3: Regressions Study 1 (model 3)](image)

Table 1: Pretest CFA model fit indices

<table>
<thead>
<tr>
<th>Fit indices</th>
<th>Preferred threshold</th>
<th>CFA Full model (1)</th>
<th>CFA Reduced model (2)</th>
<th>SEM Model (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\chi^2$ (p-value)</td>
<td>1935.414 (0.0)</td>
<td>974.896 (0.0)</td>
<td>1043.827 (0.0)</td>
<td></td>
</tr>
<tr>
<td>df</td>
<td>1139</td>
<td>558</td>
<td>576</td>
<td></td>
</tr>
<tr>
<td>$\chi^2$/df</td>
<td>$\leq 3.0$</td>
<td>1.699</td>
<td>1.747</td>
<td>1.812</td>
</tr>
<tr>
<td>GFI</td>
<td>$\geq 0.90$</td>
<td>0.736</td>
<td>0.797</td>
<td>0.781</td>
</tr>
<tr>
<td>RMSEA</td>
<td>$\leq 0.10$</td>
<td>0.053</td>
<td>0.0554</td>
<td>0.0603</td>
</tr>
<tr>
<td>(90% interval)</td>
<td>(0.0476 ; 0.0573)</td>
<td>(0.0485 ; 0.0621)</td>
<td>(0.0538 ; 0.0667)</td>
<td></td>
</tr>
<tr>
<td>NNFI</td>
<td>$\geq 0.95$</td>
<td>0.918</td>
<td>0.929</td>
<td>0.922</td>
</tr>
<tr>
<td>CFI</td>
<td>$\geq 0.95$</td>
<td>0.924</td>
<td>0.937</td>
<td>0.929</td>
</tr>
</tbody>
</table>
3.4.4. Discussion

The purpose of this first study is to validate the questionnaire and address its shortcomings. In this section the results from the CFA and SEM are discussed and improvements are suggested for the second study.

ICT tools

An important finding from the pretest was that ICT tools have been defined too broadly. For the technology characteristics, respondents were asked to ‘evaluate the characteristics of their ICT tools, whether hardware or software’. For task-technology fit they were asked to ‘evaluate the supporting value of the ICT tools, whether hardware or software’. Based on their comments, respondents perceived hardware and software tools to be too distinct to provide an overall judgment about, for example, its mobility. Respondents thought they had to evaluate both their hardware and software ICT tools separately, with only one set of questions. Therefore the definition of ICT-tools in the introduction of the questionnaire should be slightly adjusted, to such an extent that it still reflects the full definition as provided in the theory chapter. By definition people who have access to software also need hardware tools. Hence the explicit distinction in the introduction does not need to be made. It is therefore chosen to drop the explicit explanation about hardware and software in Study 2. In the second study will be explained that ICT tools are information systems, email programs, and office applications, all including several examples. Now respondents will not be confused about whether to evaluate their hardware or software tools separately, because they are asked to evaluate the characteristics (for technology questions) or supportive value (for task-technology fit questions) of the tools they use for conducting their daily task portfolio in general. The emphasis is thus placed on one’s tasks, instead of the ICT tools.

For example, when someone’s main task is to call people when traveling, a PDA probably fulfills and will thus evaluate the degree of perceived mobility positively. However, when someone’s tasks also include the need to have external access to a data repository, not having access to this data repository (whether one only has a PDA, the data repository in not externally accessibly, or for any other reason) will result in a more negative evaluation of the degree of mobility. Now it is expected that the respondents evaluate all ICT tools necessary (hardware tools are thus evaluated implicitly) for conducting their tasks. This is contrary to the situation in the pretest, in
which respondents perceived to be asked to evaluate both hardware and software tools separately with only one set of questions.

**Employee satisfaction and productivity**

The regression results that discussed here, are included in Table 6 in Appendix 5. All dependent factors are highly related to task-technology fit. According the pretest data, employees become more satisfied if they have higher levels of task-technology fit ($\beta = 0.333$, $p < 0.001$). The total variance in employee satisfaction explained by task-technology fit is 11.1%. Productivity was measured with two different constructs, one general construct (employee productivity) and one making a direct link between the ICT tools and one’s performance. Employee productivity is significantly higher when people experience task-technology fit ($\beta = 0.249$, $p < 0.01$), but this effect was even stronger for ICT performance impact ($\beta = 0.659$, $p < 0.001$). Task-technology fit explained 6.2% of the total variance of employee productivity, and 43.3% of ICT performance impact. Based on these pretest findings, hypothesis 3 a,b, and c are supported.

**Task non-routineness**

Respondents who perceived their job to be high on task non-routineness, perceived their set of ICT tools to be less supportive and thus show lower levels of task-technology fit ($\gamma = -0.213$, $p < 0.01$), thereby supporting hypothesis (2a). However, respondents also commented that they did not understand the wording of the questions operationalizing task non-routineness. The translation of ‘business problems’ into ‘bedrijfsproblematiek’ most probably caused the problem, because this wording is not commonly used in Dutch. The search for a new construct operationalization of task non-routineness threw me back in the discussion about whether or not differentiating between task variability and difficulty.

When carefully examining the definitions of both concepts, the basis of variability is the degree to which one’s work requires different methods or procedures for conducting a task portfolio (Van de Ven and Delbecq, 1974). The basis of task difficulty is the degree to which these methods and procedures are structured, one has knowledge about the sequence of steps to take, and one needs thinking time, in order to conduct a task portfolio (Van de Ven and Delbecq, 1974).
Though these two concepts are operationalized separately in various studies (Daft and Macintosh, 1981; Perrow, 1967; Van de Ven and Delbecq, 1974), others have converged them in one construct because these two constructs showed low discriminant validity or were translated to one dimension of routineness / non-routineness (Dewar et al., 1980; Goodhue and Thompson, 1995; Hage and Aiken, 1969; Lynch, 1974; Van de Ven et al., 1976). Especially this last argument needs further consideration. Although in this case it is referred to as one dimension, neglecting the presence of two distinct concepts that make up this dimension in the first place indicates premature conclusions. When using the concept of task routineness, it was in essence defined as task variability (Dewar et al., 1980; Hage and Aiken, 1969) or task difficulty (Goodhue and Thompson, 1995) after all. Moreover, operationalizing task routineness on one dimension for parsimony reasons only (Karimi et al., 2004; Majchrzak et al., 2005) does not offer much hope either. Also, since Perrow (1967) introduced the model of work-unit structure (Figure 4 on the next page), he introduced the concept of task routineness / non-routineness as either end of a dimension which was actually defined by the degree of variety and difficulty. Hence, this are two separate constructs. High levels of both variety and difficulty denotes task non-routineness and low levels of variety and difficulty denotes task routineness. It now sounds plausible to conceptualize routineness as a one-dimensional construct, but as discussed above, it was actually measured on two axes, variability and difficulty. It is thus not quite valid to converge the two concepts. The purpose of the framework was to offer a work-unit structural taxonomy for organizational comparison (Daft and Macintosh, 1981; Perrow, 1967; Van de Ven and Delbecq, 1974). For example, a specialist focuses on a narrow subject (i.e. low variety) but the issues to solve do not have similar structured processes (i.e. difficulty). The opposite is true for routine service units which do employ a wide variety of tasks, however, on a lower level of task difficulty (Van de Ven and Delbecq, 1974). Offering insight in both concepts is required to indicate user demand on a technology. No technology for example will provide a full or objective procedure for conducting difficult tasks (Daft and Macintosh, 1981). Neither will there be a technology, or set of technologies, that fully supports the broad spectrum of someone high on task variety. Technology demands will thus vary as the degrees of task variability and difficulty vary, but it is expected that the demand on a technology will increase either way as either of these concepts increase in magnitude. It is therefore that the task non-routineness hypothesis from the theory chapter is adjusted and split in task variety and difficulty based on Van de Ven et al. (1974) and Daft and Macintosh (1981).
Hypothesis 2a becomes adjusted hypothesis 2a/b, which is formulated as;

**Adjusted hypothesis 2**: higher levels of (a) task variety and (b) task difficulty will result in lower levels of task-technology fit

*Figure 4: Task routineness (Perrow, 1967)*

**Task interdependence**

First, the excess items from task interdependence are deleted in the confirmatory factor analysis. The resulting items (1 to 4) reflect the construct fully according its definition. The first two items address interdependence in general terms, the third item addresses received interdependence and the fourth item addresses initiated interdependence. Respondents from the pretest did not perceive lower levels of task-technology fit, when they expressed themselves to be high on task interdependence. Although the regression coefficient is in the predicted direction ($\gamma = -0.025$), it is very small and not significant ($p > 0.1$). So far, hypothesis 2b is not supported. One minor change in the second items is suggested to increase the readability of the question. ‘Coordination’ from Pearce and Gregerson (1991) was translated to ‘coördineren’ and is replaced by ‘afstemmen’ for the second study. Since the hypothesis of task non-routineness is adjusted, the hypothesis for task interdependence now has number 3. The content of the hypothesis will not change.
Technology characteristics

As presented in the confirmatory factor analysis above, the excess items from personalization and mobility are deleted and thus the constructs serve as input for the pilot study with 4 items. Mobility item 6 (item 4 in pilot test) need to be adjusted slightly to improve the understanding of the respondent. Initially the question asked if people could get permanent connection with ICT tools, for example by using ‘mobile devices’. Since mobile devices are highly used technologies, and the concept addresses a respondent’s perceived degree working anywhere anytime supported by its ICT tools, ‘mobile devices’ should be used as subject in the question instead to refer to ‘connections’. Respondents evaluated the characteristics of the ICT tools they have at their disposal for conducting their daily task portfolio. Hypothesis 3b indicated that ICT tools which enable mobility would result in task-technology fit, but this hypothesis is not supported in this pretest ($\gamma = 0.089, p > 0.1$). ICT tools which the respondents perceived to be personalizable ($\gamma = 0.348, p < 0.001$) and those who enable collaboration ($\gamma = 0.400, p < 0.001$) did resulted in higher task-technology fit. So far, hypotheses 3 a and c are supported. Since the hypothesis of task non-routineness is adjusted, the hypotheses for technology characteristics now has number 4. The content of the hypotheses will not change.
3.5. Adjusted conceptual model and literature overview

Based on the results and discussion from Study 1 (pretest), the following adjusted conceptual model is presented. This model will be tested in Study 2 (pilot test). The literature used for operationalizing the concepts is presented in Table 2.

Figure 5: Adjusted conceptual model

Table 2: Literature overview

<table>
<thead>
<tr>
<th>Model dimension</th>
<th>Construct</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task characteristics</td>
<td>Task non-routineness *</td>
<td>Goodhue and Thompson, 1995</td>
</tr>
<tr>
<td></td>
<td>Task interdependence</td>
<td>Pearce and Gregerson, 1991</td>
</tr>
<tr>
<td></td>
<td>Task variety</td>
<td>Daft and Macintosh, 1981 and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Morganson and Humphrey, 2006</td>
</tr>
<tr>
<td></td>
<td>Task difficulty</td>
<td>Van de Ven et al., 1974</td>
</tr>
<tr>
<td>Technology characteristics</td>
<td>Personalization</td>
<td>Self developed and based on;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blom, 2000 and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>D’Ambra and Rice, 2001</td>
</tr>
<tr>
<td></td>
<td>Mobility</td>
<td>Kobsa, 2001</td>
</tr>
<tr>
<td></td>
<td>Collaboration</td>
<td>Campion et al., 1993</td>
</tr>
<tr>
<td>Task-technology fit</td>
<td>Task-technology fit</td>
<td>Moore and Benbasat, 1991</td>
</tr>
<tr>
<td>Dependent factors</td>
<td>Satisfaction</td>
<td>Jun et al., 2006</td>
</tr>
<tr>
<td></td>
<td>Productivity</td>
<td>Staples et al., 1999</td>
</tr>
<tr>
<td></td>
<td>ICT performance impact</td>
<td>Goodhue and Thompson, 1995</td>
</tr>
</tbody>
</table>

* substituted by task variety and task difficulty after pretest
4. Study 2: Empirical test of conceptual model

The goal of this study is to test the adjusted conceptual model as presented in Figure 5, from now on just referred to as conceptual model. The methodology used for this study is addressed first, followed by the analysis.

4.1. Methodology

Much of the methodology used in this second study is similar to the first study. Those topics that changed based on the pretest are discussed below. First the constructs operationalization will be presented, followed by the method of analysis, and data collection.

Constructs operationalization

Most of the constructs are operationalized similarly to the constructs from the pretest. The biggest change is put forward in the operationalization of task non-routineness, which is split up in task variety and task difficulty based on Van de Ven et al. (1974) and Daft and Macintosh (1981). Their measures showed good convergent and discriminant validity (Ahuja and Carley, 1999), and are therefore used in this study. For task variety two items are used from Morgeson and Humphrey (2006) because they match the theoretical definition and thus increase content validity. Both constructs have 4 items on a 5 point-Likert scale.

Furthermore, 4 items from both personalization and mobility have been removed from the questionnaire for the pilot study as discussed in the previous chapter. From task interdependence 6 items are removed. From the remaining task interdependence items, the second question was slightly adjusted, ‘coordinatie’ became ‘afstemmen’. One minor change has also been made in the question wording of mobility item 6 (item 4 for the pilot test). The question initially used ‘mobile devices’ as an example of getting permanent connection with all ICT-tools. The adjusted question asks if ‘mobile devices enable permanent connectivity with other ICT tools’. The changed wording of these questions, and the new constructs of task variety and task difficulty are presented in Appendix 2.

Method of analysis

This study uses multiple linear regression (ordinary least squares (OLS) regression) for testing the conceptual model from Figure 5. The reason for using this method of analysis is that the
minimum required sample size for using SEM is violated, there are only 38 complete observations. SPSS 17.0 is used for multiple linear regression.

Data collection

Also for this study an electronic survey was constructed with Global Park. The questionnaire incorporated in total 117 questions and statements, 47 of these questions are addressed in this study. Respondents were asked to fill out the questions according their experience with the set of ICT tools they have at their disposal for conducting their daily task portfolio. For technology characteristics, they were specifically asked to ‘evaluate the characteristics of the ICT tools they used most frequently for conducting their daily task portfolio’. For the task-technology fit construct, they were specifically asked to evaluate ‘the supporting value of the ICT tools they used most frequently for conducting their daily task portfolio’. It was furthermore explained that ‘ICT tools are both information systems (e.g. HRM / inventory / administration), email programs, office applications (e.g. Word and Excel), and communicators (chat), shared workspaces and other applications’. The questions were fully randomized per dimension. An invitation was send to the respondents with a hyperlink that brought them to the online questionnaire. The sample of respondents is all employees from TopForce, a technical ICT consultancy firm. After finishing the entire questionnaire, respondents had the opportunity to leave some comments. The total sample size is 80, of which 38 completed the entire questionnaire (response rate of 47,5%). The task characteristics and technology characteristics questions were answered by 48 respondents, the task-technology fit questions by 39 respondents, and the final satisfaction and productivity questions were fully answered by 38 respondents. A possible reason for the drop-out while filling out the questionnaire is the fair length. The average response time was approximately 8 minutes (the total response time for all 117 questions was 22 minutes). The average age of the respondents is 34 years, the youngest being 16 and the oldest 52.

4.2. Analyses

The advantage of SEM over linear regression is that, amongst others, it can estimate a structural model with multiple latent independent and dependent variables simultaneously, including mediating variables. In Study 2 multiple linear regression need to be applied, and therefore several linear regressions need to analyzed to address the magnitude and strength of the hypothesized relations. Moreover, since task-technology fit is conceptualized as mediating concept, this also needs to be addressed with multiple linear regressions. Since multiple linear
regression is not able to handle latent constructs, this analysis is based on variables that are constructed as the mean of their items. The data is first checked for any multicollinearity, then it is addressed if task-technology is a mediator, and then the causal relations are analyzed.

*Any trace of multicollinearity?*

Multicollinearity is the degree to which independent variables in ordinary least squares regression are so strongly correlated, that the shared variance from all independent variables of the regression model could not be attributed to the individual independent variables. In other words, in case of multicollinearity the variables are too similar in order to tread them as separate constructs and therefore they cause invalid regressions. The regression results on which these analyses are based do not suffer from any multicollinearity, because all Tolerance scores are far above the 0.2 threshold (van Dalen and de Leede, 2000), the lowest tolerance score being 0.394 for variability predicting task-technology fit in Study 2. The Tolerance scores are included in Table 8 in Appendix 5 for Study 1 and Table 10 in Appendix 6 for Study 2.

*Task-technology fit as mediator?*

Task-technology fit is a mediating variable when several conditions are met (Baron and Kenny, 1986; Kenny *et al.*, 1998). Consider *a* as independent variable, *b* as mediator and *c* as dependent variable; a variable is a mediator if (1) the independent variables (e.g. task variety) significantly predict the mediating variable (i.e. task-technology fit) (*a*→*b*), and if (2) the mediating variable significantly predicts the dependent variables (e.g. employee satisfaction) (*b*→*c*). If the independent variables have no significant direct relation with the dependent variables if controlled for the mediator (*a*,*b*→*c*), there is a complete mediation. There is a partial mediation when there are also some direct relations between the independent and dependent variables, but when the *a*→*b* and *b*→*c* relations are also significant.

An overview of the regression results is presented in Table 9 in Appendix 6. The results indicate that task-technology fit is a mediator, because almost all regression results indicate that the independent variables have a significant relation with task-technology fit (*a*→*b*) (first column in Table 9), and task-technology fit is significantly predicting two of the three dependent variables when it is included in the regression (*a*,*b*→*c*). The regression results for testing their corresponding hypotheses will be further discussed in the following section.
4.2.1. Causal relations

The regression results in Study 2 (visually represented in Figure 6 on the next page) are slightly smaller and less significant as compared to the SEM results from Study 1. A possible explanation is that because this second study is based on a lower number of respondents, the regression results explain less variance and therefore the relations are found to be less significant. Moreover, the results presented in this study are based on multiple linear regression, which in general produces less significant relations than SEM (Nusair and Hua, 2010). The results should not directly be compared between the two models presented, because there are two different methods of analyses employed. Instead, the next section addresses a comparison between the first and second study, based on the same method of analysis (multiple linear regression). Here, the results are presented from study 2.

In this second study, task-technology for example does not lead to employee satisfaction ($\beta = -0.081, p > 0.1$). Hypothesis 1a is therefore not supported in this pilot test, contrary to the pretest results in which it was strongly supported ($\beta = 0.333, p < 0.001$). The next two dependent variables address the respondent’s productivity. Employee productivity addresses one’s productivity in general, and is found to be positively resulting from task-technology fit ($\beta = 0.167$), therefore hypothesis 1b is supported although the relation is only significant at 10%. The total explained variance of employee productivity is 14.6% (see Table 9 in Appendix 6). A possible violation of the mediating role of task-technology fit between the independent variables and employee productivity is found for task variety ($\beta = 0.396, p < 0.01$) and personalization ($\beta = 0.224, p < 0.01$). Therefore task-technology fit has a partly mediating role between these concepts. ICT performance impact, a more focused productivity measure which addresses a respondent’s productivity as direct cause of the use of their ICT tools, is significantly (at $p < 0.1$) resulting from task-technology fit ($\beta = 0.179$). The total explained variance of ICT performance impact is 13.3%. Hypothesis 1c is therefore supported with the note that collaboration with its direct effect on ICT performance impact ($\beta = 0.179, p < 0.1$) is possibly violating the mediating role of task-technology fit.

For the task characteristics, respondents perceived both task variety ($\beta = -0.680, p < 0.01$) and task difficulty ($\beta = -0.098, p < 0.05$) to result in lower levels of task-technology fit, and therefore hypotheses 2a and 2b are supported. This is also in line with the pretest, in which higher levels of task non-routineness resulted in lower levels of task-technology fit. The regression coefficients
however show that the effect of task variety is much larger and stronger than task variety. For task interdependence, no relation was found in the pretest, nor it is found in this pilot test (β = -0.272, p > 0.1), although the regression coefficient is in the predicted negative direction. Therefore hypothesis 3 is not supported.

For the technology characteristics it was hypothesized that if the ICT tools exhibit higher perceived degrees of (3a) personalization, (3b) mobility and (3c) collaboration, this would result in higher levels of task-technology fit. All three hypotheses are supported, with β = 0.273 (p < 0.05) for personalization, β = 0.246 (p < 0.05) for mobility, and β = 0.420 (p < 0.01) for collaboration. The task and technology characteristics explained in total 34.2% of task-technology fit’s variance.

4.2.2. Meta analytical comparison between Study 1 and Study 2
The difference between the first and second study, is that the first study was conducted to validate the questionnaire with paid panel members and that the second study is an empirical test in an organization. Study 1 has 196 observations and therefore it was possible to use a more
advanced method of analysis. Besides, the respondents from the first study work for different organizations all over The Netherlands, and therefore the results from the pretest are based on a broader sample than the second study. Study 2 only included employees from one organization. The advantage of Study 2 is that it used an improved questionnaire, most extensively because the concept of task non-routineness was replaced by task variety and difficulty. Now the question arises if the results from both Study 1 and Study 2 are similar, and thus the results from both studies mutually increase each other’s explaining power. For this purpose, a meta analytical comparison is made between the pretest results and the pilot test results, in which the null hypothesis is tested that both studies produce similar results. The method of analysis employed here is based on the meta analytical procedure of comparing regression coefficients between the two independent studies (Paternoster et al., 1998). However, the regression results from both studies need to be compared based on the same method of analysis. Since Study 1 employed structural equation modeling and Study 2 multiple linear regression, it could be possible that model differences are caused by the different methods of analyses. In order to be able to properly compare both studies, Study 1 will also be analyzed with multiple linear regression. Following the discussion about testing the mediating role of task-technology fit with multiple linear regressions, the regression results are presented in Table 7 in Appendix 5. The results of comparing Study 1 and Study 2 are presented in Table 3, where the $z$-values\(^3\) denote similar regression coefficients if its value is between ± 1.96 for a significance level of 5%. The results indicate that many regression results are not similar, except for 4a and 4c. This means that both studies do not strengthen each other’s results. A possible reason for these differences is based on the low number of respondents in the second study (n=38) as compared to the first study (n=196), and there is therefore less variance detectable in the data. Another reason is that Study 2 is conducted at one specific organization, and therefore the results in Study 2 deviates from the broader sample in Study 1. However, all but two regressions from the Study 2 are significant in the predicted direction, and therefore the theoretical model is in general largely supported. To provide a more detailed analyses, the individual hypotheses from both will be compared and discussed below.

\[
\begin{align*}
  z &= \frac{b_1 - b_2}{\sqrt{SE_{b_1}^2 + SE_{b_2}^2}}
\end{align*}
\]
One striking observation is that task-technology fit did not result in employee satisfaction in Study 2, as compared to a strong positive significant relation in Study 1. Therefore hypothesis 1a is only partially supported based on the results from Study 1. Task-technology fit was found to be significant positively related with employee productivity in both Study 1 and Study 2. Hypothesis 1b is therefore fully supported. ICT performance impact was significantly positive affected by task-technology fit in both Study 1 and 2, and therefore hypothesis 1c is fully supported.

In Study 2, the concept of task non-routineness was replaced by the two separate concepts task variety and difficulty. These results are not included in the meta analytical comparison, because the concepts are theoretically distinct and can therefore statistically not be compared. However, since both task non-routineness from Study 1 and the related concepts of task variety and task difficulty from Study 2 were supported in the predicted direction in Study 2, both hypotheses 2a and 2b are fully supported. The regression coefficients from task interdependence on task-technology fit were not found to be significant in both studies, and therefore hypothesis 3 is not supported.

Concerning the technology characteristics, personalization and collaboration produce comparable effects in both Study 1 and 2. The effects of personalization and collaboration on task-technology fit is significantly positive in the predicted directions, and therefore both hypotheses 4a and 4c are supported. For mobility however, mixed results are found. In Study 1 mobility was not found to be affecting task-technology fit with the SEM method of analysis, but the relation was found to be significant in the predicted direction when OLS was employed ($\beta = 0.080, p < 0.1$). When employing OLS in Study 2, mobility was also found to be positively related to task-technology fit ($\beta = 0.246, p < 0.1$). Based on the meta analytical comparison the results from Study 1 and 2 are significantly different ($p > 0.001$). A possible reason for these differences is that SEM incorporates measurement error on item level, whereas OLS does not. Moreover, mobility could be a more important factor for the employees of TopForce than for people in general. This relation should therefore be further investigated in another empirical setting with a larger sample size so that SEM can be employed as method of analysis. Hypothesis 4b is therefore only partially supported.
4.2.3. Summary of results

Table 3 presents an overview of the hypotheses for both the first and second study, their corresponding regression coefficients and significances, a comparison of the regression coefficients between Study 1 and Study 2, and the overall conclusion if the hypotheses are supported.

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Regression coefficients</th>
<th>Study 1</th>
<th>Study 1</th>
<th>Study 2</th>
<th>z-value</th>
<th>Supported?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>SEM</td>
<td>OLS</td>
<td>OLS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1(a) TTF → employee satisfaction (+)</td>
<td>0.333****</td>
<td>0.087**</td>
<td>-0.081</td>
<td>3.232</td>
<td>Partially</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.082)</td>
<td>(0.052)</td>
<td>(0.112)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1(b) TTF → employee productivity (+)</td>
<td>0.249***</td>
<td>0.056*</td>
<td>0.167*</td>
<td>-2.526</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.084)</td>
<td>(0.044)</td>
<td>(0.104)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1(c) TTF → ICT performance impact (+)</td>
<td>0.659****</td>
<td>0.286****</td>
<td>0.179*</td>
<td>2.050</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.079)</td>
<td>(0.053)</td>
<td>(0.122)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2(a) Task non-routineness → TTF (-)</td>
<td>-0.213***</td>
<td>-0.185***</td>
<td>n/a</td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.087)</td>
<td>(0.062)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2(b) Task variety → TTF (-)</td>
<td>-0.680****</td>
<td>n/a</td>
<td></td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.363)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2(b) Task difficulty → TTF (-)</td>
<td>-0.098**</td>
<td>n/a</td>
<td></td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.263)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Task interdependence → TTF (-)</td>
<td>-0.025</td>
<td>-0.036</td>
<td>-0.272</td>
<td>3.440</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.072)</td>
<td>(0.070)</td>
<td>(0.285)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4(a) Personalization → TTF (+)</td>
<td>0.348****</td>
<td>0.282****</td>
<td>0.273**</td>
<td>0.173</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.086)</td>
<td>(0.059)</td>
<td>(0.127)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4(b) Mobility → TTF (+)</td>
<td>0.089</td>
<td>0.080**</td>
<td>0.246**</td>
<td>-3.592</td>
<td>Partially</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.088)</td>
<td>(0.046)</td>
<td>(0.131)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4(c) Collaboration → TTF (+)</td>
<td>0.400****</td>
<td>0.331****</td>
<td>0.420***</td>
<td>-1.414</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.092)</td>
<td>(0.062)</td>
<td>(0.149)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* significant at p < 0.1 ** p < 0.05 *** p < 0.01 **** p < 0.001

Standard error in parentheses

z-value denotes comparing regression results between Study 1 OLS and Study 2 OLS
5. Discussion

The purpose of this study was to address the effectiveness of ICT tools employed by individuals in organizations for carrying out their daily task portfolio. The principle of the task-technology fit model was applied to find out if employees show higher degrees of satisfaction and productivity if the set of ICT tools they use fit with their task portfolio. The conceptual model was tested in two stages, one pretest (Study 1) and one pilot test (Study 2). The model was slightly adjusted based on the pretest results and tested again in the second study. An overview of the results from both studies, and if the hypotheses are supported can be found in Table 3 (page 57). In this chapter I will discuss the results from both studies.

The first three hypotheses involved the relation between task-technology fit and employee satisfaction and productivity. Productivity was measured with two concepts, the assessment of one’s perceived general productivity (i.e. employee productivity), and one construct which addressed the perceived productivity as direct cause from using the ICT tools (i.e. ICT performance impact). In Study 1 task-technology fit strongly resulted in employee satisfaction. However, this effect disappeared in Study 2. The hypothesis that task-technology fit results in employee satisfaction is therefore only partially supported. One of the possible explanations is that because Study 2 is based on a low number of respondents, the regression results explain less variance and therefore the relation has not been found significant. Besides, Study 2 was conducted at one specific organization where employee satisfaction could be leveraged by other factors than just task-technology fit. Since employee satisfaction is such a broad concept, other concepts could explain a part of its variance. This was showed in Study 1, where the mediating role of task-technology was partly violated because three independent factors showed a direct relation with employee satisfaction.

The effect of task-technology fit on employee productivity in the Study 2 is smaller and less significant (although it is still significant at p < 0.1) than in Study 1. The third dependent variable, ICT performance impact, was found to be affected by task-technology fit in both studies. The effect of task-technology fit was larger on ICT performance impact than on the other two dependent variables. This is not a very big surprise, since the concept of ICT performance impact is defined more narrow and therefore addresses only a specific part of someone’s perceived general productivity. Task-technology fit is therefore better able to predict ICT performance impact than the other two dependent concepts. In other words, someone’s perceived degree of
employee satisfaction and productivity are leveraged by other factors that were not included in this thesis. Task-technology fit is only one of these factors, but it still does affect employee productivity consistently in both studies as hypothesized. This relation was not found for employee satisfaction in Study 2, but this could be due to the specific sample (TopForce) where the survey was conducted. All together, employees who exhibit higher levels of task-technology fit report higher levels of employee productivity and ICT performance impact. The total variance explained in ICT performance impact was 43.3% in Study 1 and 13.3% in Study 2. Other studies also found the effect for task-technology fit on ICT performance impact (Goodhue and Thompson, 1995; Staples and Seddon, 2004). Both these studies incorporated the degree of technology utilization, and were able to explain up to 16% of explained variance in ICT performance impact in Goodhue and Thompson, and up to 48% in Staples and Seddon. In Study 2, a possible violation of the mediating role of task-technology fit on employee productivity is found for task variety and personalization. This was not found in Study 1, and it is therefore expected that these results are specifically related to the sample from Study 2 and not related to the theoretical model. For ICT performance impact however, collaboration was found to be violating the mediating role of task-technology fit in both studies. Therefore the direct relation between collaboration and ICT performance impact requires future research.

The second hypothesis which was found to be supported, is the relation between task non-routineness and task-technology fit. In both studies task non-routineness resulted in lower levels of task-technology fit. This is in line with the findings of Goodhue and Thompson (1995), which also found that employees who put higher demands on their ICT tools are more aware of its shortcomings and therefore show lower levels of task-technology fit. In the second study however, task non-routineness was split up in the two distinct concepts (task variety and task difficulty) because these were expected to represent the concept of task non-routineness in more detail. This was indeed found, employees whose job is high on task variety have a larger negative effect on task-technology fit than people whose job is characterized as being high on task difficulty.

Based on both studies, it was not found that employees who are high on task interdependence have lower levels of task-technology fit. This is in line with Goodhue and Thompson (1995) which found task interdependence to relate negatively with only two of their eight task-technology fit constructs, and therefore they only partially supported this relation. The dependency on
technologies for carrying out work is very high nowadays, and it is therefore argued that coordination efforts in organizations should shift from task interdependence to technology interdependence (Bailey et al., forthcoming). In essence technology interdependence is the same as task interdependence, but now it is the interaction among technologies instead of people. When placing this concept in the dimensions of this thesis, the degree of technology interdependence would be a technology characteristic which would probably negatively affect task-technology fit. Future research is needed to address this proposition however.

For the technology characteristics dimension, two relations are fully supported and one partially. Employees who have ICT tools which they perceive to enable them to be mobile and to conduct collaborative work, show a better fit with their tasks. Mobility was not found to consistently lead to higher levels of task-technology fit. In Study 1 the relation was only found when a less strong statistical method of analysis was employed (multiple linear regression), which also applies to Study 2. Therefore the hypothesis that ICT tools with higher perceived levels of mobility characteristics result in higher task-technology fit is only partially supported.
Conclusion

Now finalizing this thesis, several conclusions can be drawn from the two studies I conducted for answering the research question ‘Will employees show increased satisfaction and productivity when the ICT tools they use, exhibit a fit with their daily task portfolio?’

The fit between someone’s task and ICT tools is measured with one construct which asks respondents if the ICT tools they use are supportive in conducting their daily task portfolio. In other words, it is the alignment, congruence, or match between one’s tasks and ICT tools. The dependent factors were employee satisfaction, employee productivity, and ICT performance impact. Employee satisfaction was not consistently found to be affected by task-technology fit. Employee productivity is a more general productivity concept, whereas ICT performance impact addresses one’s productivity as direct cause of using ICT tools. These two productivity concepts were affected by task-technology fit, but the effect on the latter was largest. Task-technology fit thus leads to increased productivity, best addressed with the direct measure of ‘ICT performance impact’. The two other dependent factors are more general, and therefore the effect of task-technology fit is leveraged by other factors which were not included in this study. Several other sub questions were formulated to provide more focus, and will be addressed below.

*Which task characteristics should be assessed, and which of these factors predict task-technology fit?* Based on a literature study on task characteristics it was tested if task non-routineness and task interdependence had an effect on task-technology fit. Task non-routineness was found to be better operationalized in two distinct concept; task variety and task difficulty. Task variety was found to be most negatively resulting in task-technology fit. Task difficulty also resulted in lower degrees of task-technology fit, but this effect was smaller. This implies that employees who have tasks which require them to conduct a wide range of operations (i.e. variety), are to a greater extent less supported by their ICT tools than people who’s tasks are more difficulty. This offers a more detailed insight in the relation between the task characteristic and task-technology fit than was found to date. Task interdependence did not show to be a decisive factor, and will thus not play an important role in addressing task-technology fit.

*Which technology characteristics should be assessed, and which of these factors predict task-technology fit?* The original task-technology fit model did not explicitly operationalize the technology dimension. Given this gap in research, I proposed three technology characteristics for
measuring the type of ICT tools employees use for conducting their daily task portfolio. The two
technology characteristics that cause increasing levels of task-technology fit are personalization
and collaboration. In other words, if people use ICT tools which can be personalized and enable
collaboration, these tools show a better fit with their task portfolio. ICT tools that should enable
mobility were not consistently found to lead to task-technology fit.

**Contribution to theory**

The findings in this study contribute to theory in several ways. First, I offered a more detailed
insight in the role of the task characteristics affecting task-technology fit. Here I proposed that
task non-routineness is too general, and should actually be operationalized as it was originally by
Perrrow (1967), by means of task variety and task difficulty. Secondly, the task-technology fit
model from Goodhue and Thompson (1995) I expanded by explicitly addressing three technology
characteristics. Two concepts from this dimension showed to be leading to task-technology fit.
The third contribution I made is based on the call from Staples and Seddon (2004) to further
investigate the dependent side of the task-technology fit model. Important factors in
organizational research are employee satisfaction and productivity. From these two general
concepts, employee productivity was found to be affected by task-technology fit, next to the
more specific ICT performance impact measure which was used to date (e.g. by Goodhue and
Thompson, 1995; Staples and Seddon, 2004).

**Managerial implications**

The managerial implication from this thesis is the awareness not to invest in the best-of-breed or
a larger number technologies, but in those tools that best fit with the task portfolio of
employees. More specifically, an employee who has a job characterized as being high on task
variety especially places high demands on the ICT tools. When people work with tools that fit
with their task portfolio, it has especially positive impact on their productivity. However, it
should be noted that investing in new workplace technologies requires more than just investing
in ICT tools (Brynjolfsson and Hitt, 1998), even if it theoretically fits with someone’s task
portfolio. If an organization wants to adjust their technological basis, it needs to fit with the tasks
and work practices of its employees. To the extent that investments and organizational
restructuring only focuses on ICT tools and not on task, hierarchy, decision making, or other
organizational structures, the net benefit of ICT tools could even decrease. Task-technology fit
was shown to increase individual employee productivity, and is therefore a necessary but not sufficient condition for improving organizational productivity.

**Strength, limitations and future research**

Now the conclusions are drawn, it should also be noted that thesis is subject to several limitations. The first limitation is in line with the goal of this thesis itself, addressing the effectiveness of the total set of ICT tools. The strength of addressing the total set of ICT tools is that it goes beyond one specific system or technology. In most cases, it is not one system or technology that affects someone’s productivity, but several (interconnected) technologies. The drawback of this approach is that the reported task-technology fit could be ‘an average’ of someone’s feeling about its ICT tools. The positive fit of one ICT tool could be leveraged by the negative fit of another. When an organization has one key system, the focus could be narrowed down to this one specific system. The broad focus that this thesis addresses, results in a second limitation. Task-technology fit was operationalized with one construct including 4 items. The strength of this operationalization is that it addresses task-technology fit in a concise way, it considerably shortens the demands on a respondent filling out a lengthy questionnaire. However, it is not possible to address the effect of specific fit factors. Instead, when operationalizing task-technology fit as a multidimensional construct there would be two advantages; (1) better conclusions could be drawn about which specific fit factors play a mediating role in the task-technology fit model, and (2) the fit factors could serve as a diagnostic for addressing possible lack of supportive value of the ICT tools. When doing this, a single fit score would still be able to be reported when constructing task-technology fit as a formative second order construct as in Staples and Seddon (2004).

An avenue for future research is the role of collaboration. The mediating role of task-technology fit was violated by collaboration, which showed to have a direct relation with ICT performance impact beyond task-technology fit. However, collaboration still exhibited a strong relation with task-technology fit as well. The question now arises, why collaboration exhibits a direct relation with ICT performance impact. It would furthermore strengthen the results that are presented in this thesis if several replications would be conducted at various organizations from different industries. Since the dependency on ICT tools is very high in nowadays workplaces, and task interdependence was not found to affect task-technology fit, a third avenue for future research is to investigated the interdependence between ICT tools instead of between people.
References


Appendix 1  Questionnaire Study 1

Randomized →

Task non-routineness

[geheel me oneens – geheel mee eens] 7 puntsschaal  (Goodhue and Thompson, 1995)
1. Ik heb te maken met slecht gedefinieerde bedrijfsproblematiek
2. Ik heb te maken met ad-hoc, niet routinematige bedrijfsproblematiek
3. De bedrijfsproblematiek waarmee ik werk, behelst het beantwoorden van vragen die nog nooit in vergelijkbare vorm zijn gesteld

Task interdependence

[geheel me oneens – geheel mee eens] 7 puntsschaal  (Pearce and Gregerson, 1991)
1. Ik werk nauw samen met anderen.
2. Ik moet mijn werkzaamheden met anderen coördineren
3. Mijn eigen prestaties zijn afhankelijk van het verkrijgen van de juiste gegevens van anderen
4. De manier waarop ik werk, heeft grote invloed op anderen
5. Voor mijn werk moet ik vaak met anderen overleggen*
6. In mijn werk ben ik niet afhankelijk van anderen*
7. Ik kan mijn eigen werk plannen en hoef weinig met anderen te coördineren*
8. Ik heb slechts af en toe gegevens van anderen nodig om mijn werk uit te voeren*
9. Om mijn werk te kunnen doen, besteed ik het grootste deel van mijn tijd aan het communiceren met andere mensen*
10. Op mijn werk wordt er regelmatig een beroep op mij gedaan om informatie en advies te geven*

Randomized →

Personalization

[geheel me oneens – geheel mee eens] 7 puntsschaal  (self developed)
1. Ik kan de ICT-tools aanpassen aan mijn persoonlijke voorkeuren (Blom, 2000)
2. De gebruikersinterfaces kunnen zodanig worden ingesteld dat ze aan mijn persoonlijke behoeften voldoen (Appelt et al., 1998)*
3. Ik kan de verschillende componenten van de ICT-tools volledig beheren
4. Ik kan ICT-modules kiezen die mij de specifieke informatie verschaffen die ik voor mijn werk nodig heb (Blom, 2000)
5. Ik kan het uiterlijk van de ICT-tools aan mijn voorkeuren aanpassen (Blom, 2000)*
6. De ICT-tools kunnen zodanig gepersonaliseerd worden dat ik dezelfde handelingen niet steeds opnieuw hoef te herhalen (Blom, 2000)*
7. Ik heb totale controle over hoe ik de ICT-tools gebruik (D’Ambra and Rice, 2001)
8. Ik vind het gemakkelijk om de ICT-tools te laten doen wat ik wil (Palmer, 2002)*

**Mobility**  (self developed)

1. Ik kan de ICT-tools gebruiken die ik nodig heb, ongeacht waar ik me bevind
2. Dankzij de ICT-tools ben ik zeer mobiel*
3. Ik kan met de ICT-tools slechts op een beperkt aantal locaties werken´
4. Ik kan overal toegang krijgen tot de ICT-tools
5. Ik kan te allen tijde toegang krijgen tot de ICT-tools*
6. Ik kan een permanente verbinding met de ICT-tools krijgen als ik dat wil, bijvoorbeeld door mobiele apparatuur (Kobsa, 2001)
7. De ICT-tools die ik gebruik, zijn kantoorgericht en daardoor moeilijk te benaderen als ik op afstand werk’ (Hoang et al., 2008)*
8. Als ik op afstand werk, dan is de toegang tot de ICT-tools beperkt of vertraagd’ (Hoang et al., 2008)*

**Collaboration**  (self developed)

1. Interactie met collega’s is gemakkelijk via de ICT-tools
2. Als ik gebruik maak van de ICT-tools, kan ik met collega’s communiceren (based on Campion et al., 1993)
3. Door de ICT-tools kan ik samenwerken met collega’s (based on Campion et al., 1993)
4. De communicatie tussen mijn collega’s is verbeterd dankzij het gebruik van de ICT-tools (based on Campion et al., 1993)

← Randomized

Randomized →

**Employee satisfaction**

[geheel me oneens – geheel mee eens] 5 puntsschaal  (Jun et al., 2006)

1. Als een bekende op zoek is naar werk, zou ik hem of haar deze organisatie aanbevelen
2. Het geeft mij persoonlijk voldoening wanneer ik mijn werk goed uitvoer
3. Ik vertel anderen met trots dat ik deel uitmaak van deze organisatie
4. Dit is voor mij de beste organisatie om voor te werken
**Employee productivity** *(Staples et al., 1999)*

1. Ik geloof dat ik een effectieve medewerker ben
2. Binnen mijn werkgroep behoren mijn eigen prestaties naar mijn oordeel tot de beste 25%
3. Ik ben tevreden over de kwaliteit van mijn werkrresultaten
4. Ik werk erg efficiënt
5. Ik ben een zeer productieve medewerker

**ICT performance impact** *(D’Ambra and Rice, 2001)*

1. Het gebruiken van de ICT-tools heeft een positieve impact op mijn werk
2. De kwaliteit van mijn werk is verbeterd door het gebruik van de ICT-tools
3. Ik maak betere beslissingen door het gebruik van de ICT-tools
4. Ik kan mijn werk sneller doen door gebruik te maken van de ICT-tools

← Gerandomiseerd

* Reverse coded question

* Question deleted after pretesting (Study 1)
Appendix 2  Questionnaire Study 2

Randomized →

Task variety

[geheel me oneens – geheel mee eens] 5 puntsschaal (based on Daft and Macintosh, 1981)
1. Mijn werk wordt gekenmerkt door een hoge mate van variatie
2. Mijn werk is te omschrijven als routinematig
3. Mijn werk vereist het uitvoeren van een breed scala aan taken (Morgeson and Humphrey, 2006)
4. Voor mijn werk moeten uiteenlopende taken worden uitgevoerd (Morgeson and Humphrey, 2006)

Task difficulty (based on Van de Ven et al., 1974)
1. De stappen die ik moet doorlopen om mijn werk uit te voeren zijn duidelijk en algemeen bekend
2. Tijdens het uitvoeren van mijn werk kom ik regelmatig moeilijke problemen tegen waarvan ik niet onmiddellijk weet hoe die op te lossen
3. Over het algemeen is voor mijn werk veel tijd nodig om oplossing te bedenken voor specifieke problemen
4. Als ik niet weet hoe ik mijn taken moet verrichten, is er in het algemeen altijd wel iemand anders waar ik hulp aan kan vragen

Task interdependence (Pearce and Gregerson, 1991)
1. Ik werk nauw samen met anderen
2. Ik moet mijn werkzaamheden vaak met anderen afstemmen
3. De manier waarop ik werk, heeft grote invloed op anderen
4. Mijn eigen prestaties zijn afhankelijk van het verkrijgen van de juiste gegevens van anderen
→ Randomized

Randomized →

Personalization

See Appendix 1

Mobility (self developed)
1. Ik kan de ICT-tools gebruiken die ik nodig heb, ongeacht waar ik me bevind
2. Ik kan met de ICT-tools slechts op een beperkt aantal locaties werken
3. Ik kan overal toegang krijgen tot de ICT-tools
4. Ik kan doormiddel van mobiele apparatuur een permanente verbinding met de ICT-tools krijgen als ik dat wil (Kobsa, 2001)
Collaboration

See Appendix 1

Randomized

For employee satisfaction, employee productivity, and ICT performance impact see Appendix 1.

Reverse coded question
Appendix 3  
Study 1 Correlation matrix

Table 4: descriptive and correlation matrix reduced pretest model (2) after CFA

<table>
<thead>
<tr>
<th>Construct (number of items)</th>
<th>Mean</th>
<th>Std Dev</th>
<th>CR</th>
<th>AVE</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
</table>
| 1. Task non-routineness (3) | 4.134| 1.101   | 0.573| 0.394 | 0.628
| 2. Task interdependence (4) | 5.178| 0.977   | 0.730| 0.415 | -0.02| 0.644
| 3. Personalization (4)     | 3.515| 1.214   | 0.720| 0.397 | -0.164**| -0.011| 0.630
| 4. Mobility (4)            | 3.893| 1.719   | 0.891| 0.672 | -0.090**| 0.015| 0.417****| 0.820
| 5. Collaboration (4)       | 4.755| 1.243   | 0.850| 0.586 | -0.202***| 0.252****| 0.301****| 0.517****| 0.766
| 6. Task-technology fit (4) | 4.411| 1.394   | 0.881| 0.532 | -0.320****| 0.036| 0.554****| 0.430****| 0.543****| 0.806
| 7. Employee satisfaction (4)| 3.710| 0.712   | 0.798| 0.532 | -0.341****| 0.174****| 0.132*   | 0.201***  | 0.338****| 0.293****| 0.730
| 8. Employee productivity (5)| 3.887| 0.562   | 0.757| 0.441 | -0.059 | 0.148**  | 0.071  | 0.161** | 0.185**  | 0.217***  | 0.412****| 0.664
| 9. ICT performance impact (4)| 3.495| 0.911   | 0.876| 0.641 | -0.143** | 0.140** | 0.345****| 0.293****| 0.584****| 0.633****| 0.330****| 0.290****| 0.801

n=196  * significant at p < 0.1  ** p < 0.05  *** p < 0.01  **** p < 0.001

Values in bold on the diagonal are the root square errors of the Average Variance Extracted denoting discriminant validity

CR = Composite Reliability

AVE = Average Variance Extracted

Independent factors (1-6) reported on a 7 point Likert scale. Dependent factors (7-9) reported on 5 point Likert scale
### Appendix 4  Study 2 Correlation matrix

#### Table 5: descriptive / correlation matrix Study 2

<table>
<thead>
<tr>
<th>Construct (number of items)</th>
<th>N</th>
<th>Mean</th>
<th>Std Dev</th>
<th>CA</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Task variety (4)</td>
<td>48</td>
<td>4.026</td>
<td>0.663</td>
<td>0.756</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Task difficulty (4)</td>
<td>48</td>
<td>3.438</td>
<td>0.820</td>
<td>0.51</td>
<td>0.321**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Task interdependence (4)</td>
<td>48</td>
<td>3.500</td>
<td>0.943</td>
<td>0.82</td>
<td>0.732****</td>
<td>0.191</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Personalization (4)</td>
<td>48</td>
<td>3.453</td>
<td>1.265</td>
<td>0.772</td>
<td>0.109</td>
<td>0.015</td>
<td>0.112</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Mobility (4)</td>
<td>48</td>
<td>4.188</td>
<td>1.345</td>
<td>0.739</td>
<td>0.114</td>
<td>0.183</td>
<td>0.132</td>
<td>0.155</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Collaboration (4)</td>
<td>48</td>
<td>4.333</td>
<td>1.266</td>
<td>0.858</td>
<td>0.389***</td>
<td>0.333**</td>
<td>0.307**</td>
<td>0.245*</td>
<td>0.383***</td>
<td></td>
</tr>
<tr>
<td>7. Task-technology fit (4)</td>
<td>39</td>
<td>4.276</td>
<td>1.162</td>
<td>0.836</td>
<td>-0.335**</td>
<td>-0.033</td>
<td>-0.259*</td>
<td>0.304*</td>
<td>0.243</td>
<td>0.291*</td>
</tr>
<tr>
<td>8. Employee satisfaction (4)</td>
<td>38</td>
<td>4.066</td>
<td>0.572</td>
<td>0.749</td>
<td>0.225</td>
<td>-0.018</td>
<td>0.138</td>
<td>-0.173</td>
<td>0.026</td>
<td>-0.082</td>
</tr>
<tr>
<td>9. Employee productivity (5)</td>
<td>38</td>
<td>4.021</td>
<td>0.591</td>
<td>0.823</td>
<td>0.228</td>
<td>-0.120</td>
<td>0.196</td>
<td>-0.406**</td>
<td>0.054</td>
<td>-0.027</td>
</tr>
<tr>
<td>10. ICT performance impact (4)</td>
<td>38</td>
<td>3.651</td>
<td>0.692</td>
<td>0.882</td>
<td>-0.135</td>
<td>0.187</td>
<td>-0.230</td>
<td>0.079</td>
<td>0.066</td>
<td>0.331**</td>
</tr>
</tbody>
</table>

* significant at p < 0.1  ** p < 0.05  *** p < 0.01  **** p < 0.001

CA: Cronbach Alpha

Factors 1-3 and 8-10 reported on a 5 point Likert scale. Factors 4-7 reported on 7 point Likert scale.
<table>
<thead>
<tr>
<th>Construct (number of items)</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. Employee satisfaction (4)</td>
<td></td>
<td>-0.276*</td>
<td></td>
</tr>
<tr>
<td>9. Employee productivity (5)</td>
<td>-0.047</td>
<td>0.436***</td>
<td></td>
</tr>
<tr>
<td>10. ICT performance impact (4)</td>
<td>0.419***</td>
<td>0.060</td>
<td>0.237</td>
</tr>
</tbody>
</table>

Table 5 continued: descriptive / correlation matrix Study 2
### Appendix 5  Regressions Study 1

**Table 6: SEM regressions Study 1**

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Task-technology fit</th>
<th>Employee satisfaction</th>
<th>Employee productivity</th>
<th>ICT performance impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task-technology fit</td>
<td>.333**** (.082)</td>
<td>.249*** (.084)</td>
<td>.659**** (.079)</td>
<td></td>
</tr>
<tr>
<td>Task non-routineness</td>
<td>-.213*** (.087)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task interdependence</td>
<td>-.025 (.072)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personalization</td>
<td>.348**** (.086)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobility</td>
<td>.089 (.088)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collaboration</td>
<td>.400**** (.092)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| R² | .536 | .111 | .062 | .434 |

n=196  * significant at p < 0.1  ** p < 0.05  *** p < 0.01  **** p < 0.001

LISREL 8.8 does not produce a R², therefore this value is calculated as 1-PSI (disturbance term)

Standard error in parentheses
Table 7: OLS regressions Study 1

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Task-technology fit</th>
<th>Employee satisfaction</th>
<th>Employee productivity</th>
<th>ICT performance impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>2.482**** (.503)</td>
<td>2.627**** (.384)</td>
<td>2.999**** (.321)</td>
<td>.752 (.387)</td>
</tr>
<tr>
<td>Task-technology fit</td>
<td>.087** (.052)</td>
<td>.056* (.044)</td>
<td>.286**** (.053)</td>
<td></td>
</tr>
<tr>
<td>Task non-routineness</td>
<td>-.185*** (.062)</td>
<td>-.079** (.046)</td>
<td>.043 (.038)</td>
<td>.050 (.046)</td>
</tr>
<tr>
<td>Task interdependence</td>
<td>-.036 (.070)</td>
<td>.084** (.051)</td>
<td>.049 (.042)</td>
<td>.033 (.051)</td>
</tr>
<tr>
<td>Personalization</td>
<td>.282**** (.059)</td>
<td>-.024 (.045)</td>
<td>.007 (.038)</td>
<td>.057 (.046)</td>
</tr>
<tr>
<td>Mobility</td>
<td>.080** (.046)</td>
<td>.025 (.033)</td>
<td>.013 (.028)</td>
<td>.026 (.034)</td>
</tr>
<tr>
<td>Collaboration</td>
<td>.331**** (.062)</td>
<td>.122*** (.048)</td>
<td>.027 (.040)</td>
<td>.218**** (.048)</td>
</tr>
</tbody>
</table>

R² .375   .149   .047   .389
R² adjusted .359   .122   .017   .369

n=196   * significant at p < 0.1 ** p < 0.05 *** p < 0.01 **** p < 0.001
Standard error in parentheses

Table 8: Tolerance scores corresponding OLS regressions Study 1

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Task-technology fit</th>
<th>Employee satisfaction</th>
<th>Employee productivity</th>
<th>ICT performance impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task-technology fit</td>
<td>.625</td>
<td>.625</td>
<td>.625</td>
<td></td>
</tr>
<tr>
<td>Task non-routineness</td>
<td>.943</td>
<td>.901</td>
<td>.901</td>
<td></td>
</tr>
<tr>
<td>Task interdependence</td>
<td>.939</td>
<td>.937</td>
<td>.937</td>
<td></td>
</tr>
<tr>
<td>Personalization</td>
<td>.850</td>
<td>.759</td>
<td>.759</td>
<td></td>
</tr>
<tr>
<td>Mobility</td>
<td>.704</td>
<td>.693</td>
<td>.693</td>
<td></td>
</tr>
<tr>
<td>Collaboration</td>
<td>.752</td>
<td>.653</td>
<td>.653</td>
<td></td>
</tr>
</tbody>
</table>

n=196
## Appendix 6  Regressions Study 2

### Table 9: OLS regressions Study 2

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Task-technology fit</th>
<th>Employee satisfaction</th>
<th>Employee productivity</th>
<th>ICT performance impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>4.608****</td>
<td>4.049****</td>
<td>3.299****</td>
<td>2.827****</td>
</tr>
<tr>
<td></td>
<td>(1.244)</td>
<td>(.935)</td>
<td>(.862)</td>
<td>(1.016)</td>
</tr>
<tr>
<td>Task-technology fit</td>
<td>-.081</td>
<td>.167*</td>
<td>.179*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.112)</td>
<td>(.104)</td>
<td>(.122)</td>
<td></td>
</tr>
<tr>
<td>Task variety</td>
<td>-.680****</td>
<td>.256</td>
<td>.396**</td>
<td>-.078</td>
</tr>
<tr>
<td></td>
<td>(.363)</td>
<td>(.245)</td>
<td>(.226)</td>
<td>(.266)</td>
</tr>
<tr>
<td>Task difficulty</td>
<td>-.098**</td>
<td>-.067</td>
<td>-.137</td>
<td>.179</td>
</tr>
<tr>
<td></td>
<td>(.236)</td>
<td>(.150)</td>
<td>(.138)</td>
<td>(.163)</td>
</tr>
<tr>
<td>Task interdependence</td>
<td>-.272</td>
<td>-.062</td>
<td>.054</td>
<td>-.181</td>
</tr>
<tr>
<td></td>
<td>(.285)</td>
<td>(.186)</td>
<td>(.172)</td>
<td>(.202)</td>
</tr>
<tr>
<td>Personalization</td>
<td>.273**</td>
<td>-.044</td>
<td>-.224***</td>
<td>-.039</td>
</tr>
<tr>
<td></td>
<td>(.127)</td>
<td>(.086)</td>
<td>(.079)</td>
<td>(.093)</td>
</tr>
<tr>
<td>Mobility</td>
<td>.246**</td>
<td>.038</td>
<td>-.022</td>
<td>-.034</td>
</tr>
<tr>
<td></td>
<td>(.131)</td>
<td>(.087)</td>
<td>(.080)</td>
<td>(.094)</td>
</tr>
<tr>
<td>Collaboration</td>
<td>.420***</td>
<td>-.051</td>
<td>-.104</td>
<td>.164*</td>
</tr>
<tr>
<td></td>
<td>(.149)</td>
<td>(.105)</td>
<td>(.097)</td>
<td>(.114)</td>
</tr>
<tr>
<td>R²</td>
<td>.446</td>
<td>.127</td>
<td>.308</td>
<td>.297</td>
</tr>
<tr>
<td>R² adjusted</td>
<td>.342</td>
<td>-.076</td>
<td>.146</td>
<td>.133</td>
</tr>
</tbody>
</table>

n=38  * significant at p < 0.1  ** p < 0.05  *** p < 0.01  **** p < 0.001  
Standard error in parentheses

### Table 10: Tolerance scores corresponding OLS regressions Study 2

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Task-technology fit</th>
<th>Employee satisfaction</th>
<th>Employee productivity</th>
<th>ICT performance impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task-technology fit</td>
<td>.552</td>
<td>.552</td>
<td>.552</td>
<td></td>
</tr>
<tr>
<td>Task variety</td>
<td>.454</td>
<td>.394</td>
<td>.394</td>
<td></td>
</tr>
<tr>
<td>Task difficulty</td>
<td>.791</td>
<td>.785</td>
<td>.785</td>
<td></td>
</tr>
<tr>
<td>Task interdependence</td>
<td>.525</td>
<td>.505</td>
<td>.505</td>
<td></td>
</tr>
<tr>
<td>Personalization</td>
<td>.970</td>
<td>.841</td>
<td>.841</td>
<td></td>
</tr>
<tr>
<td>Mobility</td>
<td>.899</td>
<td>.810</td>
<td>.810</td>
<td></td>
</tr>
<tr>
<td>Collaboration</td>
<td>.806</td>
<td>.646</td>
<td>.646</td>
<td></td>
</tr>
</tbody>
</table>

n=196
Table 11: z-values for comparing Study 1 (OLS) and Study 2 (OLS)

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Task-technology fit</th>
<th>Employee satisfaction</th>
<th>Employee productivity</th>
<th>ICT performance impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task-technology fit</td>
<td>3.232</td>
<td>-2.526</td>
<td>2.050</td>
<td></td>
</tr>
<tr>
<td>Task variety</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task difficulty</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task Interdependence</td>
<td>3.440</td>
<td>0.754</td>
<td>-0.023</td>
<td>1.026</td>
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<tr>
<td>Personalization</td>
<td>0.174</td>
<td>0.211</td>
<td>2.634</td>
<td>0.925</td>
</tr>
<tr>
<td>Mobility</td>
<td>-3.592</td>
<td>-0.146</td>
<td>0.406</td>
<td>0.085</td>
</tr>
<tr>
<td>Collaboration</td>
<td>-1.414</td>
<td>1.504</td>
<td>1.253</td>
<td>0.434</td>
</tr>
</tbody>
</table>

Study 1: n=196
Study 2: n=38

If z-value > ± 1.96, the regressions from Study 1 and Study 2 are similar (at p <0.05)