THE FIT OF MOBILE WORK SUPPORT FUNCTIONS WITH MOBILE SALES-FORCE WORKER TASKS

A dissertation submitted by

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Abstract

In recent years, mobile computing technologies (MCT) have developed and matured to a stage where they now have the potential to transform organisational work. However, the wide-spread diffusion of innovative MCT within pharmaceutical companies in Germany has still not taken place. This research seeks to provide an in-depth understanding of how MCT fits with pharmaceutical sales-force work and whether MCT can add value to their relationship with physicians.

The purpose of this research is to investigate (1) how and to what extent are specific mobile work support functions enabled by MCT perceived to be useful with pharmaceutical sales-force worker tasks, (2) to what extent is perceived usefulness influenced by individual sales-force worker characteristics, (3) to what extent does perceived usefulness and intention to use mobile work support functions influence sales-force worker performance and (4) does the perceived degree of innovativeness of mobile work support functions moderate the relationship between perceived usefulness and intention to use and the relationship between perceived usefulness and perceived impact on mobile work performance of mobile work support functions.

Drawing on task-technology fit (TTF) and technology acceptance model (TAM) theory, this study used two research phases and a mixed methodological approach to conduct an in-depth case study of the German division of a large pharmaceutical company. The first research phase collected primarily qualitative data using semi-structured interviews to determine how and why specific mobile work support functions are perceived to be useful with pharmaceutical sales-force worker tasks. The first research phase informed the second research phase by providing support for the conceptual model proposed for this research and assisted in the refinement of the online survey instrument in the context of the case study organisation by developing real-life usage scenarios for each of mobile work support functions investigated. The second research phase collected quantitative data to validate and test the research's conceptual model. Thereby, the second research phase sought to determine to what extent there is a perceived fit between sales-force worker tasks and mobile work support functions and to what extent this fit and individual characteristics of sales-force workers influence sales-force worker performance and intention to use mobile work support functions.

The research findings indicate that except for mobile job scheduling and dispatching functionalities, all mobile work support functions investigated in this research were considered to be moderately useful and innovative. Moreover, mobile work support functions are perceived to accelerate communication, improve information delivery, reduce paper-based work, reduce double-handling of data entries, improve preparation for ad-hoc sales calls and facilitate a more efficient usage of dead times. However, MCT might be also misused as a control tool, might reduce work autonomy and might increase workload and stress. Regarding the task characteristics investigated in this research, time criticality and location dependence of mobile sales-force workers positively affect perceived usefulness of mobile work support functions. Furthermore, this study confirmed the relationships established by TTF theory as the research results indicate that perceived usefulness of mobile work support functions positively affects intention to use and perceived impact on mobile work performance of mobile work support functions. In addition, no moderating effect of the perceived degree of innovativeness could be determined for both the influence of perceived usefulness on intention to use and the influence of perceived usefulness on perceived impact on mobile work performance. Lastly, this study revealed that differences across job roles, across length of tenure and across business units affect perceived usefulness of mobile work support functions - but not across gender.

This study contributes to theory by examining the impact of individual characteristics on perceived usefulness of mobile applications, by conducting a large-scale test of the TTF model for mobile technologies at the operational level, by adding contextual extensions to the TTF model and by examining the link between sales technology and sales-force worker performance using TTF theory. The study contributed to practice by establishing a generalisable model that is not tied to pharmaceutical sales-force work and can be retested in a different industry setting. The scope of this research is limited to in-depth research conducted in a single-case organisation focusing on pharmaceutical sales-force work in Germany. This research provides a unique opportunity often not available to researchers to conduct an in-depth test of the proposed research model within a large organisation. Future research should retest the research model empirically validated and tested in this study in other contexts and industries to analyse the impact of the perceived degree of innovativeness on intention to use and perceived impact on mobile work performance. In addition, the research model should be retested with more recent and advanced MCT and particularly the use of 'mobile apps' and tablet PCs (e.g., iPads/android tablets) and their potential impact on work performance.

Certification of dissertation

I certify that the ideas, experimental work, results, analyses, software and conclusions reported in this dissertation are entirely my effort, except where otherwise acknowledged. I also certify that the work is original and has not been submitted for any other award, except where otherwise acknowledged.

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Signature of Candidate Date

Endorsement:

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Signature of Supervisor Date

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As with most dissertations, this study would not have been possible without the help of others.

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List of abbreviations

Abbreviation	Description
3G	3rd generation
4G	4th generation
AMOS	Analysis of moment structures
ANOVA	Analysis of variance
AVE	Average variance extracted
B2B	Business-to-business
B2E	Business-to-employee
BU	Business unit
CB-SEM	Covariance-based structured equation modelling
CR	Composite reliability
CRM	Customer relationship management
DBA	Doctor of business administration
DOI	Diffusion of innovation
DSL	Digital subscriber line
ERP	Enterprise resource planning
F	Female
FAQ	Frequently asked questions
FTHREC	Fast track human research ethics committee
GMS	Global system for mobile communication
GoF	Goodness of fit
GP	General practitioner
GPRS	General packet radio service
HSPA	High speed packet access
IM	Instant messaging
IPTV	Internet protocol television

Abbreviation	Description
IS	Information system
IT	Information technology
ITD	Innovation diffusion theory
ITU	Intention to use
LOCDEP	Location dependence
LOCVAR	Location variety
LOE	Loss of exclusivity
LRS	Location-related services
LRSITU	Intention to use location-related services functionalities
LRSPI	Perceived impact on mobile work performance of location-related services functionalities
LRSPIN	Perceived degree of innovativeness of location-related services functionalities
LRSPU	Perceived usefulness of location-related services functionalities
M	Male
MC	Mobile communication
MCITU	Intention to use mobile communication functionalities
MCPI	Perceived impact on mobile work performance of mobile communication functionalities
MCPIN	Perceived degree of innovativeness of mobile communication functionalities
MCPU	Perceived usefulness of mobile communication functionalities
MCT	Mobile computing technologies
MIS	Mobile information searching
MISITU	Intention to use mobile information searching functionalities
MISPI	Perceived impact on mobile work performance of mobile information searching functionalities
MISPIN	Perceived degree of innovativeness of mobile information searching functionalities
MISPU	Perceived usefulness of mobile information searching functionalities
MJS	Mobile job scheduling and dispatching

Abbreviation	Description
MJSITU	Intention to use mobile job scheduling and dispatching functionalities
MJSPI	Perceived impact on mobile work performance of mobile job scheduling and dispatching functionalities
MJSPIN	Perceived degree of innovativeness of mobile job scheduling and dispatching functionalities
MJSPU	Perceived usefulness of mobile job scheduling and dispatching functionalities
MMS	Multimedia messaging service
MO	Mobile office
MOITU	Intention to use mobile office functionalities
MOPI	Perceived impact on mobile work performance of mobile office functionalities
MOPIN	Perceived degree of innovativeness of mobile office functionalities
MOPU	Perceived usefulness of mobile office functionalities
MTP	Mobile transaction processing
mSFA	Mobile sales-force automation
MTPITU	Intention to use mobile transaction processing functionalities
MTPPI	Perceived impact on mobile work performance of mobile transaction processing functionalities
MTPPIN	Perceived degree of innovativeness of mobile transaction processing functionalities
MTPPU	Perceived usefulness of mobile transaction processing functionalities
Op	Operational sales-force worker
PDA	Personal digital assistant
PI	Perceived impact on mobile work performance
PIN	Perceived degree of innovativeness
PLS	Partial least squares
PLS-SEM	Partial least squares structured equation modelling
PU	Perceived usefulness
QoS	Quality of service
RFID	Radio-frequency identification

Abbreviation	Description
RQ	Research question
SD	Standard deviation
SEM	Structured equation modelling
SFA	Sales-force automation
SMS	Short message service
SOHO	Small office home office
SOV	Share of voice
SPSS	Statistical package for social sciences
Sup	Supervisor
TA	Therapeutic area
TAM	Technology acceptance model
TC	Task complexity
TCR	Time criticality
TI	Task interdependence
TPB	Theory of planned behaviour
TRA	Theory of reasoned action
TTF	Task-technology fit
UM	Unified messaging
UMTS	Universal mobile telecommunications system
USQ	University of Southern Queensland
UTAUT	Unified theory of acceptance and use of technology
W-CDMA	Wideband code division multiple access
WiMAX	World interoperability for microwave access
WLAN	Wireless local area network

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Lembach, M. and Lane, M.S. (2011), *The fit of mobile work support functionalities with pharmaceutical sales-force worker tasks,* 11th International Conference on Electronic Business, 28 Nov-2 Dec 2011, Bangkok, Thailand.

1 Introduction

1.1 Background

1.1.1 Background to this research

During the last two decades, the global pharmaceutical industry has benefited from several changes in societal structure. Increased life expectancy, increased wealth of the population in developed countries and the rise in the world population have led to an increased demand for pharmaceutical products (Fischer & Breitenbach 2007, p. 7). Worldwide, pharmaceutical drugs have an exclusivity of 20 years; prominent drugs (e.g., Lipitor, Viagra) are likely to be copied by generic companies after the drugs have lost their exclusivity (Fischer & Breitenbach 2007). Thereby, most of the turnover can be made in the first 20 years when a drug is patent-protected. As there are over 38,000 drugs available in Germany (Fischer & Breitenbach 2007, p. 17), a physician cannot be familiar with all these drugs or their pharmacodynamics. According to the German 'Heilmittelwerbegesetz' (law on advertising in the healthcare system), a pharmaceutical company is not permitted to advertise drugs directly to patients (AOK-Bundesverband 2008). Pharmaceutical companies employ sales-force workers who inform targeted physicians about pharmaceutical products that are available in the marketplace. In turn, these physicians are able to consult with patients about pharmaceutical products and are qualified to write drug prescriptions.

The European pharmaceutical industry is nowadays challenged by increasing financial pressure, regulatory constraints and changes in buyer behaviour (Ruzicic & Danner 2007). In order to stay competitive in the market, the use of sales technology is intended to increased sales-force worker performance (Ahearne et al. 2008; BenMoussa 2006; Donaldson & Wright 2004; Eggert & Serdaroglu 2011). Mobile computing can provide the technological basis for better utilising sales technology when sales-force workers are travelling to visit customers.

1.1.2 Motivation for the research

According to industry experts, mobile computing has been the defining information technology trend of the first decade of this millennium (Helal 1999; Lilischkis 2003; Urbaczewski et al. 2003; Xianpei et al. 2008). In ninety-four countries worldwide, mobile phones surpassed fixed phones in the year 2000 and reached 100 percent market penetration by 2004 (Lee & Lee 2009). In addition, capabilities and functionalities of mobile devices, mobile applications, and mobile networks have grown exponentially in recent years (Computerwoche 2008; Ladd 2010; Lee & Lee 2009).

Despite the high investments in sales technology and a considerable amount of research investigating the link between sales technology and work performance (e.g., Ahearne et al. 2008; Ahearne & Schillewaert 2001; BenMoussa 2006; Koschembahr 2005; Scornavacca & Sutherland 2008), the ‘relationship between sales technology and sales-force worker performance remains primarily unsubstantiated’ (Ahearne et al. 2008). This research assumes that there are gaps in the current research regarding the impact of sales technology on sales-force worker performance. Mobile computing technologies (MCT) are expected to add value for mobile workers such as pharmaceutical sales-force workers by, for example, reducing paper-based work, providing online access to a company’s systems and the Internet during dead times and enhancing existing business processes (Accenture 2004; Henri & Aurelie 2006; IBM Cooperation 2004; Liang & Wei 2004; Perry et al. 2001; Schierholz et al. 2007; Sheng et al. 2005). This research assumes that MCT can play a key role in adding value to pharmaceutical sales-force work and the sales force-physician relationship through improved access to relevant information and a more efficient use of the pharmaceutical sales workforce’s time in the field.

Therefore, the motivation for this research is to investigate to what extent a perceived good fit of mobile work support functions enabled by MCT and mobile sales-force worker tasks influences work performance of mobile sales-force workers and their intention to use mobile work support functions.

1.1.3 Background to pharmaceutical sales-force work in Germany

Pharmaceutical sales-force workers are considered mobile workers as they are 'working away from their office desk for more than 20% of their working day' (Gartner 2002). As pharmaceutical sales-force workers are mainly dealing with information, ideas and expertise in their mobile work setting, they can be considered mobile knowledge workers (Yuan & Zheng 2006). They have many working locations inside a geographically limited area and therefore the 'yo-yo' metaphor is applicable (Lilischkis 2003). Their main purpose is to promote pharmaceutical products ('detailing'), and maintain and enhance customer relationships by visiting traditional customers in the German pharmaceutical market such as physicians, hospitals and pharmacies (Fischer & Breitenbach 2007). Traditional pharmaceutical sales-force work is share of voice (SOV) driven where pharmaceutical companies try to contact customers through a high frequency of sales calls (Eggert & Serdaroglu 2011). Section 2.2.1 provides more details on specific sales activities of pharmaceutical sales-force workers.

BenMoussa (2006, pp. 15-16) identified three main issues pharmaceutical sales-force workers face in their mobile work setting, namely (1) large intervals of time between sales calls, (2) high costs associated with travelling and waiting time and (3) raised regulatory pressure on physicians' prescribing freedom. Macintosh (2004) conducted a survey of physicians with the aim of analysing their expectations and attitudes toward pharmaceutical sales-force workers. Several issues that marketing and sales teams in pharmaceutical companies need to consider have been identified, namely:

- Physicians want most of all 'unbiased, evidence-based scientific information about products including head-to-head comparisons as well as risks and side effects' (Mackintosh 2004, p. 15).
- To make the interaction with the sales-force worker more valuable, 'a substantial 57% of physicians are willing to spend more time with representatives who bring additional information and value-added services' (Mackintosh 2004, p. 15).

- ‘38% of the surveyed physicians have decided…to make less time for sales-force workers’ (Mackintosh 2004, p. 15).

All these identified issues can be addressed positively through a sales-work force adopting and leveraging MCT in their interactions with physicians.

1.1.4 Sales-force work and IT support in the case organisation

The purpose of this subsection is to describe the nature of sales-force work in the case organisation and to summarise how sales-force workers were supported by information technology at the time this research was conducted. The information provided is based on the author’s work experience as an IT manager in the case organisation. The author had the chance to observe pharmaceutical sales-force work through participating and accompanying sales-force workers from different business units in their daily working life. Due to the study’s non-disclosure agreement with the case organisation, only information relevant for this study is revealed—information that might facilitate the identification of the case organisation was intentionally eliminated.

Nature of sales-force work in the case organisation

During a sales call, sales-force workers mainly provide and discuss product-related information. Product-related information includes news about current products, news about competitor drugs, and information about products that are not on the market yet, but are still in the clinical trial stage. Discussions about medical studies can also be part of a sales call (e.g., a clinical trial revealed the efficacy of product X with regard to disease Z). Other important information for the physician concerns knowledge about potential new indications of specific drugs (e.g., product Z is supposed to also help against disease Y). In addition, current medical literature and information about competitor products are of importance (e.g., why is product A considered to be superior compared to product B for indication C). As physicians are expected to continuously educate themselves, pharmaceutical companies offer specific trainings to fill these needs.

Sales-force workers in the case organisation plan their sales calls on a weekly basis. A usual sales call takes five to 20 minutes. On average, a typical sales-force worker spends most of the working day in the mobile work setting. Even though sales-force workers plan their sales-calls activities on a weekly basis, most physicians do not know upfront that they are going to be visited by sales-force workers, as they do not have fixed appointments. As this research is also investigating differences among groups of sales-force workers, it is important to note that supervisors have a different work focus than operational sales-force workers. Besides their regular sales-force work, supervisors are involved in coaching staff reporting directly to them, sales area management activities, and alignment with headquarter strategies, etc.

Sales-force structure in the case organisation

Similar to other businesses, customers are treated differently based on their importance to the company. Inter alia, customers are further segmented on their medical specialisation (e.g., general practitioner [GP], oncologist, cardiologist, etc.), the location of work (office-based physicians, physicians working in hospitals, pharmacies) and customer value (VIP customer, etc.).

Based on this customer segmentation, the sales organisation of this research's case organisation is divided into four different strategic business units that have different product portfolios and focus on different customer groups. Within the business units, a further division in separate sales-force lines with more specialisations is possible. The business units differ in their degree of competition with other players in the market, the number, amount and value of their product portfolio and the situation of new products in the business unit's product pipeline. While the business units are working mostly independently, there are some interdependencies among them. The so-called 'spill-over effect' deals with the fact that drugs prescribed in hospitals will most likely be prescribed by GPs after a patient has left the hospital and still needs a prescription for the respective drug.

IT support in the case organisation

To supports its sales-force workers with appropriate sales technology, a plethora of IT systems for different purposes within the case organisation exist. In the mobile work setting, mobile phones and (offline) laptops were the only means to access data in mobile work settings at the time this research was conducted, and do not fall under the definition of mobile computing but, rather, nomadic computing (cf. section 2.3 for more information on the different types of computing). Thereby, online access to corporate information systems is only possible when working from home or from the company's headquarters. In the mobile work setting, sales-force workers are required to collect customer and market-related information (e.g., call and visit reports, sample management, customer feedback, plans for the next call, customer network information, number of private patients, etc.) that is then stored in a central CRM system. Data from the CRM system is crucial for their daily work and for further analysis by internal departments (sales effectiveness, market research, etc.). Inter alia, data about calls, visits, turnover, inquiries, samples, customer feedback, event management-related information, business plans, products and customer turnover can be found in the CRM system and have to be refined and updated after each sales call. The previously mentioned weekly planning process is captured in the CRM system. In addition, most of the administrative work (e.g., submitting weekly expense reports, capturing CRM relevant data, email communication with colleagues and headquarters, preparation for the next working day) has to be done in the 'home office' (cf. section 1.5 for a definition of the term 'home office'), which would appear to be restricting the efficiency and effectiveness of sales-force workers.

In this study, the author assumes that MCT is not used effectively and innovatively in the case organisation and that the potential of MCT has not yet been leveraged.

1.2 Research problem, research questions and theoretical framework

Goodhue and Thompson's task-technology fit (TTF) model and aspects of technology acceptance model (TAM) (Davis et al. 1989) provide the theoretical framework for this research. According to the TTF model, an information technology (e.g., MCT) can improve an employee's performance when the technology is utilised and the technology fits the tasks it supports (Goodhue & Thompson 1995, p. 213). Since the model's introduction in 1995, its validity has been confirmed in several studies that examined the use of mobile technologies (e.g., Dishaw & Strong 1999; Gebauer et al. 2010; Lee et al. 2005; Zheng 2007). In this study, the TTF model has been adapted to a new context (Influence of a perceived good fit of mobile work support functions enabled by MCT and mobile sales-force worker tasks on work performance of mobile sales-force workers and their intention to use mobile work support functions) using semi-structured interviews and is validated and tested in this context through a large-scale online survey. Two constructs of the TAM (perceived usefulness; intention to use) have been integrated in this study's final research model.

Thereby, the main objectives of this research is to investigate

1) how and to what extent are specific mobile work support functions enabled by MCT perceived to be useful in supporting mobile sales-force worker tasks;
2) the extent to which perceived usefulness is influenced by individual sales-force worker characteristics;
3) the extent to which perceived usefulness and intention to use mobile work support functions influence mobile sales-force worker performance; and
4) whether the perceived degree of innovativeness of mobile work support functions moderates the relationship between perceived usefulness and intention to use; and the relationship between perceived usefulness and perceived impact on mobile work performance of mobile work support functions.

To achieve this objective, a two-stage research design is selected, and 10 research questions and 13 hypotheses are formulated.

Table 1.1 summarises specific research questions investigated in this study. Research questions 4 to 10 are translated into specific hypotheses which are tested in phase 2 of this research.

Table 1.1 - Research questions

	Research question
Research phase 1 - Semi-structured interviews	
RQ1	How useful is each of the mobile work support functions in supporting mobile sales-force worker tasks?
RQ2	To what degree is each of the mobile work support functions innovative in supporting mobile sales-force worker tasks?
RQ3	Why is each of the mobile work support functions useful or not useful in supporting mobile sales-force worker tasks?
Research phase 2 - Online survey	
RQ4	To what degree do task characteristics of mobile sales-force workers influence perceived usefulness of mobile work support functions?
RQ5	To what extent does a perceived fit between mobile sales-force worker tasks and use of mobile work support functions influence perceived mobile work performance?
RQ6	To what extent does a perceived fit between mobile sales-force worker tasks and use of mobile work support functions influence intention to use mobile work support functions?
RQ7	To what extent does the intention to use mobile work support functions by mobile sales-force workers influence perceived mobile work performance?
RQ8	To what extent is the relationship between the perceived usefulness of mobile work support functions and perceived mobile work performance influenced by the perceived degree of innovativeness of mobile work support functions?
RQ9	To what extent is the relationship between the perceived usefulness of mobile work support functions and intention to use mobile work support functions influenced by the perceived degree of innovativeness of mobile work support functions?
RQ10	Do individual characteristics of mobile sales-force workers influence the perceived fit between mobile sales-force worker tasks and use of mobile work support functions?

Source: Developed for this research

1.3 Justification for this research

This research contributes to the existing body of knowledge in several ways. First, this study establishes a generalisable framework for measuring the influence of the perceived fit of mobile work support functions enabled by MCT and mobile sales-force worker tasks on work performance of mobile sales-force workers and their intention to use mobile work support functions. This new framework is not tied to the pharmaceutical industry and is generic enough to be applied in other industries.

Furthermore, this study follows suggestions for future research in previous studies by:

- examining the impact of individual characteristics on perceived usefulness of mobile applications (Yuan et al. 2010);
- conducting a large-scale test of the TTF model for mobile technologies at the operational level (Gebauer et al. 2010);
- adding contextual extensions to the TTF model (Ahearne et al. 2008); and
- examining the link between sales technology and sales-force worker performance using TTF theory—a gap in current research (e.g., Ahearne et al. 2008; Ahearne & Schillewaert 2001; BenMoussa 2006; Koschembahr 2005; Scornavacca & Sutherland 2008).

Thereby, the constructs 'individual characteristics' and 'perceived degree of innovativeness of mobile work support functions' complement the original TTF model and provide new insights regarding the role and significance of these variables for ongoing TTF research. Individual characteristics (e.g., gender, length of tenure, job role, business units) of mobile sales-force workers are considered to significantly affect perceived usefulness of mobile work support functions. The 'perceived degree of innovativeness' construct is integrated into this study's research model as the author assumes that this construct has a moderating effect on the relationship between perceived usefulness and intention to use; and the relationship between perceived usefulness and perceived impact on mobile work performance of mobile work support functions.

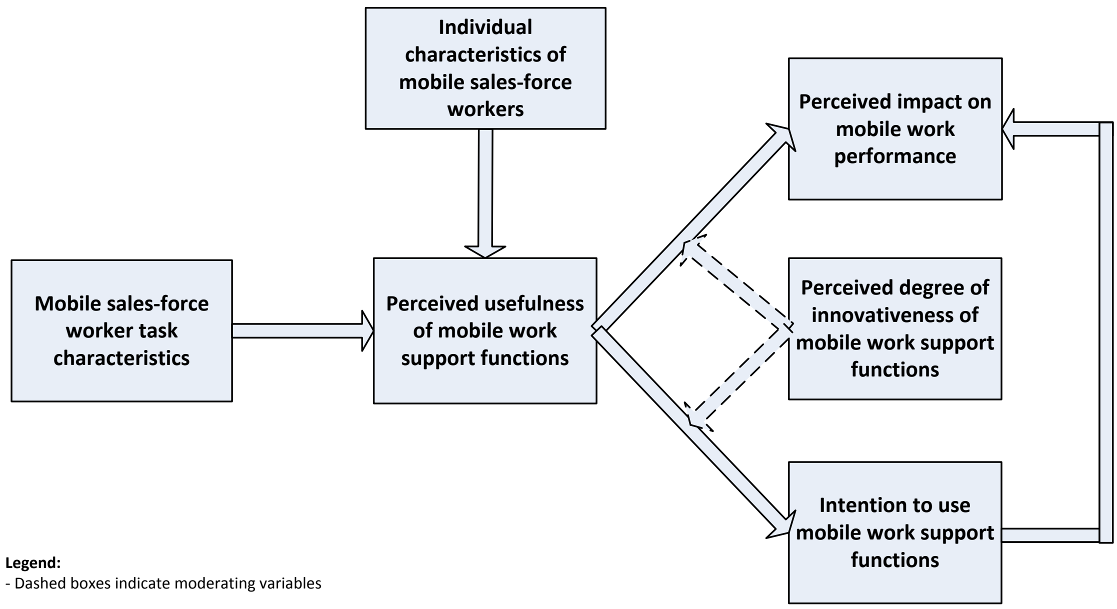
Last but not least, this research provides the opportunity to compare some of the findings of this study regarding the TTF model and mobile knowledge workers with previous recent empirical studies by Zheng (2007) and Yuan et al. (2010).

1.4 Methodology

Drawing on TTF and technology acceptance model (TAM) theories, this study uses two research phases and a mixed methodological approach to conduct an in-depth case study of the German division of a large pharmaceutical company. The first research phase collects primarily qualitative data using semi-structured interviews to determine how and why specific mobile work support functions are perceived to be useful in supporting pharmaceutical sales-force worker tasks. The first research phase informs the second research phase by providing support for the conceptual model proposed for this research and assists in the refinement of the online survey instrument in the context of the case study organisation by developing real-life usage scenarios for each of the mobile work support functions investigated. The second research phase collects quantitative data to validate and test the research's conceptual model. Thereby, the second research phase determines to what extent there is a perceived fit between sales-force worker tasks and mobile work support functions and to what extent this fit and individual characteristics of sales-force workers influence sales-force worker performance and intention to use mobile work support functions.

To achieve the objectives of this study, the TTF model has been adapted and two new constructs, namely, perceived degree of innovativeness and individual characteristics, have been integrated. Figure 1.1 illustrates this adapted model on a high-level basis.

Figure 1.1 - High-level research framework



Source: Developed for this research

More details on how the research model has been developed will be discussed in section 2.5 of chapter 2 (literature review).

1.5 Definition of terms

As the definitions adopted by researchers are often not uniform (Perry 2002, p. 18), the purpose of this subsection is to define and contrast the following key terms that are used within this dissertation:

- **Mobile work** is defined as the work that is done outside the regular office, initially by management and staff who travel extensively (McLennan 2007, p. 7). **Mobile workers** are working away from their office desk for more than 20% of their working day (Gartner 2002).
- **Sales-force workers** are the specific group of employees involved in a company's selling process and thereby an organisation's personal link to its customers (Encyclopaedia Britannica 2011; Kotler 2003). Sales-force workers are considered to be mobile workers.
- **Mobile tasks** are all work-relevant mobile workers' tasks that need to be accomplished in the mobile work setting.
- In the **home office**: all those work-relevant tasks conducted when a sales-force worker returns home from the daily sales trip. Sales-force workers in the case organisation are expected to work from home to accomplish their non-mobile tasks (e.g., email inquiries from colleagues and customers, CRM data upload, preparation for the next working day, weekly expenses reports, time management reports).
- This research considers **dead times** as those waiting times when a mobile worker is 'trapped' in the work process and has to wait for the next step in the work process (e.g., having to wait for the next sales call).
- **Mobile computing** systems are defined as 'computing systems that may be easily moved physically and whose computing capabilities may be used while they are being moved. Examples are laptops, personal digital assistants (PDAs), and mobile phones' (B'Far 2005).

1.6 Delimitations of scope and key assumptions

The scope of this dissertation is limited in several ways. First, an in-depth research investigating the impact of the perceived fit of mobile work support functions and mobile sales-force workers tasks on perceived impact on mobile work performance and intention to use mobile work support functions is conducted in a single-case organisation. Second, the investigation concentrates on pharmaceutical sales-force work in Germany. Third, as the researcher has been employed at the case organisation at the time of the research, he might be biased in several ways. These biases might be limited by acknowledging this tendency, by having a clear focus on the research problem, by conducting a comprehensive literature review, by using multiple sources of evidence (interviewing different persons; a combined research approach consisting of a case study research design that is validated by a survey), by having a clear definition of the unit of analysis (sales-force workers in the German pharmaceutical industry) and by working closely with the academic supervisor.

The first key assumption of this research is that mobile work support functions enabled by MCT have the potential to add value to pharmaceutical sales-force work. Thereby, this research aims to identify those specific areas where mobile work support functions can add value to pharmaceutical sales-force work and aims to measure the impact on sales-force workers' performance and intention to use mobile work support functions. Aspects such as mobile solutions promoted by pharmaceutical sales-force workers that support the physician-patient relationship or mobile applications offered by pharmaceutical companies that directly target patients (e.g., an iPhone application that support asthma patients) are outside the scope of this dissertation. This research acknowledges the existence of other relevant stakeholders (key opinion leaders, healthcare organisations, payers, government customer networks, etc.) in pharmaceutical companies in Germany who might be visited by sales-force workers, but these are outside the scope of this research. In addition, this research focuses on the work of pharmaceutical business units.

Last but not least, this study focuses on the business to employee (B2E) relationship as sales-force workers in the German pharmaceutical industry are not allowed to directly sell drugs to physicians or patients. The business to business (B2B) part is only relevant to the extent that sales-force workers may provide better information and therefore a better service to the customer through the use of mobile computing.

1.7 Outline of the dissertation

The chapter structure of this dissertation is outlined in the following paragraphs.

Chapter 2 - 'Literature review' provides a systematic review of the relevant literature upon which this research's theoretical and conceptual framework is built. Thereby, an in-depth discussion on mobile computing, mobile work and pharmaceutical sales-force work is conducted. As this research's theoretical framework is based on the TTF model, a separate section introduces foundations of the TTF framework and proposes an adapted framework to solve the research problem and questions. This chapter concludes with the development of the proposed research model from the relevant literature for this study and a set of research questions and testable hypotheses for the study's research phases 1 and 2.

Chapter 3 - 'Research methodology' explains and justifies this study's overall research paradigm and methodology. This chapter also describes and justifies the research designs of both research phases of this study (i.e., data collection procedures and data analysis techniques) in detail. Furthermore, ethical considerations are acknowledged and discussed.

Chapter 4 - 'Data analysis - Research phase 1' presents and discusses the results of data analyses for the first research phase of data collection. Appropriate qualitative analysis techniques are used to analyse the data collected in the semi-structured interview process.

Chapter 5 - 'Data analysis - Research phase 2' presents and discusses the results of data analyses for the second research phase of data collection. Appropriate quantitative analysis techniques are used to analyse the data collected in the online survey.

Chapter 6 - 'Discussions of data analysis and findings' presents and discusses the main findings of this study from the integration of the results from both data analysis phases, and relates the main findings to the context of the relevant literature for this study.

Chapter 7 - 'Conclusions and implications' provides a high-level summary of this research in terms of the research questions and hypotheses investigated and tested in this research, the methodological approach used in this study, and the key findings. Most importantly, this chapter discusses the key contributions that this study makes for theory and practice and the implications of this research for current and future research and practice. Lastly, suggestions for future research are provided.

1.8 Chapter summary

The purpose of this introductory chapter is to provide an overview of this study. The research problem and general research questions have been defined and determined as being worthy of research, the research methodology has been outlined, and relevant key terms have been defined.

In this study, the impact of the perceived fit of mobile work support functions enabled by MCT and mobile sales-force workers tasks on perceived impact on mobile work performance and intention to use mobile work support functions is examined. Drawing on TTF and technology acceptance model (TAM) theories, this study uses two research phases and a mixed methodological approach to conduct an in-depth case study of the German division of a large pharmaceutical company.

The next chapter provides an extensive review of the relevant literature in the context of the research problem and general research questions which will be examined, and culminates with the development of a research model, a set of research questions, and a set of hypotheses which provide the theoretical and conceptual framework for this research.

2 Literature review

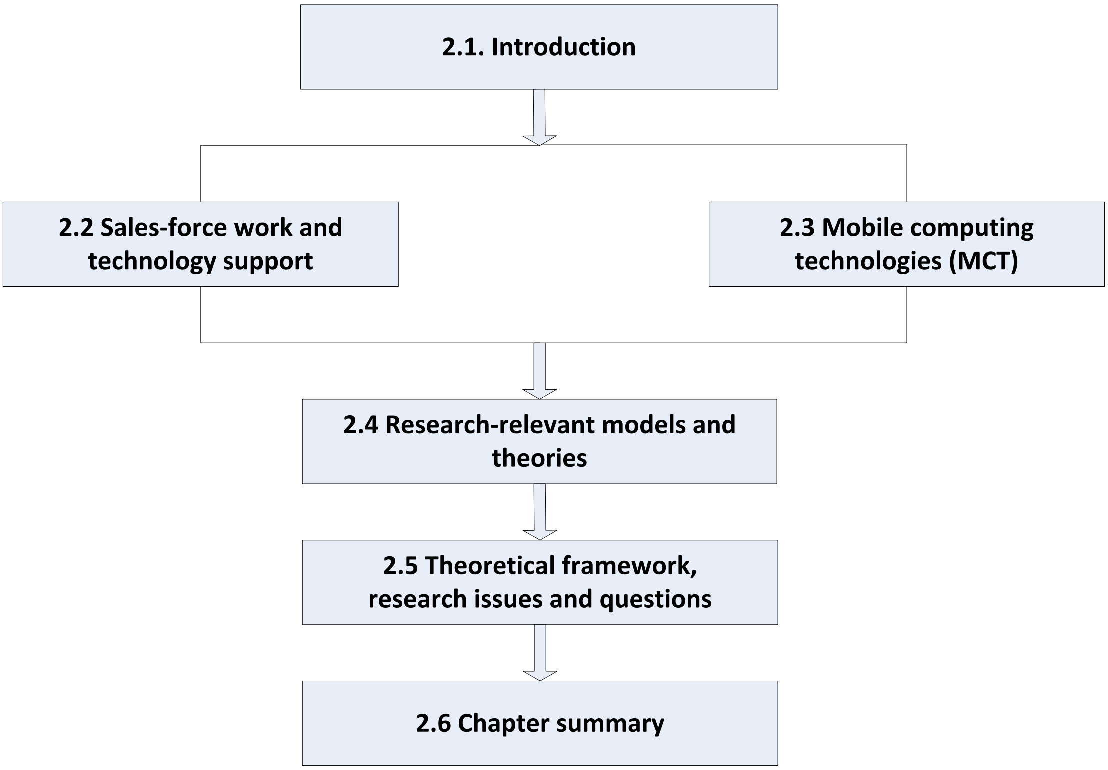
'Technology is our friend when it is inconspicuous, working smoothly and invisibly in the background...to provide comfort and benefit'.

Donald A. Norman, former vice president of Apple's advanced technology group (1999, p. 115).

2.1 Introduction

The purpose of a dissertation's literature review chapter is to 'build a theoretical foundation upon which the research is based by reviewing the relevant literature…to identify research issues which are worth researching because they are controversial and have not been answered by previous researchers' (Perry 2002, p. 20). As this study is investigating the impact of the perceived fit of sales-force worker tasks and mobile computing technologies (MCT) on sales-force worker performance and intention to use MCT, the structure of this chapter is as follows. First, existing literature on sales-force work, sales technology and the potential impact of sales technology on sales-force worker performance is examined. Second, mobile computing is introduced and its characteristics, benefits and limitations are investigated. Moreover, three technologies enabling wireless broadband Internet access are analysed and compared. Third, models and theories considered relevant to this research are discussed. Fourth, this research's theoretical framework is introduced and justified. Thereby, respective research questions and hypotheses are stated. Last but not least, this chapter concludes with a summary of its major findings. Figure 2.1 provides an outline of the structure of this chapter.

Figure 2.1 - Structure of literature review chapter



Source: Developed for this research

2.2 Sales-force work and technology support

The purpose of this section is to examine the existing literature on sales-force work, sales technology and the potential impact of sales technology on sales-force worker performance.

2.2.1 Sales-force work: definition and overview

Sales force and sales-force work

In 1960, McCarthy coined the term 'marketing mix', which is considered a toolbox for implementing a marketing strategy. Marketing mix consists of four elements: product, price, place and promotion (McCarthy 1960). Thereby, a sales force is considered one major tool of the promotion element of the marketing mix (Encyclopaedia Britannica 2011). Sales-force workers are the specific group of employees involved in a company's selling process and thereby an organisation's personal link to its customers; investment in sales-force activities can positively affect an organisation's overall sales (Kotler 2003).

Activities of pharmaceutical sales-force workers

Table 2.1 summarises sales activities that have been identified to be specific for pharmaceutical sales-force workers (Engle & Barnes 2000).

Table 2.1 - Key sales activities of pharmaceutical sales-force workers

Activity	Pre-sales activity	Within -sales activity	Post-sales activity	Education -related activity	Other activity	Is relevant for the sales-force group investigated?
Plan selling activities	X					X
Search out leads	X					X
Identify decision makers	X					X
Prepare sales presentation	X					X
Overcome objections		X	X	X		X
Introduce new products		X				X
Call on new products	X					X
Write up orders		X	X			
Handle shipping problems			X			
Interface with marketing department	X		X			X
Learn about products				X		X
Train/Educate customers				X	X	X
Provide technical information		X				X
Receive information/feedback		X				X
Check with superiors					X	X
Share information with colleagues				X		X
Learn about competitive information				X		X
Set up displays					X	

Activity	Pre-sales activity	Within -sales activity	Post-sales activity	Education -related activity	Other activity	Is relevant for the sales-force group investigated?
Take inventory for customer					X	
Encourage local advertising					X	
Attend sales conferences				X		X
Attend regional sales meetings				X		X
Work at client conferences	X				X	
Set up product exhibitions				X		
Attend periodic training sessions				X		X
Recruit new sales representatives					X	
Train new sales representatives				X		X
Travel with trainees				X		X
Entertain customers		X				X
Take clients to dinner		X				X
Assist in providing educational opportunities		X				X
Establish good relations with distributors					X	
Sell to distributors					X	
Handle product-related problems			X			X

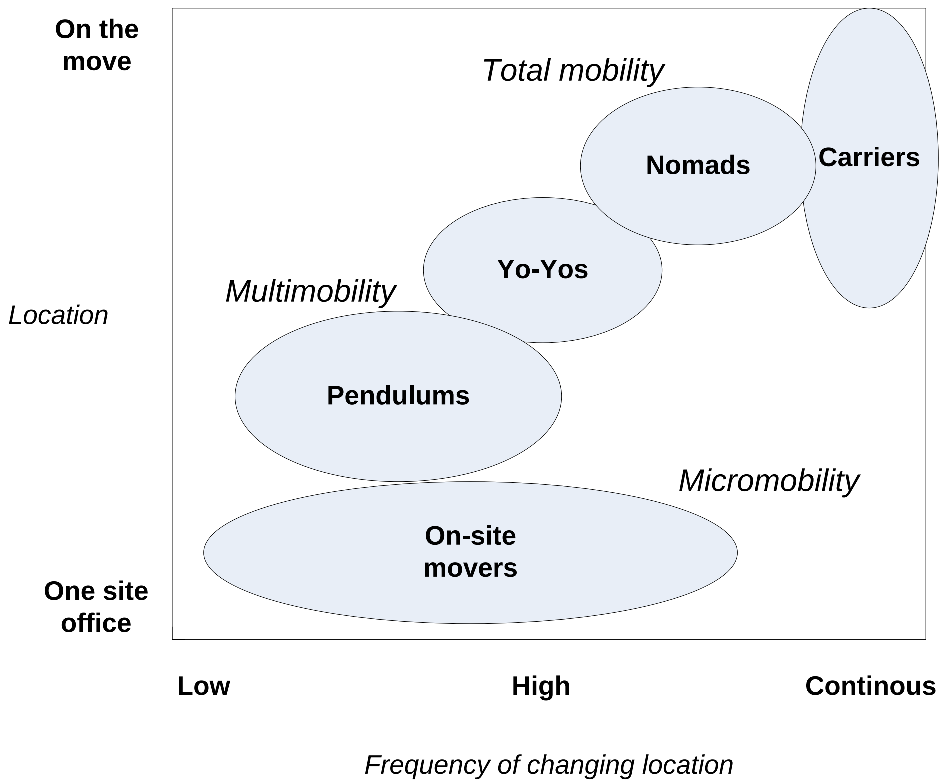
Adapted from Engle & Barnes (2000)

While not all of these activities are applicable to the sales-force group investigated in this study’s case organisation (column ‘Is relevant for the sales-force group investigated?' indicates which activities are relevant for this study), table 2.1 provides a general overview of the key activities of pharmaceutical sales-force workers.

Sales-force work and mobile work

In this research, pharmaceutical sales-force work is considered to be a specific form of mobile work, as pharmaceutical sales-force workers are ‘working away from their desk for at least 20% of their time’ (Gartner 2002). Based on a mobile worker’s location and his/her frequency of changing locations, figure 2.2 differentiates among five categories of mobile workers.

Figure 2.2 - Categorisation of mobile workers based on location and the frequency of changing locations



Adapted from Lilischkis (2003)

Lilischkis (2003) describes the five different types of mobile workers depicted in figure 2.2 as follows:

- ‘On-site movers’
    - During work, on-site movers move continuously within a geographically limited working area, e.g., a plant area or office premises. Examples of on-site workers are security and maintenance personnel. The frequency of location changes for on-site-movers varies from low to continuous.
- ‘Pendulums’
    - Pendulum workers have few possible working places and change their location quite often. An example might be a person doing remote work with two or more regular working places (e.g., office and home office).
- ‘Yo-Yos’
    - Yo-Yos are mobile workers who have many working locations within a geographically limited area. A sales-force worker responsible for a specific district is an example of this kind of worker.
- ‘Nomads’
    - Nomads are highly mobile and their area of mobility is not limited to a certain geographical area. An example of a nomad is a manager of a global organisation travelling between office sites. Nomads are those persons who work continuously wherever they are.
- ‘Carriers’
    - A mobile worker who is on the move all the time is a carrier (e.g., lorry drivers). Carriers are even more mobile than nomads.

According to Lilischkis’ (2003) categorisation of types of mobile work, pharmaceutical sales-force workers in Germany can be considered ‘Yo-Yos’ as they have many working locations inside a geographically limited area. By differentiating the nature and the characteristics of the tasks of different mobile workers, Yuang and Zheng (2006) classify mobile workers into three types, namely ‘mobile knowledge workers’, ‘field workers’ and ‘emergency workers’. Based on this classification, a pharmaceutical sales-force worker can be considered a ‘mobile knowledge worker’ as the rating of the task characteristics applied for mobile knowledge workers is in line with the task characteristics of pharmaceutical sales-force workers. The discussion above should help in classifying pharmaceutical sales-force work within the context of mobile work. As this research assumes that different types of mobile workers have different needs for mobile work support, technology support must adapt accordingly to fit with the tasks of the respective type of mobile worker.

2.2.2 Sales technology and sales-force work

Customer relationship management

'One face to the customer' is the key metaphor behind customer relationship management (CRM)—a concept adopted by many sales-force driven organisations that aims 'to create relationships with customers on an individual basis in order to transform the information collected into a useful tool to treat each customer differently' (Lubbe & Van Heerden 2003, p. 99). CRM has its roots in customer-oriented selling, which was introduced by Saxe and Weitz in 1982 who defined it as 'the degree to which salespeople practice the marketing concept by trying to help their customer make purchase decisions that will satisfy customers' needs' (Saxe & Weitz 1982). Thereby, customer-oriented sales-force workers avoid behaviours that may lead to customer dissatisfaction and take actions to increase long-term customer satisfaction. Keillor et al. (1999) state that customer orientation is an important characteristic of a high-performing sales-force worker. Boles et al.(2001) found that regular contact with customers is associated with increased sales and that disclosure of (personal) information by a sales-force worker increases the relationship between customer and sales-force worker. This research considers CRM as an important concept that sales-force driven organisations need to address to stay competitive. A technology (e.g., MCT) supporting sales-force work should therefore be in line with an organisation's CRM strategy.

Sales-force automation

Initially, sales-force automation (SFA) applications were designed to support sales-force workers in information-gathering tasks (Saxe & Weitz 1982). As part of a CRM initiative, SFA applications can automate certain sales processes and support sales-force workers in their daily business (Larpsiri & Speece 2004, p. 392). An effective CRM initiative that is supported by the appropriate SFA applications is expected to positively affect an organisation's sales-force effectiveness (Larpsiri & Speece 2004, p. 392). Often referred to as mobile SFA or 'mSFA' (Scornavacca & Sutherland 2008), MCT can provide the technological foundation for certain SFA applications and thereby has the potential to positively affect sales-force worker performance. In this research, sales technology is considered an umbrella term for technology that has the potential to support sales-force workers. Siebel System (subsidiary of Oracle) is a popular example of a CRM/SFA software vendor that also offers a specific module (i.e., 'Siebel ePharma') to effectively support pharmaceutical sales-forces with CRM/SFA software.

Issues with CRM and sales technology

Current issues with CRM include the costs associated with a customer-oriented approach. Buehrer et al. (2005) conducted long-term research on SFA adoption and identified a lack of organisational support and lack of adequate training as main barriers that negatively affect the adoption of SFA systems. Erffmeyer and Johnson (2001) revealed that most of the SFA initiates are triggered by management with improved efficiency as the main target. Their study reveals that SFA planning was made with 'little or no input from representatives of the sales force' (Erffmeyer & Johnson 2001). This research assumes that a successful introduction of a CRM/mSFA platform needs to address these issues to leverage tangible benefits for organisations.

2.2.3 Impact of sales technology on sales-force worker performance

Mulki et al. (2007) define sales-force worker performance as the behaviour of employees at work aiming to contribute to their firm's organisational goals. In addition, Kohli (1989) classified the influences on sales-force performance into three general categories, namely sales-force worker's characteristics and role perceptions, task characteristics and supervisory behaviours. Scornavacca and Sutherland (2008) consider overall sales and sales efficiency as the two most significant dimensions in evaluating a sales-force worker's performance and researched the following attributes and indicators of sales-force worker performance when using mSFA tools. Table 2.2 summarises these attributes and indicators of sales-force worker performance.

Table 2.2 - Attributes and indicators of sales-force worker performance

Dimension	Attribute	Indicator
Overall sales		
	Selling process	
		Sales volume
		Sales objectives
		Sales presentations
	Customer relations	
		Customer relations
		Providing information
	Market	
		Market knowledge
	Sales person	
		Turnover intentions
		Time management
Efficiency		
	Interdependence	
		Communication
		Collaboration
		Coordination
		Data management
	Order	
		Ordering time
		Order accuracy

Adapted from Scornavacca and Sutherland (2008)

Despite high investments in sales technology and a considerable amount of research investigating the link between sales technology and work performance (e.g., Ahearne et al. 2008; Ahearne & Schillewaert 2001; BenMoussa 2006; Koschembahr 2005; Scornavacca & Sutherland 2008), the ‘relationship between sales technology and sales-force worker performance remains primarily unsubstantiated’ (Ahearne et al. 2008).

Furthermore, research by Avlonitis and Panagopoulous (2005) did not find a link between sales-force worker performance and CRM adoption. Thereby, this study assumes that there are gaps in the current literature regarding the impact of sales technology on sales-force worker performance. This study aims to contribute to the existing body of knowledge in this domain by investigating the impact of a specific technology on work performance in a specific industry setting. A discussion on the measurement of the impact of technology on work performance is continued in section 2.4.

Table 2.3 gives a summary of recent research on sales technology support for sales-force workers considered relevant to this study.

Table 2.3 - Summary of research on technology support for sales-force work

Author(s) & Date	Focus of the study	Study results/ Contribution
(Ahearne & Schillewaert 2001)	Based on a qualitative research methodology, a theory on how information technology usage can affect sales-force worker performance was established. The research setting is the pharmaceutical industry.	This study makes some empirical contributions regarding the influencing factors of sales-force worker performance. Call productivity, sales skills and smart selling behaviour are considered to positively affect sales performance. These constructs can be supported with IT.
(Ahearne et al. 2008)	Extension of TTF theory by examining the mechanisms through which the use of IT by the sales force influences sales-force worker performance. The research model incorporates key marketing constructs (sales-force workers' customer service, attention to personal details, adaptability, knowledge) that could mediate IT's impact on sales-force workers performance.	Results in a pharmaceutical sales setting show that IT usage can improve customer service and sales-force workers' adaptability, thereby leading to improved sales performance. The researchers suggest the creation of contextual extensions of TTF theory to determine how the use of IT by individuals could lead to benefits.
(Avlonitis & Panagopoulous 2005)	Based on the TAM and IS success models, the authors provide a conceptual model to explain CRM acceptance antecedents and consequences in a pharmaceutical sales-force setting.	The researchers found evidence that sales-force workers are more likely not to adopt and use implemented information systems in day-to-day activities if they feel that such systems are not useful and/or are difficult to use. Contrary to other research in this area (i.e., Igbaria & Tan 1997), the authors neither found a linkage between CRM acceptance and sales-force worker performance nor between CRM user satisfaction and sales-force worker performance.
(BenMoussa 2009)	BenMoussa proposes a value-based approach for the introduction of mobile applications to support sales-force workers. This approach provides guidelines on how to determine whether or not mobile technologies would add value to sales-force work before those technologies actually get selected and implemented. Good planning of SFA investment would help firms avoid resistance of the sales force towards the implemented systems, rather than having to treat it at the post-implementation stage.	With the aim to prevent further failures in IT investments, BenMoussa presents and illustrates a value-based approach for planning the introduction of MCT applications to support sales-force workers. BenMoussa's suggested approach starts by identifying targeted gaps where a new IT support is needed, based on both the sales force's barriers that hamper the sales force's performance and the effectiveness of existing IT support available to them. Thereby, target barriers are sorted out where a new ICT is needed and provides benefits to sales-force workers.

Author(s) & Date	Focus of the study	Study results/ Contribution
(BenMoussa 2010)	Organisational enablers that facilitate a successful adoption of SFA systems and how the adoption of sales technology happens were investigated. The study investigates the impact of MCT on sales-force workers' barriers to performance that they face when operating within a mobile work setting.	BenMoussa found evidence that sales-force workers will only choose to adopt SFA if they believe that it is useful in helping them to deal with the barriers to performance they face and thereby would have an impact on their job performance. Adoption can be increased with training that goes beyond technical issues (i.e., a work system perspective).
(Boujena et al. 2009)	Boujena et al.'s qualitative research investigates the benefits of SFA from the customer's perspective within a framework based on theories from the sales and information systems literature relating to the benefits of the implementation of information technology.	The research indicates that customers perceive benefits on four main dimensions of their interaction with salespersons, namely salesperson's professionalism, customer interaction frequency, salesperson responsiveness and salesperson-customer relationship quality. The research is unique because it is the first to examine aspects of SFA from the customer perspective.
(Henri & Aurelie 2006)	Henri and Aurelie's exploratory empirical study investigates 'the real advantages and opportunities' of MCT for organisations.	Organisational and individual benefits are tightly intertwined, and each kind of benefit largely relies on the existence of the others. Benefits brought by mobile tools in organisational contexts are linked to a 'gift-counter-gift' logic, i.e., individuals seem to be compelled to be available and reachable (the counter-gift) because their firm equipped them with mobile tools.
(Honeycutt et al. 2005)	This research examines and explains impediments that exist in three SFA areas: planning, communication and evaluation.	The research identified significant gaps between organisational and sales-force worker perception with regard to SFA. While sales-force workers might consider it as a significant drawback, management may consider sales technology to be a benefit. Sales managers must consider these viewpoints when contemplating SFA adoption to plan, clearly communicate, and evaluate the benefits to the sales force.
(Koschembahr 2005)	The article discusses the potential of a mobile learning solution and its impact on sales-force worker performance. The setting is the pharmaceutical industry.	According to the authors, mobile learning can lead to cost savings, enhanced customer service and better selling opportunities. In addition, it can give a company a competitive edge, produces a workforce with high job satisfaction and reduces employee turnover.

Author(s) & Date	Focus of the study	Study results/ Contribution
(Schillewaert et al. 2005)	Based on TAM, Schillewaert et al. study 229 salespeople from different industries to explain why sales-force workers adopt sales technology.	Personal innovativeness, organisation facilitators (e.g., user training, support) and social influences (e.g., peer usage, supervisor influence, competitor utilisation) can positively or negatively affect the adoption of sales technology within enterprises.
(Scornavacca & Sutherland 2008)	By using an exploratory single case study approach, the authors investigate the perceived impact of mSFA on sales-force worker performance. According to the authors, overall sales and sales efficiency are the two most significant dimensions to evaluate a sales-force worker's performance.	The findings indicate that sales-force workers and management share different perceptions regarding the extent to which mSFA could improve individual performance. Their overall opinion on the impact of mSFA on sales-force worker performance is positive.
(Speier & Venkatesh 2002)	Speier and Venkatesh use identity theory as a lens to better understand a sales-force worker's perceptions associated with technology.	The authors found evidence that sales technology implementation may actually hinder a sales force, resulting in significant increases in staff turnover and decreases in perceptions of organisational commitment and job satisfaction of sales-force workers.

Source: Developed for this research

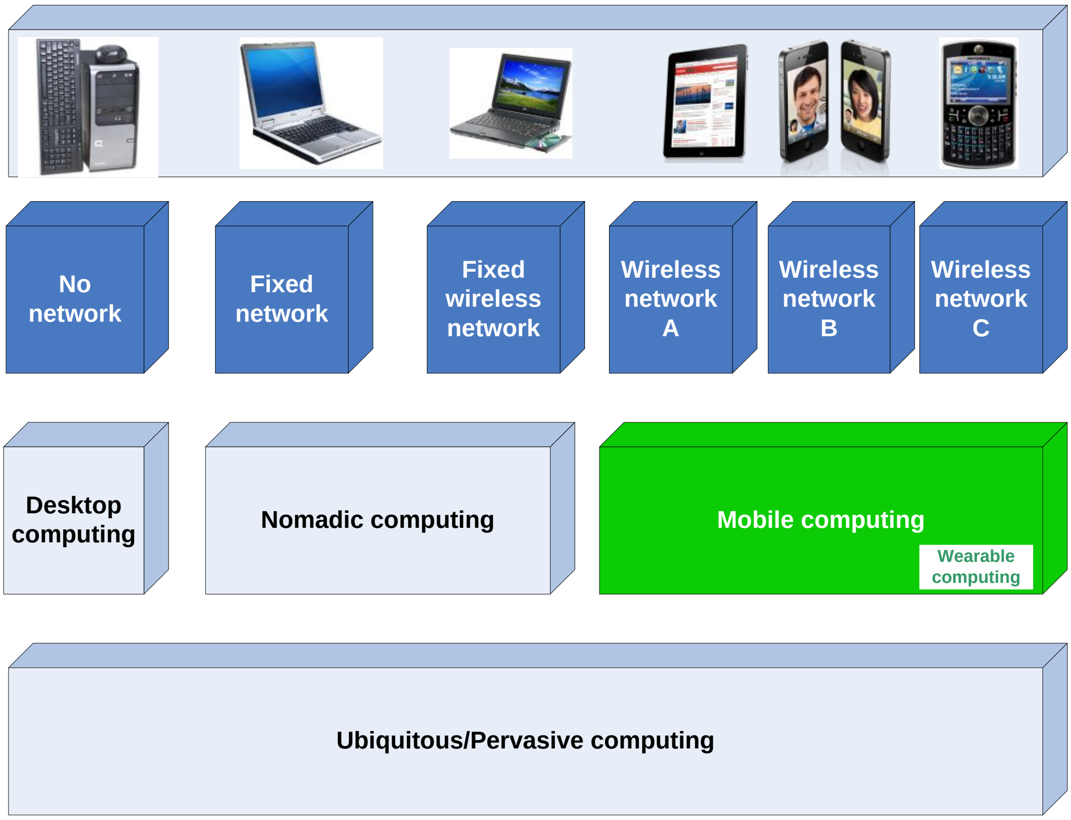
2.3 Mobile computing technologies (MCT)

According to industry experts, mobile computing has been the defining information technology trend of the first decade of this millennium (Helal 1999; Lilischkis 2003; Urbaczewski et al. 2003; Xianpei et al. 2008). In 94 countries worldwide, mobile phones surpassed fixed phones in the year 2000 and reached 100% penetration by 2004 (Lee & Lee 2009). Indeed, there has been a steady increase of research articles in the domain of mobile computing within the last decade (Ladd 2010; Scornavacca & Sutherland 2008). In addition, capabilities and functionalities of mobile devices, mobile applications, and mobile networks have grown exponentially in recent years (Computerwoche 2008; Ladd 2010; Lee & Lee 2009). To provide an up-to-date overview of this topic, this subsection discusses and contrasts definitions of mobile computing and related terms. Then, three technologies enabling wireless broadband access for MCT are examined. Last but not least, characteristics, benefits and limitations of mobile computing are summarised and synthesised.

2.3.1 Definitions of key terms

A plethora of terms and definitions exist in the domain of mobile computing. In differentiating the types of networks and their connectivity, figure 2.3 provides an overview on relevant terms and their delimitations.

Figure 2.3 - Overview of relevant terms in the mobile computing domain



Adapted from Helal (1999)

Ubiquitous computing

Based on this differentiation, ubiquitous computing can be considered an umbrella term for desktop computing, nomadic computing and mobile computing (Helal 1999). The term ubiquitous computing, also abbreviated as 'Ubicomp', was coined by Mark Weiser in his well-known article 'The Computer for the Twenty-First Century' (Weiser 1991). After mainframe computing (one computer for many persons) and personal computing (one computer for one person), ubiquitous computing (many computers for one person) is considered the 'third wave of computing' and stands for 'the idea of integrating computers seamlessly into the world'–similar to street signs or writing (Weiser 1991).

Pervasive computing

Pervasive computing and ubiquitous computing can be differentiated with regard to their level of mobility and embeddedness (Lyytinen & Yoo 2002, p. 64). While both types of computing have a high level of embeddedness (thus, a high level of integration in everyone's life through practically invisible computers), pervasive computing has only a low level of mobility and is thereby bound to a specific environment. In practice, these terms are used interchangeably (Mattern 2008).

Nomadic computing

The difference between nomadic computing and mobile computing is the underlying network and its connectivity. Helal (1999, pp. 2-5) describes this difference as follows: 'Both nomadic and mobile computing require small portable devices, however the kind of network used in nomadic computing does not allow mobility, or does so within the confines of the building at pedestrian speed…Mobile computing, on the other hand, requires the availability of wireless networks that support outdoor mobility and handoff from one network to the next, at pedestrian and vehicular speeds'. The following examples illustrate this delimitation:

- Nomadic computing takes place when a person is working offline on his/her laptop in a café.
- An employee accessing his/her emails via wireless LAN (WLAN) in a meeting room of the organisation's campus is considered nomadic computing.
- Mobile computing takes place when a person is accessing his/her emails online with an iPhone in a café via UMTS.
- Both forms of computing need a small portable device, e.g., a PDA or a laptop.
- Working on a workstation at work or at home is considered desktop computing.

Desktop computing

Desktop computing is different from nomadic computing and mobile computing because desktop computers have a fixed location (the user's desk) and are not supposed to be moved (Helal 1999; Kling & Iacono 1989).

Wearable computing

Wearable computers are those computers that may be worn by humans like a hat, shoe or clothes (i.e., wearable accessories). Wearable computers are always on, operational while on the move, hands free and context aware. Wearable computers need to be equipped with proactive attention and notifications with different types of sensors. In the future, the ultimate wearable computer will have sensors implanted within the body and supposedly integrate with the human nervous system (Talukder & Yavagal 2005). In this dissertation, wearable computing is considered a specific form of mobile computing.

Mobile commerce & mobile business

Mobile computing provides the technical foundation for mobile commerce and mobile business. Turowski and Pousttchi (2003) consider them synonymous and do not distinguish between the two terms; other researchers (e.g., Lehner 2003; Zobel 2001) consider mobile commerce a specific form of mobile business that focuses on transaction handling.

Yan and Lihua (2008, p. 300) define mobile business as 'all processes, activities and systems in an enterprise which are executed with or supported by mobile technologies, including supporting the creation, negotiation and transaction of business processes internally with employees (B2E) and externally with customers or suppliers (B2B)'. Given this definition of mobile business, the B2E part is of greater relevance for this research, as sales-force workers in the German pharmaceutical industry are not allowed to directly sell drugs to physicians or patients. The B2B part is only relevant to the extent that sales-force workers may provide better information and therefore a better service to the customer through the use of mobile computing.

Having discussed several key terms related to mobile computing, the remainder of this subsection discusses mobile computing in more detail.

Mobile computing

A broad definition of mobile computing is provided by Reza B'Far, who defines it as 'computing systems that may be easily moved physically and whose computing capabilities may be used while they are being moved. Examples are laptops, personal digital assistants (PDAs) and mobile phones' (B'Far 2005).

Table 2.4 summarises several definitions for the term mobile computing.

Table 2.4 - Definitions for mobile computing

Author & Year	Definition
(B'Far 2005)	'Computing systems that may be easily moved physically and whose computing capabilities may be used while they are being moved. Examples are laptops, personal digital assistants (PDAs), and mobile phones'.
(Forman & Zahorian 1994)	'A new paradigm of computing…in which users carrying portable devices have access to a shared infrastructure independent of their physical location'.
(Fuchs 2009)	The aim of mobile computing is to provide the user and its applications with effective computer-based concepts, processes and solutions that will enable her/him to read and work with (private) data and information in a heterogeneous environment with an always uncertain connectivity situation– regardless of place and time. *(Definition has been translated from German into English).*
(Talukder & Yavagal 2005)	A computing environment that is 'mobile and moves along with the user'.
(Wang 2007)	'Computing services that can physically move with people and become taken-for-granted, ever-present devices expanding people's capabilities to inscribe, remember, communicate and reason independently of the devices'.
(Welling 1999)	'Computing activity associated with portable computing devices and their mobile users'.

Source: Developed for this research

This dissertation uses the term **mobile computing technologies (MCT)** and defines the term as follows:

- Computing hardware and system that can easily be moved and used while on the move, has wireless access to the Internet and an organisation's intranet, is based on most current hardware, uses wireless broadband bandwidth (at least 3G) and provides the technical basis for mobile business.

The above definition intentionally does not specify a specific type of mobile device, e.g., a laptop, tablet PC, or smartphone.

2.3.2 Technological foundation of MCT

Wireless broadband technologies provide the technological foundation for MCT. This research assumes that pharmaceutical sales-force workers in Germany will be faced with different technologies enabling wireless broadband Internet access. Thereby, the purpose of this subsection is to analyse three wireless broadband technologies enabling mobile broadband Internet access, namely UMTS, WiMAX and WLAN.

Table 2.5 summarises the features of all three standards.

Table 2.5 - Comparison of three standards enabling mobile broadband Internet access

	UMTS	**WiMAX**	**WLAN**
IEEE standard	irrelevant	802.16	802.11
Range	irrelevant	50 km	30-300 m
Line of sight	irrelevant	LOS (IEEE 802.16) NLOS (IEEE 802.16-2004)	irrelevant
Max download capacity	2 Mbit/s (WCDMA) 84,4 Mbit/s (HSDPA)	75 Mbit/s	54 Mbit/s (IEEE 802.11a)
Max upload capacity	284 Kbit/s (WCDMA) 5,6 Mbit/s (HSUPA)	75 Mbit/s	54 Mbit/s (IEEE 802.11a)
Popularity	medium	lowest	highest
Wave technology	micro waves	micro waves	radio waves
Frequency	1,9-2,1 GHZ (WCDMA)	10- 62 GHZ (802.16) 2-11 GHZ (802.16-2004)	2.4 GHZ 5 GHZ
Target groups	Broadband access for 'mobile people'	In rural areas as alternative to xDSL, metropolises	Urban areas, SOHOs
Role in market	Mass market	Niche player	Mass market

Adapted from (Elektronik Kompendium 2009; IEEE 2009; Sauter 2008)

UMTS (Universal Mobile Telecommunications System) is a mobile broadband access standard offering a set of services to mobile computer and phone users no matter where they are located in the world. The terms UMTS and '3G' are often used interchangeably and so will do in this study. UMTS has evolved from its predecessors 1G, 2G and 2.5G. 1G ('first generation') refers to the original analogue mobile phones that were very large, heavy and expensive. 2G stands for the introduction of the digital mobile phone, enabled by the GSM (Global System for Mobile Communication) technology. From a technical perspective, the 2.5G standard had a major technically different feature compared to its predecessors as it uses 'General Packet Radio Service' (GPRS), a packet-switching technology to transmit data. The initial download rates of UMTS (384 Kbit/s - 2 Mbit/s) are realised by W-CDMA (Wideband Code Division Multiple Access) technology. W-CDMA is the technology behind the UMTS standard and is allied with the 2G GSM standard. One major drawback of W-CDMA is that it does not provide sufficient bandwidth for broadband services, e.g., triple play services that aim to provide HD television, Internet access and telephone via one single access point (Sjoelli 2004). Currently, the role of 'High Speed Packet Access' (HSPA – also known as 3.5G) is becoming more and more important, as it tremendously expands the UMTS bandwidth. HSPA offers improvements in communications in both download (HSDAP) and upload (HSUAP) bandwidth. In particular, HSPA offers:

- improved speed of access up to 84.4 Mbit/s to the terminal;
- improved interactivity through minimised packet delays; and
- improved network capacity to support more 3G users.

WiMAX (World Interoperability for Microwave Access) is a microwave-based technology enabling the delivery of last mile wireless broadband access as an alternative to cable and DSL. WiMAX offers the biggest bandwidth (75 Mbit/s) and the largest range (50 kilometres) compared to the other technologies outlined in this section. A major downside of WiMAX is that a direct line of sight connection between the base station and subscriber station is necessary to provide the bandwidth mentioned above. IEEE 802.16-2004 also supports a near line of sight connection—but this implies a significant reduction in bandwidth. WiMAX is expected to become a serious niche player in the wireless market—positioned as an alternative to xDSL or cable, especially in (rural) areas where no broadband access can be provided.

Wireless LAN (WLAN) uses radio waves to connect a user device to a LAN. It transmits network messages through the air for relatively short distances. Currently, WLAN is the most widespread wireless access technology for both, residential customers and small businesses. A downside may be the short range of a WLAN network and the relatively low bandwidth compared to WiMAX. But WLAN may be the enabler-technology for WiMAX networks. Clients may access a WiMAX network through a WLAN access point. That is why experts expect that WiMAX and WLAN are going to 'merge'—with WiMAX as the backbone technology (Gaskin 2004).

This research assumes that all of the abovementioned standards are relevant for pharmaceutical sales-force workers in the case organisation of this study. In addition, a high bandwidth is expected to add value for the applications provided via MCT. While this research suggests using UMTS as standard technology enabling broad band access for smartphones, WLAN and WiMAX are suitable for accessing broadband content in hotels or in cafés.

2.3.3 Characteristics of MCT

The purpose of this section is to provide an overview of the characteristics of MCT. Characteristics are considered those (more technical) attributes that are specific to mobile computing, as defined in section 2.3.1. In order to identify a good perceived fit between sales-force worker tasks and MCT, this study assumes that the consideration of MCT's technical characteristics is crucial for a successful MCT initiative. Several characteristics of MCT are now discussed separately in the following section.

Ubiquity

According to Pousttchi and Thurnher (2005), ubiquity 'deals with the possibility to send and receive data anytime and anywhere and thereby to eliminate any spatiotemporal restrictions'. The anytime/anywhere paradigm is included in the above definition, and this dissertation considers 'ubiquity' and 'anytime/anywhere' as interchangeable terms. The identification of 'ubiquity' as a characteristic of MCT has been widely acknowledged by other researchers (e.g., BenMoussa 2006; Lehner 2003; Liang & Wei 2004; Perry et al. 2001; Schierholz et al. 2007; Talukder & Yavagal 2005; Vuolle & Käpylä 2010). For this research, 'ubiquity' as a characteristic of MCT is considered an important differentiator to other forms of computing (e.g., desktop computing) and provides the basis for the key benefits of MCT, as discussed in section 2.3.4.

Context-sensitivity

Personalisation, location-based services and interactivity are the key features of 'context-sensitivity', which enables the delivery of customised goods or services that fit with the needs of a particular user in her/his current situation (Pousttchi & Thurnher 2005, pp.105-107). Schierholz et al. (2007) provide a similar definition, as this characteristic allows the 'contextualisation of information systems…and may include the identification of the individual user as well as geographic position and physical environment'. 'Context-sensitivity', as a characteristic of MCT, has also been identified by other researchers (e.g., BenMoussa 2006; Perry et al. 2001; Yuan et al. 2010; Zheng 2007). This characteristic is considered relevant to this research, as context-sensitive applications are assumed to offer added value to pharmaceutical sales-force work.

Command and control functions

Pousttchi and Thurnher (2005, pp. 105-107) define the 'command and control functions' characteristic as 'the use of the mobile device as a remote control for almost any application or device'. For example, alarm systems can send pictures of an incident via SMS to a house owner, or a person can turn on his/her room heater while being 15 minutes away from home (Talukder & Yavagal 2005). This characteristic has also been acknowledged by other researchers (e.g., Liang & Wei 2004; Perry et al. 2001; Yuan et al. 2010). The 'command and control functions' characteristic is not considered relevant to this research, as there is no need to remotely command and/or control any kind of resources via MCT within the given research setting.

Identifying functions

Pousttchi and Thurnher (2005) state that identifying functions 'provide the ability to authenticate the subscriber as well as the device already immanent to a mobile network'. This security-specific characteristic is important when the authenticity of the user is important (e.g., in an m-banking environment). 'Identifying functions' are considered irrelevant to this research, as there is no need for a sophisticated authentication of a mobile sales-force worker in the given research setting.

Other characteristics

Indeed, further characteristics of MCT can be found within the literature. For example, Schierholz et al. (2007) mention 'multimediality' (i.e., multi-media functions of mobile phones such as digital cameras) and 'convenience and familiarity' (MCT can offer a higher degree of convenience compared to standard desktops or laptop PCs). BenMoussa (2006) names the generic MCT communication functions (e.g., taking calls) as characteristics.

This research focuses on those characteristics that are supposed to be relevant for pharmaceutical sales-force work. Thereby, this study considers 'context-sensitivity' and 'ubiquity' to be relevant characteristics for this research; other characteristics, such as 'multimediality' are only of minor relevance to this research.

Table 2.6 summarises the characteristics of MCT and their relevance to this research.

Table 2.6 - Characteristics of MCT

Characteristic	Description	Relevance for this research	Author(s) & Year
Ubiquity	Ubiquity deals with the possibility to send and receive data anytime and anywhere, thereby eliminating any spatiotemporal restrictions.	This characteristic is relevant, as this is the one major differentiator from the other forms of computing and provides the basis for the major benefits of MCT, as discussed in the next section.	(BenMoussa 2006; Lehner 2003; Liang & Wei 2004; Perry et al. 2001; Schierholz et al. 2007; Talukder & Yavagal 2005)
Context-sensitivity	Personalisation, location-based services and interactivity are the key features of 'context-sensitivity', which enable the delivery for customised goods or services that fit with the needs of a particular user in her/his current situation.	Similar to ubiquity, this characteristic is relevant to this research. Thereby, context-sensitive applications are considered to offer added value to pharmaceutical sales-force work.	(BenMoussa 2006; Perry et al. 2001; Pousttchi & Thurnher 2005; Watson et al. 2002; Zheng 2007)
Identifying functions	Identifying functions provide the ability to authenticate the subscriber, and the device is already immanent in a mobile network.	Irrelevant, as there is no need for a sophisticated authentication of a mobile worker in the research setting. Might be more relevant in an m-payment environment.	(Pousttchi & Thurnher 2005)
Command & control functions	This characteristic uses the mobile device as a remote control for almost any application or device.	Irrelevant, as there is no need to remotely control any kind of resources through MCT in this research setting.	(Liang & Wei 2004; Perry et al. 2001; Pousttchi & Thurnher 2005; Schierholz et al. 2007)
Other	• Interactivity, convenience and familiarity, 'multimediality ' (Schierholz et al. 2007) • Communication capabilities (BenMoussa 2006)	Irrelevant, as they are not focussing on mobile work support but have a more entertainment-related focus.	cf. description

Source: Developed for this research

2.3.4 Benefits of MCT

Based on the characteristics of MCT discussed in the previous subsection, specific benefits for mobile workers can be derived from the use of MCT. In this dissertation, benefits are considered those specific MCT functionalities that provide added value for individuals and organisations and thereby have the potential to improve work performance. Thus, this subsection analyses how MCT can provide benefits and added value for individual mobile workers and their organisations. Benefits that are mainly related to the entertainment category are not considered in the following discussion. Benefits of MCT are assumed to facilitate the identification of sales-force worker tasks that fit with MCT.

In the following paragraphs, the benefits of MCT are summarised from two perspectives. First, the benefits of MCT are considered to be primarily advantageous for the individual worker (Henri & Aurelie 2006). Then, secondly, the benefits of MCT primarily affecting the organisational level are discussed. This research assumes that individual and organisational benefits are interrelated and that a positive effect at one level can lead to spill over effects at the other level. For example, real-time data entry on the spot by a mobile worker is considered to increase individual mobile worker performance. As a mobile worker has more time to perform other work-related tasks, this also can positively affect organisational performance.

Benefits for individual mobile workers

Based on current research, four major benefits of MCT have been identified that have the potential to increase an individual mobile worker’s work efficiency and effectiveness, namely:

- effective use of dead times or waiting times
- improved preparation for unexpected events
- increased communication, collaboration and information-gathering capabilities
- work process optimisation

  (Henri & Aurelie 2006; IBM Cooperation 2004; Liang & Wei 2004; Perry et al. 2001; Schierholz et al. 2007; Sheng et al. 2005).

This research considers dead times those waiting times when a mobile worker is ’trapped‘ in the work process and has to wait for the next step in the work process.

For example, those waiting times when a pharmaceutical sales-force worker sits in a physician's waiting room before the actual sales call takes place are considered dead times. During their lunch hour, most physicians have no surgery hours and sales-force workers have to wait until a sales call is possible. In the mobile work environment, a mobile worker is able to handle specific mobile tasks or administrative work during this time (Liang & Wei 2004; Yuan et al. 2010; Zheng 2007). For example, office-related tasks can be accomplished in a mobile office; the mobile worker can more flexibly use the available time in the mobile work environment (Henri & Aurelie 2006; Schierholz et al. 2007; Sheng et al. 2005).

Due to the complexity of their mobile tasks, pharmaceutical sales-force workers have to cope with unexpected events (e.g., spontaneous customer visits, specific inquiries from VIP customers) in their mobile work setting. Mobile communication functionalities (e.g., cell phones, SMS, MMS, instant messaging) and mobile information-searching functionalities (Internet search, enterprise access, etc.) can help solve respective information needs (IBM Cooperation 2004; Yuan et al. 2010; Zheng 2007). Context-specific information (e.g., the nearest customer in reach) can be provided based on the user's location via location-based services (Yuan et al. 2010; Zheng 2007) or information self-services (IBM Cooperation 2004).

Another important benefit of MCT for individuals and organisations is the potential to optimise existing work processes. While business process engineering and streamlining is primarily considered an organisational benefit, the individual mobile worker can benefit from MCT by making data entries on the spot and, more generally, can benefit through the reduction of paper-based work (IBM Cooperation 2004; Perry et al. 2001; Pousttchi & Thurnher 2005; Sheng et al. 2005).

Organisational level

A review of the relevant literature suggests that organisations can derive benefits from MCT through:

- higher transparency;
- higher flexibility;
- increased customer service;

- increased employee satisfaction;
- new business models/sources of revenue; and
- increased organisational effectiveness through business process optimisation and reengineering.
  (Accenture 2004; Henri & Aurelie 2006; IBM Cooperation 2004; Koschembahr 2005; Liang & Wei 2004; Schierholz et al. 2007; Scornavacca & Sutherland 2008; Sheng et al. 2005).

Higher transparency of corporate resources is enabled through improved data quality, achieved through more timely updates of data, prompt data collection procedures and a real-time overview of the location of corporate resources through location-based services (IBM Cooperation 2004; Schierholz et al. 2007; Yuan et al. 2010; Zheng 2007). For example, taxi enterprises can have a better overview of the location of their fleet currently in use. Carrier businesses can track their goods with RFID technology. With regard to resource handling, higher flexibility can be achieved through better handling and coordination of resources via mobile job scheduling and dispatching (Schierholz et al. 2007; Scornavacca & Sutherland 2008; Zheng 2007). Customer service can be improved through better order handling and accuracy, improved information delivery to the customer, increased ability to meet customer commitments and by providing added value to the customer with mobile services not previously available (IBM Cooperation 2004; Laukkanen 2005; Scornavacca & Sutherland 2008). A common example is the placement of orders in the presence of the customer. Thereby, availability of alternative products can be identified online, and the potential for cross-selling and upselling opportunities can be explored more effectively.

In addition, MCT is considered to positively affect job satisfaction and reduce employee turnover through the increased flexibility for employees to use their mobile working time and by the reduction of administrative work (IBM Cooperation 2004; Koschembahr 2005).

Depending on an organisation’s business model, MCT can provide the foundation for mobile business process reengineering (e.g., order placement) that is intended to increase organisational effectiveness and reduce process costs (Accenture 2004;

IBM Cooperation 2004). In addition, m-business has the potential to enhance or even change an organisation's business model and to exhaust new sources of revenues, such as the creation of specific mobile products not available before (e.g., iPad applications) or additional revenues gained through a mobile distribution channel (Accenture 2004; IBM Cooperation 2004; Pousttchi & Thurnher 2005; Schierholz et al. 2007; Sheng et al. 2005).

Table 2.7 summarises the benefits of MCT from the individual and organisational perspective based on recent literature.

Table 2.7 - Benefits of MCT (individual and organisational level)

Benefit description	**Example(s)**	**Author(s) & Date**
Individual level		
Effective use of dead times or waiting times	• Handling of work-related and administrative tasks during dead times in the mobile work setting • Increased flexibility in how to use the time available for work-related tasks	(Henri & Aurelie 2006; IBM Cooperation 2004; Liang & Wei 2004; Perry et al. 2001; Schierholz et al. 2007; Sheng et al. 2005)
Improved preparation for unexpected events	• Better preparation for spontaneous customer visits/sales calls	(Henri & Aurelie 2006; IBM Cooperation 2004; Liang & Wei 2004; Schierholz et al. 2007; Sheng et al. 2005)
Improved communication, collaboration and information-gathering capabilities	• Mobile communication (phone, email, UMS, instant messaging) • Mobile information searching (Internet, enterprise access to corporate systems such as an intranet, ERP, CRM, etc.) • Receiving context-specific information (next relevant customer in reach, navigation information) via location-based services • Improved data handling • Real-time access to customer information	(IBM Cooperation 2004; Yuan et al. 2010; Zheng 2007).
Work process optimisation	• Doing work-related tasks on the spot (e.g., order entry) • Reduction of double work by entering data on the spot • Mobile transaction processing • Reduction of paper-based work	(IBM Cooperation 2004; Perry et al. 2001; Pousttchi & Thurnher 2005; Sheng et al. 2005; Zheng 2007)

Benefit description	Example(s)	Author(s) & Date
Organisational level		
Higher transparency on corporate resources	• MCT can increase 'data quality' through more timely updates of data and prompt data collection procedures • Better overview of the location of corporate resources through location-based services	(IBM Cooperation 2004; Schierholz et al. 2007; Yuan et al. 2010; Zheng 2007)
Higher flexibility with regard to resource handling	• Better handling and coordination of resources through mobile job scheduling and dispatching	(Schierholz et al. 2007; Scornavacca & Sutherland 2008; Zheng 2007)
Improved customer service	• Better order handling and accuracy • Better information delivery to the customer • Better meeting customer commitments • Additional value can be brought to the customer by mobile services not previously available	(IBM Cooperation 2004; Koschembahr 2005)
Increased employee satisfaction	• Increased job satisfaction and reduced employee turnover	(IBM Cooperation 2004; Koschembahr 2005)
Opportunity of new business models/sources of revenue	• M-business as a new distribution channel • Creation of new 'mobile' products not available before	(Accenture 2004; Pousttchi & Thurnher 2005; Schierholz et al. 2007; Sheng et al. 2005)
Business process optimisation & reengineering	• Business processes (e.g., order placement) can be optimised with the use of MCT and process costs can be reduced	(Accenture 2004; IBM Cooperation 2004; Pousttchi & Thurnher 2005; Schierholz et al. 2007; Sheng et al. 2005)

Source: Developed for this research

Mobile work support functions for individual mobile workers

As this research is investigating the impact of a good perceived fit of MCT and sales-force worker tasks and its impact on mobile work performance, the benefits of MCT for individuals are of greater relevance to this research. Many of the abovementioned benefits are considered to be of a more theoretical nature and do not provide exact guidance on how to specifically support mobile workers in the given research context. With a focus on mobile work support, Zheng (2007, p. 86) identified six mobile work support functions, namely, (1) mobile communication; (2)

mobile information searching; (3) mobile transaction processing; (4) location-related services; (5) mobile job scheduling and dispatching; and (6) mobile office.

- Mobile workers can use ‘mobile communication’ functionalities to interact with their colleagues and clients through voice and text messages
- ‘Mobile information searching’ helps mobile workers to receive time-critical information in real time while working in their mobile work setting
- ‘Mobile transaction processing’ facilitates routine organisational and business transactions as they are performed on the spot and thereby can be conducted in a more efficient and cost effective way
- ‘Location-related services’ support mobile workers by providing job-related location information, e.g., showing the availability of certain resources or colleagues who are within reach
- ‘Mobile job scheduling and dispatching’ includes both scheduling of shared resources (e.g., equipment) and scheduling of appointments (e.g., tasks, time and location)
- ‘Mobile office’ functionalities enable mobile workers to use word processing, spread-sheet, presentation software and personal information software while on the move (Zheng 2007).

These mobile work support functions are considered comprehensive and appropriate for this kind of research and will thereby help in analysing the perceived fit of pharmaceutical sales-force worker tasks and MCT. This research acknowledges the existence of other types of mobile work support (as e.g. suggested by Liang & Wei 2004; Yuan et al. 2010), but these are not considered relevant to this research context as the mobile work support functions listed above are considered to be the most appropriate to fit with pharmaceutical sales-force work.

2.3.5 Technical limitations and adoption issues of MCT

According to recent research, the promise of mobile services has not yet materialised (Damsgaard & Hedman 2009). To effectively examine the perceived fit between sales-force worker tasks and MCT it is important to consider current issues with MCT, as they might negatively affect acceptance and/or adoption of MCT at the individual and organisational level and thereby the potential of MCT to positively affect work performance might not be leveraged.

This section differentiates between two types of limitations. First, technical limitations that are based on the very nature of MCT are examined. Second, primarily soft issues with MCT that a mobile worker might come across when actually having to use MCT are discussed.

Technical limitations

This research identifies the following (primarily technical) limitations of MCT, namely:

- device-specific limitations;
- issues related to a restricted bandwidth and network capability;
- usability issues; and
- security concerns (Chen & Skelton 2005; Forman & Zahorian 1994; Gururajan & Murugesan 2005; Helal 1999; Ladd 2010; Shilton 2009; Xianpei et al. 2008).

Device-specific limitations of MCT deal with screen size, memory, storage capabilities, power capabilities and high initial costs (Chen & Skelton 2005; Forman & Zahorian 1994; Gururajan & Murugesan 2005; Helal 1999). Network and bandwidth-related issues deal with the low transmission/bandwidth compared to desktop computers, technical issues when integrating different wireless technologies, frequent disconnection (e.g., by roaming outside the geographical coverage area of the wireless service) and fluctuations in the quality of service (Chen & Skelton 2005; Gebauer et al. 2010; Gururajan & Murugesan 2005; Helal 1999). Usability-related issues deal with the handling of mobile devices and user-unfriendly dialogs (Alahuhta et al. 2005; Chen & Skelton 2005; Gururajan & Murugesan 2005; Ladd 2010). Security-relevant issues deal with the misuse of the mobile device as a surveillance tool, the lack of anonymity, and data security in general (Chen & Skelton 2005; Gururajan & Murugesan 2005; Helal 1999; Shilton 2009; Xianpei et al. 2008).

Adoption and acceptance issues

Adoption- and acceptance-related issues deal with more intangible issues and can sometimes be derived from the technical limitations stated above. The fear by end users that the mobile device can be misused as a surveillance tool is one factor that might negatively affect user adoption and acceptance (Shilton 2009). Especially regarding mobile email usage, patterns have been identified that are ‘dangerous, distracting, anti-social and that infringe on work-life boundaries’ (Middleton & Cukier 2006). Furthermore, older people with a greater length of tenure are more likely to resist new technologies such as MCT (Meyer 2007). In addition, Chesley (2005) found that cell phone use over time is associated with an increase in negative family-work spill over for women, but not for men. Sarker and Wells (2003) examined the determinants influencing the implementation and acceptance of wireless handheld phones, namely, individual characteristics, technology characteristics, context, communication/task characteristics and modalities of mobility. Last but not least, BenMoussa (2006) identified training and end-user support as crucial factors that can affect adoption and acceptance of MCT.

Table 2.8 summarises the issues associated with MCT.

Table 2.8 - Technical limitations and adoption issues of MCT

	Author(s) & Date
Technical limitations	
Device-specific limitations • Screen size • Memory • Storage capabilities • Power • High initial costs	(Chen & Skelton 2005; Forman & Zahorian 1994; Gururajan & Murugesan 2005; Helal 1999)
Security-related issues • Lack of anonymity • Data security • Mobile devices can be misused as a surveillance tool. Four billion telephones on earth can become four billion 'little brothers'	(Chen & Skelton 2005; Gururajan & Murugesan 2005; Helal 1999; Shilton 2009; Xianpei et al. 2008)
Network and bandwidth-related issues • Transmission rate • Low bandwidth compared to desktop computers • Integration of different wireless technologies • Frequent disconnection, e.g., by roaming off outside the geographical coverage area of the wireless service • Fluctuations in the quality of service (QoS) network through a heterogeneous and fragmented wireless network infrastructure	(Chen & Skelton 2005; Gebauer et al. 2010; Gururajan & Murugesan 2005; Helal 1999)
Usability-related issues • Handling of mobile devices is difficult and user-unfriendly • There is a lack of research on user interface design of mobile devices	(Alahuhta et al. 2005; Chen & Skelton 2005; Gururajan & Murugesan 2005; Ladd 2010)
Adoption issues	
• Mobile devices can be misused as a surveillance tool, as four billion telephones on earth can become four billion 'little brothers'	(Shilton 2009)
• Wide-spread adoption of mobile technologies has the potential to increase the work-life conflict and eventually negatively affect organisational performance	(Middleton 2007, p. 10)
• Identified mobile email usage patterns that are 'dangerous, distracting, anti-social and that infringe on work-life boundaries'	(Middleton & Cukier 2006)
• Determinants influencing the implementation and acceptance of wireless handheld phones, namely, individual characteristics, technology characteristics, context, communication/task characteristics, and modalities of mobility	(Sarker & Wells 2003)
• Older employees with greater tenure are more likely to resist new technologies than employees who are new to a company	(Meyer 2007)
• Cell phone use over time is associated with increases in negative family-work spill-over for women, but not men.	(Chesley 2005)
• Training and end-user support are crucial factors affecting adoption	(BenMoussa 2006)

Source: Developed for this research

All in all, when introducing innovative MCT in a pharmaceutical company to improve sales-force worker performance, issues with MCT need to be examined and addressed prior to a rollout. Some limitations (e.g., limited bandwidth and device computing capabilities) will be eliminated or reduced through technical progress (Wamser 2010) but still need to be considered at the current stage.

2.4 Research-relevant models and theories

As this research is investigating the perceived fit of a specific technology (i.e., mobile computing) with sales-force worker tasks and its impact on mobile work performance, the purpose of this subsection is to discuss research-relevant models and theories that investigate the impact of an information system's use on individuals and organisations. The models and theories discussed here are considered to reflect and enhance current research in this area. This subsection—and the overall dissertation—differentiates between the terms information technology (IT) and information system (IS) as follows. While IT is considered a technology that generally supports information and communication-related tasks, an Information System is considered a particular product of IT that is implemented in organisations and includes various components such as hardware, software, processes and people (Gebauer et al. 2010).

2.4.1 Technology acceptance model (TAM)

'*Computer systems cannot improve organisational performance if they aren't used*' (Davis et al. 1989, p. 982).

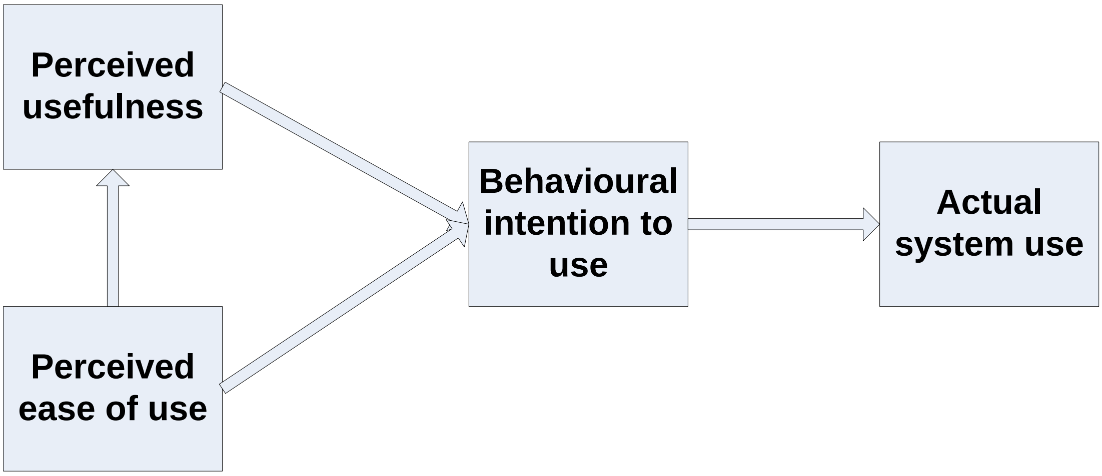
To predict, explain and increase user acceptance of an IT system, the technology acceptance model (TAM) was developed to better understand why people accept or reject computer programs (Davis et al. 1989). TAM has its roots in social science and, more specifically, in behaviour and attitude theory. Two major theories are often considered in attempts to understand the behaviour of individuals, namely, the theory of reasoned action (TRA) (Fishbein & Ajzen 1975) and the theory of planned behaviour (TPB) (Ajzen & Madden 1986). TAM has been derived from TRA and TPB and developed specifically to explain and predict individual acceptance of information technology (Davis et al. 1989). While the TRA is a general theory about human behaviour, TAM is specific to information technology usage.

Basically, 'actual system use' (i.e., technology acceptance) is influenced by a user's 'behavioural intention to use' that itself is affected by two independent constructs, namely, the 'perceived usefulness' and 'perceived ease of use' of a specific technology.

Perceived usefulness is defined as 'the prospective user's subjective probability that using a specific application system will increase his or her job performance within an organisational context' (Davis et al. 1989, p. 985). Perceived ease of use is defined as 'the degree to which the prospective user expects the target system to be free of effort' (Davis et al. 1989, p. 985).

Figure 2.4 provides an overview of the dependencies within the TAM model.

Figure 2.4 - TAM



Adapted from Davis et al. (1989, p. 985)

Since its introduction in 1989, TAM has been widely researched and extensive empirical support has been found for TAM (e.g., Chau & Hu 2002; Hu et al. 1999; Karahanna et al. 1999; Subramanian 1994; Venkatesh & Davis 1996; Verkasalo et al. 2009). To reduce the limitations of TAM, several successor models have been established (Lee et al. 2004). In 2000, Venkatesh and Davis introduced 'TAM2', which 'extends TAM by showing that subjective norms exert a significant direct effect on usage intentions over and above perceived usefulness and perceived ease of use for mandatory (but not voluntary) systems' (Venkatesh & Davis 2000). Moreover, Venkatesh et al. (2003) introduced another extension of TAM called 'Unified Theory of Acceptance and Use of Technology (UTAUT)' (Venkatesh et al. 2003). This model provides three direct determinants of 'behavioural intention' (performance expectancy, effort expectancy and social influence) and two direct determinants of 'usage behaviour' (behavioural intention and facilitating conditions) (Venkatesh et al. 2003, p. 467). UTAUT was found to outperform the other models in measuring technology acceptance, for example, TAM and TAM2 (Venkatesh et al. 2003, p. 467). In 2008, Venkatesh and Bala (2008) introduced 'TAM3', which extends 'TAM2' with six additional factors influencing 'perceived ease of use' (i.e., computer self-efficacy, perceptions of external control, computer anxiety, computer playfulness, perceived enjoyment, objective usability).

Relevance for this research

This research considers the use and acceptance of MCT as necessary preconditions to increase sales-force worker performance with MCT. However, TAM, with its constructs described above, does not provide guidance about whether and how the constructs 'intention to use' and 'actual system use' (i.e., acceptance) influence work performance. Thereby, Davis et al. (1989) propose that 'perceived usefulness' implies performance impacts, but the performance-related construct is outside the model. As TAM does not provide constructs to explicitly measure performance impacts of MCT, it is not considered an appropriate theoretical model for this research. However, two constructs of the TAM (intention to use, perceived usefulness) will be integrated in this study's final research model (cf. section 2.5 for more information on the study's research model).

2.4.2 Diffusion of innovation (DOI) theory

'Without device adoption, there is no mobile commerce' (Sarker & Wells 2003)

While TAM focuses on the acceptance of a specific technology at the individual level, diffusion of innovation (DOI) theory focuses on the adoption at the organisation level. Everett M. Roger's DOI theory—sometimes called innovation diffusion theory (IDT)—is an appropriate framework to examine the adoption of a new technology such as MCT. Rogers (2003, p. 12) defines an innovation as 'an idea, practice or object that is perceived as new by the individual or other unit of adoption'. In addition, he defines DOI as 'the process by which an innovation is communicated through certain channels over time among the members of a social system…the diffusion effect is the cumulatively increasing degree of influence upon an individual to adopt or reject an innovation, resulting from the activation of peer networks about an innovation in a social system' (Rogers 2003).

Types of innovation decisions

Rogers differentiates among three different types of innovation decisions, namely, optional innovation-decisions, collective innovation-decisions and authority innovation-decisions (Rogers 2003).

An optional innovation-decision is where the choice to adopt an innovation is made by the individual on a voluntary basis and a collective innovation-decision is where the choice to adopt an innovation is made on a consensual basis by all members of the social system and then each member is required to adopt the innovation. An authority innovation-decision is where the choice to adopt an innovation is made by a few individuals on behalf of the entire social system and then each member is required to adopt the innovation (Burley et al. 2005; Rogers 2003).

Authority innovation-decisions reflect the reality in most organisations, where management makes the decision to adopt an innovation and then mandates its use towards the employees. This type of innovation decision is also valid for the case organisation examined in this research.

Adoption rates and characteristics of an adoption

According to Rogers, most innovations have an S-shaped rate of adoption (Rogers 2003, p. 12). DOI theory explains why some innovations have rapid rates of adoption while others do not. To explain these different rates of adoption, DOI theory proposes five specific characteristics of an innovation (relative advantage, compatibility, complexity, trialability, and observability) that can positively and negatively affect the adoption rates (Rogers 2003, p. 12). Another important finding by Rogers is that people differ in their innovativeness, the 'degree to which an individual is relatively early in adopting new ideas than other members in a social system' (Rogers 2003, p. 2). Rogers (2003) introduced five adopter categories (innovators, early adopters, early majority, late majority and laggards) whose classification and innovativeness are based on the relative time at which an innovation is adopted.

Relevance for this research

According to Adegbesan and Ricart (2007, p. 27), the term technological innovation refers to the embodiment of new technologies in products/services and/or their production and delivery systems. This usage refers to a firm-level phenomenon with commercial or strategic aims (Adegbesan & Ricart 2007, p. 27). Accordingly to Rogers (1998), innovation can lead to increased organisational performance when introducing changes to a firm's activities (e.g., new or improved products or processes, investments in new machines, marketing expenditures, investment in training, the creation of intellectual property or the purchase of technology).

Thus, DOI theory helps to identify the research setting with regard to the type of innovation decision (i.e., authority innovation decisions in the case organisation) and by the identification of MCT as a technological innovation in this context.

DOI theory can be applied to understand how the adoption of an innovation (e.g., MCT), can be positively influenced at the organisational level. In addition, DOI can help assess the current status of adoption of a specific innovation (e.g., MCT) within an organisation. The type of innovation decision is assumed to affect intention to use and perceived usefulness of an innovation such as MCT.

As with TAM, DOI theory does not provide specific guidance on how to determine work performance of individual employees. As this research assumes that innovativeness and work performance are related constructs, a moderating variable (perceived degree of innovativeness) will be integrated in the study's final research model.

2.4.3 Information system success model

In 1992, DeLone and McLean published a paper in which they aimed to present a comprehensive taxonomy to provide an integrated view on the concept of information system (IS) success (DeLone & McLean 1992). The IS success model or 'D&M IS Success Model' consists of six interdependent and interrelated major categories of IS success. Table 2.9 summarises the definitions for the categories of the IS success model.

Table 2.9 - Categories of IS success

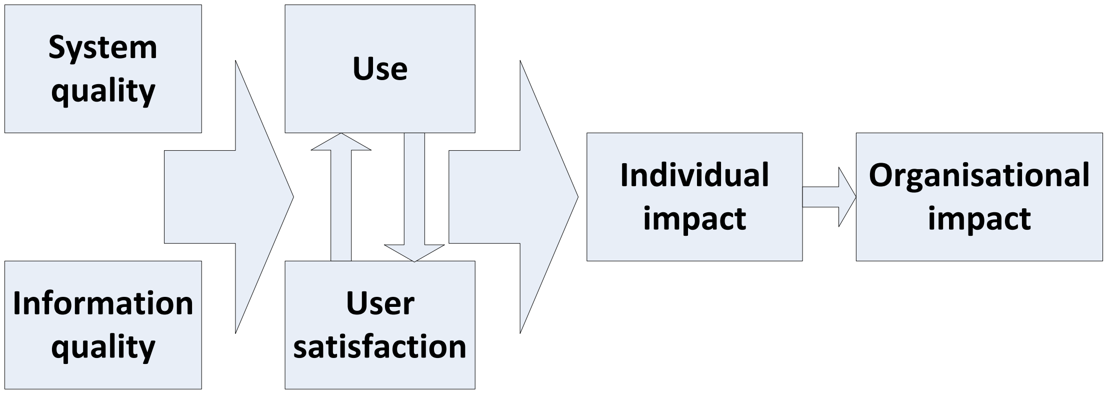
No.	Category	Definition
1	System quality	Desired characteristics of the information system itself that produces the information
2	Information quality	Accuracy, meaningfulness, and timeliness of information provided
3/4	Use & user satisfaction	Interaction of the information product with its recipients
5	Individual impact	Influence of the information product on management decisions
6	Organisational impact	Effect of the information product on organisational performance

Adapted from DeLone and McLean (1992, p. 62)

Basically, 'system quality' and 'information quality' affect 'use' and 'user satisfaction', which then have an impact on individuals and the respective organisation.

Figure 2.5 visualises the abovementioned categories and their dependencies.

Figure 2.5 - IS success model

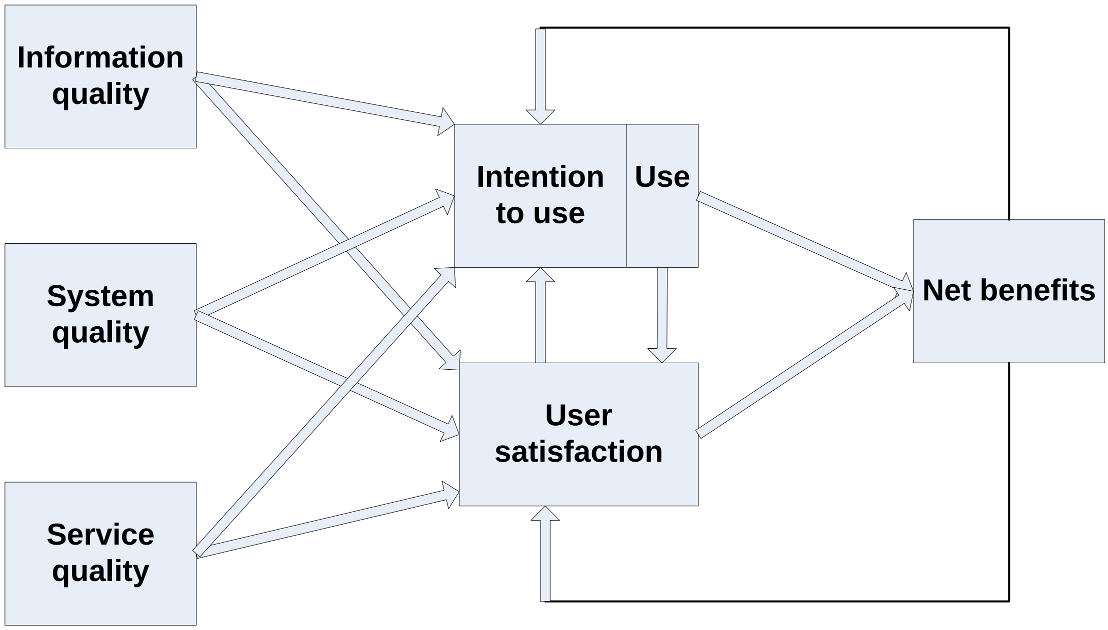


Adapted from DeLone and McLean (1992)

As the original IS success model was based on research conducted in the 1970s and 1980s and did not consider the ‘dramatic changes in IS practice’ and the ‘advent and explosive growth of e-commerce’ (DeLone & McLean 2003, p. 10), Delone and McLean (2003) introduced an updated version of their IS success model (‘Updated D&M IS Success Model’). The original IS success model has been extended by the construct ‘service quality’, and the original constructs ‘individual impact’ and ‘organisation impact’ have been combined into one single variable called ‘net benefits’. According to the updated model, ‘information quality’, ‘system quality’ and ‘service quality’ affect both ‘intention to use’ and ‘user satisfaction’. ‘User satisfaction’ affects ‘intention to use’ and, indirectly, ‘use’. ‘Use’ and ‘user satisfaction’ will result in certain ‘net benefits’ for the system stakeholders. ‘Net benefits’ can be either positive or negative and thereby positively or negatively affect ‘user satisfaction’ and future ‘intention to use’ (DeLone & McLean 2003).

Figure 2.6 displays the relationships within the updated IS success model.

Figure 2.6 - Updated IS success model



Adapted from DeLone and McLean (2003, p. 24)

Relevance for this research

Similar to DOI and TAM, the IS success model is helpful to understand necessary preconditions when introducing a new technology in organisations. The original IS success model tells us that ‘system quality’ and ‘information quality’ affect ‘use’ and ‘user satisfaction’, which then have an impact on individuals and the organisation. Considering organisational impacts is not specific enough in order to directly measure the impact of a technology on individual work performance. The same is true for the updated IS success model, where the constructs 'individual impact' and 'organisational impact' have been transformed into ‘net benefits’ construct. For this research, a model is needed that explicitly contains a construct to directly measure the impact of a technology on individual work performance. However, the ‘intention to use’ construct used in the updated IS success model will be also integrated in this study's final research model (cf. section 2.5 for more information).

2.4.4 Task-technology fit (TTF) model

Task-technology fit (TTF) is a comprehensive theoretical model that explains the linkage between the fit of tasks with an information system and its impact on individual performance (Goodhue & Thompson 1995, p. 213). The model is based on the assertion that 'for an information technology to have a positive impact on individual performance, the technology must be utilised, and the technology must be a good perceived fit with the tasks it supports' (Goodhue & Thompson 1995, p. 213).

To apply the model to a specific technology, one must identify the tasks of a potential user and analyse how this specific technology can effectively support these tasks. Then, the fit between tasks and technology and the consequences of this fit (on utilisation and performance) can be measured (Goodhue & Thompson 1995). Table 2.10 summarises the definitions of the constructs of the TTF model.

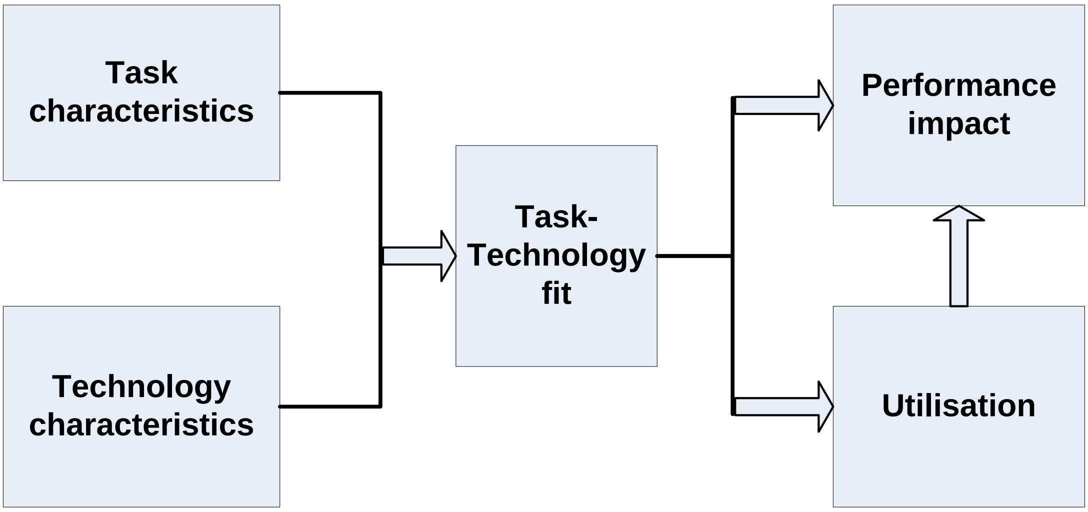
Table 2.10 - Constructs of the TTF model

Constructs	**Definition**
Task characteristics	Tasks are broadly defined as actions carried out by individuals in turning inputs into outputs. Task characteristics of interest include those that might move a user to rely more heavily on certain aspects of information technology.
Technology characteristics	Technologies are viewed as tools used by individuals in carrying out their tasks. In the context of information systems research, technology refers to computer systems (hardware, software, and data) and user support services (training, help lines, etc.) provided to assist users in their tasks.
Task-Technology fit	Task-technology fit is the degree to which a technology assists an individual in performing his or her portfolio of tasks.
Utilisation	Utilisation is the behaviour of employing the technology in completing tasks.
Performance impact	Performance impact relates to the accomplishment of a portfolio of tasks by an individual.

Adapted from Goodhue and Thompson (1995, pp. 216-218)

Figure 2.7 outlines the TTF model and the relationships of its constructs.

Figure 2.7 - TTF model



Adapted from Goodhue & Thompson (1995)

Many research papers have confirmed the model's validity (i.e., Dishaw & Strong 1999; Gebauer & Tang 2008; Lee et al. 2005). Recent research combined and tested TTF and process virtualisation theory (Overby & Konsynski 2010), evaluated TTF in the context of learning management systems (McGill & Klobas 2009) or examined the role of TTF as users' motivation to continue information system use (Larsen et al. 2009).

Relevance for this research

As this research analyses the perceived fit between mobile sales-force worker tasks with MCT and the impact of this perceived fit on sales-force worker performance and intention to use MCT, TTF is considered most appropriate for this research as it provides respective constructs to measure the fit between a specific technology and tasks and whether the level of fit influences individual work performance. Potential research participants rate the perceived performance impact of a technology that is not in place yet and whose use will be mandatory. An adaptation and application of the TTF model to this research context can help to directly answer the main research question. Thereby, it is necessary to analyse the task characteristics of sales-force workers in the German pharmaceutical industry and to examine the technology characteristics of MCT. A good perceived fit between sales-force worker task characteristics and MCT is expected to positively affect pharmaceutical sales-force worker performance.

While DOI theory analyses technology adoption at the organisational level, TAM focuses on technology acceptance at the individual level. Adoption and acceptance per se are not the main focus of this research as these factors are taken for granted in the given research context: the use of MCT as innovation is not voluntary but mandated by the management in the case organisation (cf. authority innovation-decision as discussed above).

All in all, TTF is a well-established and tested model that gives guidance on the factors that influence work performance at the individual level and is thereby the appropriate model to solve the research questions of this study. The constructs perceived usefulness and intention to use will be integrated in this study's research model (cf. sections 2.5 and 3.5 for more information). These constructs are also part of the TAM and IS success models as discussed above.

Table 2.11 summarises all research models discussed so far and their relevance to this research.

Table 2.11 - Summary of research models discussed

Name of theory	Established by	Summary	Relevance for this research
Behaviour & Attitude Theory	Theory of reasoned action (Fishbein & Ajzen 1975), Theory of planned behaviour (Ajzen & Madden 1986)	General theories to understand and predict human behaviour.	Both theories provide the theoretical foundation for TAM.
Technology acceptance model	(Davis et al. 1989)	A model to predict, explain and influence user acceptance of an IT system. TAM focuses on technology acceptance at the individual level.	Technology acceptance is a necessary precondition for technology adoption and use. TAM does not provide guidance on how to measure the impact of technology on individual work performance.
Diffusion of innovation	(Rogers 2003)	A framework to examine the adoption of a new technology in a social system. DOI analyses technology adoption at the organisational level.	Adoption is an important precondition for this research. DOI theory does not provide guidance on how to measure the impact of technology on individual work performance.
Information system success model	(DeLone & McLean 1992, 2003)	The model provides an overview on the antecedents of information system success, i.e., system quality, information quality, use and user satisfaction, individual impact and organisational impact.	If MCT can increase pharmaceutical sales-force worker performance, the project can be considered a success. The model does not provide guidance on how to measure the impact of technology on individual work performance.
Task-technology-fit	(Goodhue & Thompson 1995)	According to TTF theory, information technologies can have a positive impact on individual performance if the technology fits with the tasks it supports.	TTF is the appropriate model for this research as this study is investigating the impact of a technology (MCT) on individual work performance.

Source: Developed for this research

2.4.5 TTF-related research on mobile technologies

An information technology such as MCT can improve an employee’s performance when the technology is utilised and the technology fits with the tasks it supports (Goodhue & Thompson 1995, p. 213). Since the TTF model’s introduction in 1995, its validity has been confirmed in several studies that examined the use of mobile technologies (i.e., Dishaw & Strong 1999; Gebauer & Tang 2008; Lee et al. 2005; Yuan et al. 2010; Zheng 2007). While these studies have focused on different contexts and industries compared to this research, all of these studies came to the conclusion that additional research is necessary as the impact of mobile technology on individual work performance is still an area that is not well understood and needs to be investigated more thoroughly.

Table 2.12 provides an overview of these related studies in the fields of TTF and MCT.

Table 2.12 - Overview of relevant TTF research with a focus on mobile technology

Author(s)	Summary/ Focus	Key findings/ Open issues	Methodology	Type of paper	Relevance for this research
(Ahearne et al. 2008)	Extension of TTF theory by examining the mechanisms through which use of IT by the sales force influences sales-force worker performance. The research model incorporates key marketing constructs (sales-force workers' customer service, attention to personal details, adaptability, knowledge) that could mediate IT's impact on sales-force worker's performance.	Results in a pharmaceutical sales setting show that IT usage can improve customer service and sales-force workers' adaptability, leading to improved sales performance. The researchers suggest the creation of contextual extensions of TTF theory to determine how individuals' use of IT should lead to benefits.	Quantitative	Journal article	Even though not specifically focussing on MCT, the findings of this paper provide a key rationale provide to conduct this research. In addition, this research follows Ahearne's recommendation to extend the TTF model in order to determine how individuals' use of IT should lead to benefits.
(Deibert et al. 2008)	Developed a conceptual model to explain how mobile technologies impact business processes in the construction industry on the operational level.	The results show that the positive effect of the use of mobile technology depends on the task complexity and on the used technology; for a low task complexity, no positive impact of MCT usage on a construction site can be seen.	Quantitative	Conference paper	Research is focused on the operational/worker level and identified gaps in research on this level.
(Gebauer et al. 2010)	Developed conceptual model to establish fit between managerial tasks, mobile IT and the mobile use context (by assuming that a good perceived fit positively affects task performance).	Situations characterized by high distraction and poor network connection are particularly challenging for the design of mobile IS, the user interface need specific attention.	Qualitative	Journal paper	This study follows the suggestions by the authors to conduct an empirical study among mobile users with a joint organisation setting.

Author(s)	Summary/ Focus	Key findings/ Open issues	Methodology	Type of paper	Relevance for this research
(Lee et al. 2005)	Analysed mobile commerce performance by using the TTF model.	Future studies need to examine the organisational factors that influence mobile commerce implementation.	Quantitative	Book chapter	Several measurement items used in Lee et al. (2005) are also used in this research.
(Liang & Wei 2004)	Proposed a fit-viability framework for assessing the likely success or failure of m-commerce applications.	For a mobile application to be successful, the authors suggest to evaluate not only the fit between task and technology but also its organisational viability. In order to accomplish this, an appropriate framework is presented.	Qualitative	Journal article	Certain types of mobile commerce applications (e.g., mobile office) suggest by the author s will also be investigated in this dissertation.
(Vuolle & Käpylä 2010)	Review of what theoretical models for technology evaluation are used in a mobile work context.	More research is needed to study the effects of mobile business services from the customer company's perspective and the interrelationships between different kinds of business effects of mobile business services.	Qualitative	Conference paper	Paper provides an overview on recent research on theoretical models dealing with mobile technologies.
(Yan & Lihua 2008)	The authors present an adapted TTF research model based on the features of mobile technologies and the actual usage of mobile applications in business environments, which identifies the characteristics of mobile applications and fitting tasks.	Gained a better understanding of how a specific company could use mobile applications in their sales processes.	Qualitative	Journal paper	The research provides guidance on how sales-relevant tasks can be supported by MCT what can reused in our context.

Author(s)	Summary/ Focus	Key findings/ Open issues	Methodology	Type of paper	Relevance for this research
(Yuan et al. 2010)	Based on TTF theory, the authors propose a research model for the fit between task characteristics and four mobile work support functions (location tracking, navigation, notification and online job dispatching).	The research provides evidence that perceived usefulness of mobile notification and real-time mobile job dispatching are positively related to mobility, location tracking and navigation, which are perceived to be useful in situations of location dependency. Mobile notification and location tracking are perceived to be more useful in time-critical situations.	Quantitative	Journal paper	The mobile work support functions and research methodology proposed are similar to the given research context. Research results of this dissertation can be compared against this study.
(Zheng 2007)	Examined the need for mobile work support and appropriate mobile technologies for various kinds of mobile work.	Created a mobile task model that is derived from the original TTF model.	Quantitative	Dissertation	The mobile work support functions proposed in Zheng's dissertation provide the basis for the adapted TTF framework used in this research. In addition, the way to measure the fit (i.e., perceived usefulness) is also derived from this paper.
(Zhang et al. 2011)	Aimed at identifying the characteristics of emerging mobile technologies and applications as well as the typical attributes of tasks in modern mobile business environments, and further exploring the corresponding fit between task attributes and technology characteristics.	The authors postulate a conceptual model (based on TTF) which reflects the pair-wise links between five types of task attributes and five dimensions of mobile technology characteristics.	Qualitative	Conference paper	Even though this paper was published after the data collection of this research was conducted, it does confirm the research approach taken in this study.

Source: Developed for this research

2.5 Theoretical framework, research issues and hypotheses

The previous sections presented literature relevant for this research; this subsection covers this research's theoretical model, relevant research issues and hypotheses.

2.5.1 Research model

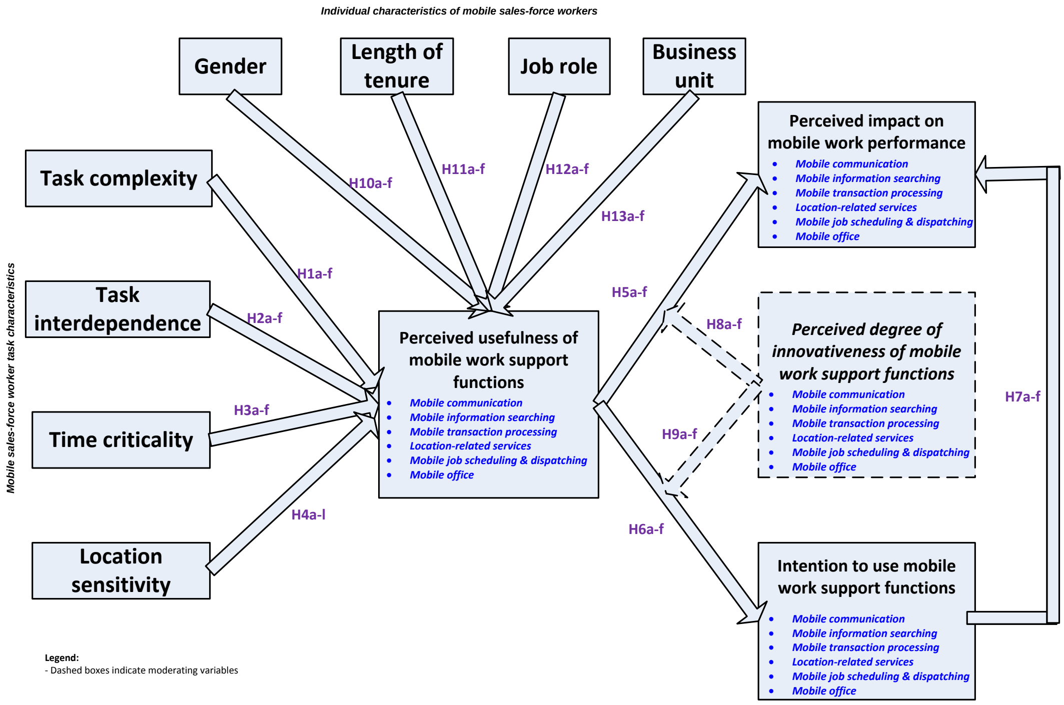
Based on an extensive review of the recent and relevant literature, a number of gaps are identified which this research aims to investigate:

1) how and to what extent are specific mobile work support functions enabled by MCT perceived to be useful in supporting mobile sales-force worker tasks;
2) the extent to which perceived usefulness is influenced by individual sales-force worker characteristics;
3) the extent to which perceived usefulness and intention to use mobile work support functions influence sales-force worker performance; and
4) whether the perceived degree of innovativeness of mobile work support functions moderates the relationship between perceived usefulness and intention to use; and the relationship between perceived usefulness and perceived impact on mobile work performance of mobile work support functions.

In order to achieve these objectives and to answer the research questions stated in section 1.2, the original TTF model has been adapted to this specific research context.

Figure 2.8 illustrates this study's proposed research model.

Figure 2.8 - Research model



Source: Developed for this research

In the following paragraphs, each variable in the research model is discussed in more detail.

Mobile sales-force worker task characteristics

For this research, a mobile worker's task characteristics are assessed by four dimensions, namely, task complexity, task interdependence, time criticality and location sensitivity. Zheng (2007, p. 58) defined these variables as follows:

- Task complexity considers the degree of non-routinisation and non-repetitiveness of a task being performed.
- Task interdependence covers the extent to which workers depend upon each other to accomplish their tasks.
- Time criticality is the degree of how time is critical to the performing of a task.
- Location sensitivity deals with the extent to which the performing of a task is dependent on location-related information.

This research acknowledges Zheng’s research and considers the above-listed dimensions for ‘mobile sales-force worker task characteristics’ appropriate for this dissertation to analyse the task characteristics of pharmaceutical sales-force workers.

Mobile work support functions

In the original TTF model, the second antecedent of ‘task-technology fit’ has been labelled as ‘technology characteristics’, as it represents the specific characteristics of the technology examined. For the mobile technology characteristics, this study focused on the six 'mobile work support functions' established by Zheng (mobile communication, mobile information searching, mobile transaction processing, location-related service, mobile job dispatching and mobile office) which are considered context variables in this study. Pilot interviews conducted in the first research phase of this study revealed that, for example, the differentiation between ‘batch mode’ and ‘real time’ mobile job scheduling and dispatching is hard for potential interviewees to understand. This led to the decision to reduce the complexity of the survey to increase the overall response rate.

Table 2.13 summarises all mobile work support functions and respective examples that are derived from the current literature (cf. section 2.3.4) and discussions with the case organisation's sales management that were considered potentially useful for pharmaceutical sales-force workers.

Table 2.13 - Mobile work support functions & Sub-functionalities

Mobile work support function	Sub-functionalities
Mobile communication	• Reading/writing emails • Opening email attachments • Unified messaging • Reading/writing SMS • Instant messaging/chat • Video telephony • Participating in web conferences/web casts
Mobile information searching	• Online access to intranet • Online access to corporate databases • Online access to CRM system • Online access to ERP • M-learning • Internet search • Accessing e-books with medical/ product information • Accessing video and audio content (IPTV broadcast, online videos, podcasts, etc.)
Mobile transaction processing	• Entering data in online systems instead of making paper-based notes (and thereby reducing paper-based work, double entry of data, etc.) • Supporting specific business processes on the spot, e.g., order placement at the customer
Location-related services	• Receiving information about the location of colleagues or customers • Receiving information from a navigation system regarding the current position and the distance to a specific location • Receiving additional information about the current location, such as hotels, gas stations, restaurants, etc. that are within reach
Mobile job scheduling & dispatching	• Receiving sales call appointments arranged by a centrally coordinated unit • Assigning new work tasks to colleagues automatically • Receiving new work tasks from colleagues headquarters automatically
Mobile office	• Outlook: Accessing online calendar, arranging appointments • Excel: Using calculating software • PowerPoint: Reading, editing and creating presentations • Holding presentations in front of the customer • Accessing and editing online task lists • Using mobile device as dictation machine • Accessing and manipulating documents that are stored online

Source: Developed from Zheng (2007) and from discussions with the case organisation's sales management

Individual characteristics of mobile sales-force workers

This research assumes that a research participant's individual characteristics can influence perceived usefulness of mobile work support functions. To examine this effect, the research model was extended with a grouping variable 'individual characteristics of mobile sales-force workers' which consists of four sub variables (gender, job role, type of business unit and length of tenure). Previous research suggests that individual characteristics might affect perceived usefulness of mobile applications (Yuan et al. 2010, p. 132).

With regard to a mobile worker's job role, differences in the perceptions of the effect of a technology on work performance among different roles of mobile workers have been identified (Deibert et al. 2008; Gebauer et al. 2010; Yuan et al. 2010; Zheng 2007). This research differentiated between two roles of pharmaceutical sales-force workers, namely, supervisors and operational sales-force workers. In addition, differences in the ratings of employees from different business units will be investigated.

Moreover, employees with a higher level of tenure are expected to be more likely to resist new technologies than employees who are new to an organisation. This study assumes that the latter employees are generally more open to new technologies than people that are in an organisation for a long time. This notion is also supported by the current literature (e.g., Meyer 2007; Morris & Venkatesh 2000).

This research also investigates whether there are differences in the perception of the usefulness of mobile work support functions across gender. For example, are women more likely to resist using mobile work support functions than men? Research has shown that MCT may especially have a negative impact on marriages and family satisfaction (Chesley 2005; Gefen & Straub 1997). Women especially considered MCT usage as increasing a negative family-work imbalance.

Zheng's (2007) research did not investigate the impact of individual characteristics on perceived usefulness of mobile work support functions. Extending the original TTF model with this variable is considered to be one major theoretical contribution of this research.

Perceived usefulness of mobile work support functions

According to Staples and Seddon (2004), there are two approaches to assess 'task-technology fit', namely:

- ‘Facets-of-fit’ (identify important facets of the task requirements and assess whether the proposed tool—in the hands of the user—meets each of these facet-of-task requirements)
- ‘Predicted outcomes’ (would a specific toolset, in the hand of the user, lead to a desired outcome?)

For this research project, the ‘predicted outcomes’ approach is considered to be appropriate as this study aims to measure the perceived impact of a specific technology (i.e., MCT) on work performance that is not in place yet. Several other researchers (e.g., Garrity & Sanders 1998; Lee et al. 2005; Zheng 2007) have already used this approach.

In order to measure the ‘task-technology fit’ construct from the original TTF model, different approaches exist. Initially, Goodhue and Thompson (1995) proposed eight constructs to measure the task-technology fit in the original TTF model. Lee et al. (2005) use four constructs of TAM (i.e., perceived usefulness, ease of use, perceived benefit and user satisfaction) to measure the fit between tasks and mobile computing technologies. Zheng (2007, pp. 48-51) solely uses the construct of perceived usefulness to measure the fit between tasks and MCT, and argues that ‘task-technology fit and perceived usefulness are the same constructs’—an approach supported by other researchers (i.e., Dishaw & Strong 1999; Staples & Seddon 2004). This research will adopt Zheng’s approach (2007) to measure 'task-technology fit' by determining the perceived usefulness of each of the mobile work support functions investigated in this research.

Perceived degree of innovativeness of mobile work support functions

This research is based on the assertion that MCT usage alone neither implies that it is being used in an innovative way nor implies performance impacts. In addition, some functionalities of MCT have been adopted widely across organisations and society in general and have thereby become a ‘commodity’ (e.g., using a mobile phone for oral communication or for writing an SMS). This research assumes that the 'perceived degree of innovativeness of mobile work support functions’ has a moderating effect on both the relationship between perceived usefulness and intention to use and the relationship between perceived usefulness and perceived impact on mobile work performance. The current literature supports the notion of the positive correlation between innovation and work performance (Adegbesan & Ricart 2007; Rogers 1998). Zheng's (2007) research did not include a moderating variable covering the perceived degree of innovativeness of mobile work support functions. Extending the original TTF model with this variable is considered a major theoretical contribution of this research.

Intention to use mobile work support functions

The dependent variable 'intention to use' from the original TTF model has been renamed to 'intention to use mobile work support functions'. As with 'perceived usefulness of mobile work support functions' and 'perceived impact on mobile work performance', intention to use is measured for a technology that is not in place yet and whose use will be mandatory. Derived from Goodhue and Thomson's (1995) original TTF model, this study assumes that the 'intention to use mobile work support functions' affects a mobile worker's 'perceived impact on mobile work performance'. Support for this relationship between intention to use MCT and perceived impact on mobile work performance can be found in the current literature (i.e., Dishaw & Strong 1999; Gebauer & Tang 2008; Lee et al. 2005; Zheng 2007).

Perceived impact on mobile work performance

The variable 'performance impact' adapted from the original TTF model has been reworded to 'perceived impact on mobile work performance'. Again, the research participants will be asked to rate the perceived impact on mobile work performance of a technology that is not in place yet and whose use will be mandatory. This variable is affected by both intention to use and perceived usefulness of mobile work support functions. In addition, this research assumes that the perceived degree of innovativeness of mobile work support functions will moderate the impact of perceived usefulness on the perceived impact on mobile work performance. Furthermore, the perceived impact on mobile work performance is measured on the individual worker level, not on the organisational level. Zheng's (2007) research is extended in this study, which explicitly measures the perceived impact on mobile work performance.

Details on the measurement of each of the abovementioned variables can be found in section 3.5 of this dissertation.

2.5.2 Research hypotheses

After having reviewed relevant studies and theoretical models (Davis et al. 1989; DeLone & McLean 1992, 2003; Goodhue & Thompson 1995) and based on the research model developed for this study, research hypotheses are formulated in the following subsections (Kerlinger & Lee 2000; Leedy & Ormrod 2005). The research model of this study is based on the assertion that a perceived high level of usefulness of mobile work support functions will positively influence intention to use mobile work support functions and the perceived impact on the work performance of mobile sales-force workers. This study also establishes whether the individual characteristics of mobile sales force workers influence the perceived usefulness of mobile work support functions. In addition, this research also examines whether the perceived degree of innovativeness of mobile work support functions will have a moderating effect on the relationship between perceived usefulness and intention to use; and the relationship between perceived usefulness and perceived impact on mobile work performance of mobile work support functions.

The hypotheses aim to test the relationships within the adapted model and to provide the empirical basis for the quantitative research questions stated above. In the following discussion, the research hypotheses are introduced and the literature support for the proposed hypothesised relationships is provided. Whenever 'mobile work support functions' is mentioned within a hypothesis, this study refers to the previously mentioned six mobile work support functions, namely, mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching and mobile office (Zheng 2007).

2.5.2.1 Influence of task characteristic-related research constructs on perceived usefulness of mobile work support functions

This subsection provides a discussion of the relevant literature which supports the proposed hypotheses measuring the impact of all task characteristic-related research constructs. As opposed to other research conducted in this area (i.e., Yuan et al. 2010; Zheng 2007), all possible combinations of task characteristic-related research constructs and perceived usefulness of mobile work support functions are investigated. The rationale for this is the rare opportunity to conduct a large-scale survey within one specific organisation and a homogeneous group of sales-force workers often not available to researchers.

Task complexity

Task complexity considers the degree of non-routinisation and non-repetitiveness of a task being performed (Zheng 2007). To accomplish unstructured, non-routine tasks, a large amount of information is necessary (Gebauer et al. 2010). This research assumes that the increased need for information can be solved with mobile work support functions. However, mobile work support functions might not be considered for low complexity tasks (Gebauer et al. 2010). Therefore, this study proposes to test the following hypotheses:

H1a-f: Task complexity has a positive impact on perceived usefulness of mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office).

Task interdependence

Task interdependence covers the extent to which workers depend upon each other to accomplish their tasks (Zheng 2007). Even though pharmaceutical sales-force workers work autonomously in their mobile work setting, coordination among them might be necessary in case of unexpected events (such as an urgent visit of a VIP customer). As coordination efforts increase with the level of task interdependence and as the amount of coordination is positively related to task interdependence

(Smolen 2006; Tushman 1978, 1979), this study proposes to test the following hypotheses:

H2a-f: Task interdependence has a positive impact on perceived usefulness of mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office).

Time criticality

Time criticality is the degree of how time is critical to the performing a specific task (Zheng 2007). This research assumes that pharmaceutical sales-force workers have to accomplish time-critical tasks in their mobile work setting. Information via email or SMS provided by colleagues and support staff can help a sales-force worker provide better information to the customer. Information about their current location and their work schedule is meant to help them decide what task to accomplish next. Current research supports these assumptions (i.e., Yuan et al. 2010; Zheng 2007). Therefore, this study proposes to test the following hypotheses:

H3a-f: Time criticality has a positive impact on perceived usefulness of mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office).

Location sensitivity

Location sensitivity deals with the extent to which performing a task is dependent on location-related information (Zheng 2007). For pharmaceutical sales-force workers, the information about their current location, information about other colleagues in reach and supporting information from navigation systems is supposed to add value to their daily work (Junglas et al. 2008; Liang & Wei 2004; Schierholz et al. 2007). In this study, location sensitivity is measured by the sub constructs 'location dependence' and 'location variance'. Therefore, this study proposes to test the following hypotheses:

H4a-f: Location variance has a positive impact on perceived usefulness of mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office).

H4g-l: Location dependence has a positive impact on perceived usefulness of mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office).

2.5.2.2 Influence of perceived usefulness of mobile work support functions on perceived impact on mobile work performance

According to the original TTF model, TTF positively affects work performance (Goodhue & Thompson 1995). Many research papers have confirmed this relationship (i.e., Dishaw & Strong 1999; Gebauer & Tang 2008; Lee et al. 2005; Zheng 2007). Based on this argument, this study proposes to test the following hypotheses:

H5a-f: Perceived usefulness of mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office) has a positive impact on perceived mobile work performance.

2.5.2.3 Influence of perceived usefulness on intention to use mobile work support functions

According to TAM, perceived usefulness of a specific technology positively affects the intention to use it (Davis et al. 1989). Strong support for this relationship can be found in the current literature (e.g., Chau & Hu 2002; Hu et al. 1999; Karahanna et al. 1999; Subramanian 1994; Venkatesh & Davis 1996; Venkatesh et al. 2002; Verkasalo et al. 2009). Therefore, this study assumes that the perceived usefulness of each mobile work support function positively affects the intention to use it and this study proposes to test the following set of hypotheses:

H6a-f: Perceived usefulness of mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office) has a positive impact on intention to use.

2.5.2.4 Influence of intention to use mobile work support functions on perceived mobile work performance

Another major relationship in the original TTF model is the impact of the intention to use a specific technology on work performance (Goodhue & Thompson 1995). Again, strong empirical support can be found for this relationship (i.e., Dishaw & Strong 1999; Gebauer & Tang 2008; Lee et al. 2005). Therefore, one can conclude that the intention to use mobile work support functions has a positive impact on the perceived mobile work performance. This leads to the following hypotheses:

H7a-f: Intention to use mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office) has a positive impact on perceived mobile work performance.

2.5.2.5 Moderating effect of perceived degree of innovativeness

In this research, the moderating effect of the perceived degree of innovativeness will be investigated. Support could be found for technologies that can be used in an innovative way and thereby have the potential to improve work performance (Adegbesan & Ricart 2007; Rogers 1998). Therefore, this study assumes that the relationship between the perceived usefulness of mobile work support functions and perceived mobile work performance is moderated by the degree of innovativeness of mobile work support functions. Therefore, this study proposes to test the following hypotheses:

H8a-f: The relationship between the perceived usefulness of mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office) and perceived mobile work performance is moderated by the perceived degree of innovativeness of mobile work support functions.

Innovative technologies make people curious to use them; 'early adopters' especially like to test and try new technologies (Rogers 2003). As mentioned above, MCT and the respective mobile work support functions are considered to be innovative in this research. Thereby, this study concludes that the relationship between the perceived usefulness and intention to use mobile work support functions is moderated by the degree of innovativeness of mobile work support functions. In order to validate this relationship, this study proposes to test the following set of hypotheses:

H9a-f: The relationship between the perceived usefulness of mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office) and intention to use mobile work support functions is moderated by the perceived degree of innovativeness of mobile work support functions.

2.5.2.6 Influence of individual characteristics on perceived usefulness of mobile work support functions

Gender

Gefen and Straub (1997) conducted a research on gender differences in the perception and use of email. Therein, they state that there is a lack of gender-based research on TAM and other IT diffusion research, and their study findings indicate that gender does have an impact on the IT diffusion process (Gefen & Straub 1997). Chesley (2005) conducted research to assess whether increases in spill-over explain changes in distress and family satisfaction associated with technology use. She found that cell phone use over time is associated with increases in negative family-work spill-over for women, but not for men. She explains this finding by stating that family worries and responsibilities are more likely to influence the outcomes for women. Thereby, this research assumes that there are gender differences in perceived usefulness of mobile work support functions and proposes to test the following set of hypotheses:

H10a-f: There are differences in perceived usefulness of mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office) across gender.

Length of tenure

Due to increased life expectancy and a simultaneous decrease in birth rates, the age structure of Germany's working population is changing. This study assumes that the research's case organisation is also affected by this trend. As older employees seem be to less qualified and less likely to use new technologies, the age structure of the workforce may have an impact on the efficiency of the adoption of new or significantly improved technologies and software (Meyer 2007). According to Meyer (2007), older workers with a higher length of job tenure may be more traditional and therefore less inclined to innovate or change their working routine at all. She concludes that age structure of the workforce is negatively related to the probability of adopting new or significantly improved technologies and software (Meyer 2007). Moreover, companies with a higher proportion of younger employees are more likely to adopt new technologies. The above findings are in line with research conducted by Morris and Venkatesh (2000). They state that age does have an important influence on technology adoption and usage decision. Furthermore, they argue that older workers have more problems adapting to changes in the operating process, especially when they have a greater length of tenure (Morris & Venkatesh 2000). This study thereby assumes that there are differences in perceived usefulness of mobile work support functions across length of tenure and proposes to test the following set of hypotheses:

H11a-f: There are differences in perceived usefulness of mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office) across length of tenure.

Job role and type of business unit

In the case organisation, different groups of sales-force workers with different needs for mobile work support exist. Supervisors have to accomplish more managerial tasks in the mobile work setting, while operational sales-force workers primarily focus on reaching their sales-call quota. Sales-force workers from different business units visit different kinds of customers and promote different products. Recent studies (e.g., Deibert et al. 2008; Gebauer et al. 2010) support the notion that perceived usefulness of mobile application can differ among different groups of workers. A prominent example is mentioned by Scornavacca and Sutherland (2008), who state that sale-force workers and management share different perceptions regarding the extent to which mSFA could improve individual performance. With regard to differences in technology perceptions, Jurison (2002) identified a substantial variance across user groups (e.g., business units in this research setting). Thus, this study assumes that there are differences in perceived usefulness of mobile work support functions across job roles of mobile sales-force workers and across business units, and proposes to test the following set of hypotheses:

H12a-f: There are differences in perceived usefulness of mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office) across job roles.

H13a-f: There are differences in perceived usefulness of mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office) across business units.

2.6 Chapter summary

This chapter reviewed research-relevant literature, and outlined the research framework, research issues and hypotheses of this study.

The analysis of existing literature on sales-force work, sales technology and the potential impact of sales technology on sales-force worker performance revealed there are gaps in the current literature regarding the impact of sales technology on sales-force worker performance.

In addition, the term 'mobile computing technologies' (MCT) was introduced and defined; and MCTs characteristics, benefits and limitations were investigated. This dissertation defines MCT as computing hardware and system that can easily be moved and used while on the move, has wireless access to the Internet and an organisation’s intranet, is based on most current hardware, uses wireless broadband bandwidth (at least 3G) and provides the technical basis for mobile business. Ubiquity, context-sensitivity, identifying functions and command and control functions are considered to be the key characteristics of MCT. For the individual worker, several benefits of MCT could be identified, namely, the effective use of dead times or waiting times, improved preparation for unexpected events, improved communication, collaboration and information-gathering capabilities and work process optimisations. Higher transparency, higher flexibility, increased customer service, increased employee satisfaction, new business models/sources of revenue and increased organisational effectiveness through business process optimisation and reengineering are considered to be benefits on the organisational level. In addition, this research identified the following (primarily technical) limitations of MCT: device-specific limitations, issues related to a restricted bandwidth and network capability, usability issues and security concerns.

The research model of this study is based on the assertion that a perceived high level of usefulness of mobile work support functions will positively influence intention to use mobile work support functions and the perceived impact on the work performance of mobile sales-force workers. This study also establishes whether the individual characteristics of mobile sales force workers influence the perceived usefulness of mobile work support functions. In addition, this research also examines whether the perceived degree of innovativeness of mobile work support functions will have a moderating effect on the relationship between perceived usefulness and intention to use; and the relationship between perceived usefulness and perceived impact on mobile work performance of mobile work support functions. Appendices 1 and 2 provide an overview of all research questions and hypotheses investigated in this study.

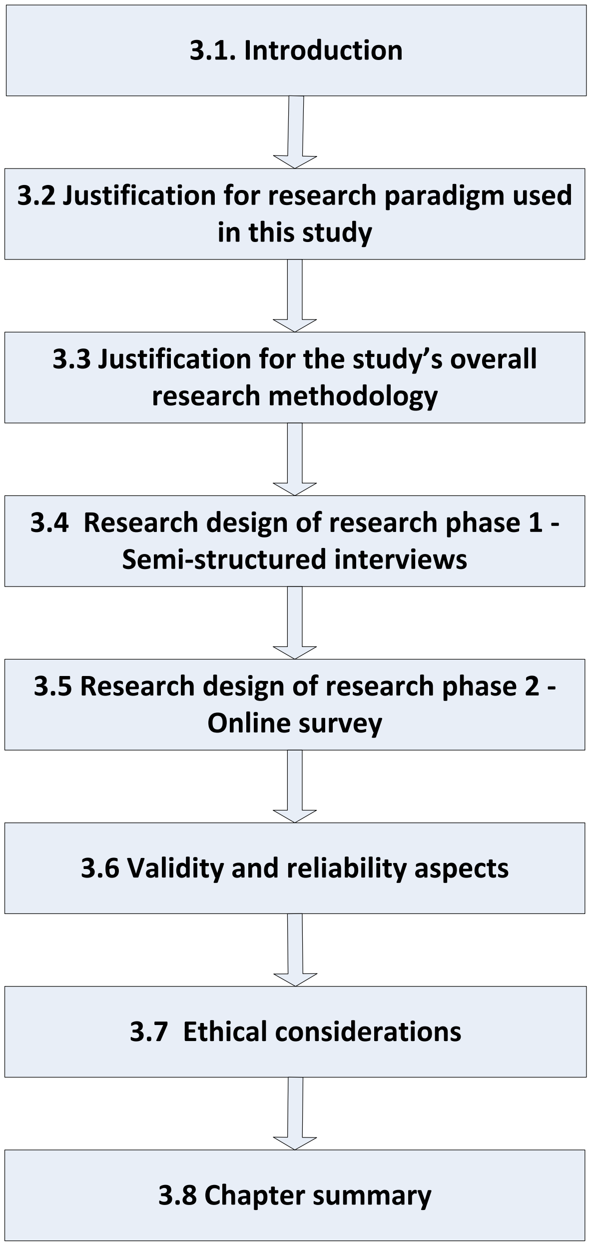
The next chapter discusses the study's research methodology and the research designs applied in both research phases of this two-stage study.

3 Research methodology

3.1 Introduction

The purpose of this chapter is to discuss and justify the overall research methodology adopted for this study and the specific research designs of both research phases of this two-stage study. Figure 3.1 outlines the structure of this chapter.

Figure 3.1 - Structure of research methodology chapter



Source: Developed for this research

First, an appropriate research paradigm for this whole study is established. Second, the study's overall research methodology is described and justified in detail. Third, the specific research designs of both research phases of this two-stage study, including data collection procedures and data analysis strategies, are presented and discussed in two separate sections. Fourth, section 3.6 describes how the validity and reliability of both research phases were addressed. The final section describes how this study was conducted within USQ's ethical guidelines for research.

3.2 Justification for research paradigm used in this study

According to Guba and Lincoln (1998, p. 195), a research paradigm is defined as 'the basic belief system or worldview that guides the investigator, not only in choices of method but in ontologically and epistemologically fundamental ways'. Thereby, the authors differentiate among four different types of research paradigms. The major assumptions behind these four paradigms are summarised as follows:

1. 'Positivism'
    - Driven by immutable natural laws and mechanisms, an apprehendable reality is assumed to exist (Guba & Lincoln 1998, p. 110).
2. 'Critical realism' (also known as 'post-positivism')
    - Reality is assumed to exist, but is only imperfectly understandable due to the 'flawed human intellectual mechanisms and the fundamentally intractable nature of phenomena' (Guba & Lincoln 1998, p. 110).
3. 'Critical theory' and related ideological positions
    - A reality that is considered to be apprehendable, that was once plastic, but that was shaped by several factors (e.g., social, political, cultural) over time into a series of structures that are now taken as 'real' (Guba & Lincoln 1998, p. 110).

4. ‘Constructivism’
    - In constructivism, realities are apprehendable ‘in the form of multiple, intangible mental constructions, socially and experientially based, local and specific in nature…and dependent for their form and content on the individual person or groups holding the constructions’ (Guba & Lincoln 1998, p. 110).

By analysing ontological, epistemological and methodological aspects, Guba and Lincoln (1994) propose three questions to identify an appropriate research paradigm. Table 3.1 lists these questions, and summarises the respective answers to these questions in relation to this study and provides the justification for critical realism as an appropriate research paradigm.

Table 3.1 - Analysis of this study’s research paradigm

	Question	**Response**
Ontology	What is the form and nature of reality and what is there that can be known about it?	This study is based on the assumption that a complex reality exists that is observable with the limited capabilities of the human mind.
Epistemology	What is the nature of the relationship between the knower and the inquirer, or what can be known?	In this study, there is a direct relationship between the researcher and the research participants. During the interviewing process in the first research phase, a personal contact is established between them.
Methodology	How can the inquirer go about finding out whatever he or she believes can be known?	The two-phased research approach strengthens the research’s validity and thereby increases the research’s generalisability and contributes to the existing body of knowledge in the specific research domain.

Adapted from Guba and Lincoln (1998)

In this study, it is assumed that a complex reality exists that is observable with the limited capabilities of the human mind, that there is a direct relationship between the researcher and the research participants and that the two-phased research approach increases the external validity of this research. Thereby, ‘critical realism’ (post-positivism) is considered to be an appropriate research paradigm for this study. This conclusion is supported by McPhail and Perry (2002), who describe 'critical realism' as a suitable research paradigm for marketing and management research.

3.3 Justification for the study’s overall research methodology

The purpose of this research is to investigate

1) how and to what extent are specific mobile work support functions enabled by MCT perceived to be useful in supporting mobile sales-force worker tasks;
2) the extent to which perceived usefulness is influenced by individual sales-force worker characteristics;
3) the extent to which perceived usefulness and intention to use mobile work support functions influence sales-force worker performance; and
4) whether the perceived degree of innovativeness of mobile work support functions moderates the relationship between perceived usefulness and intention to use; and the relationship between perceived usefulness and perceived impact on mobile work performance of mobile work support functions.

To achieve this purpose, an appropriate research methodology has been chosen, which is justified in the following.

Research methodology vs. research design

While the research methodology is the ‘general approach a researcher takes in carrying out the research project’ (Leedy & Ormrod 2005, p. 12), the research design is the ‘general strategy for solving a research problem’ (Leedy & Ormrod 2005, p. 85). Thus, this study considers research design as a subset of the research methodology. The study’s research methodology is discussed in this section. In general, the study's research design is ex post facto as the variables involved are not manipulated by the researcher as in experimental research. The research design of each phase of this two-stage research is discussed fully: firstly, section 3.4 describes the design of research phase 1 and, secondly, section 4.2 outlines the design of research phase 2.

Two-phased research approach

This study used a two-phased and methodological approach in an in-depth case study of the German division of a large pharmaceutical company. The first research phase collected primarily qualitative data using semi-structured interviews to determine to what extent specific mobile work support functions were perceived to be useful and innovative in supporting mobile sales-force worker tasks. The first research phase informed the second research phase by providing support for the conceptual model proposed for this study and assisted in the refinement of the online survey instrument in the context of the case study organisation by developing real-life usage scenarios for each mobile work support function investigated.

The second research phase collected quantitative data to validate and test the conceptual model. Thereby, the second research phase determined to what extent mobile work support functions are perceived to be useful in supporting mobile sales-force worker tasks and to what extent does such perceived usefulness and individual characteristics of sales-force workers influence sales-force worker performance and intention to use mobile work support functions. In addition, the moderating effect of the perceived degree of innovativeness on both the relationship between perceived usefulness and intention to use and the relationship between perceived usefulness and perceived impact on mobile work performance will be investigated. Both research phases were interrelated, and several aspects were investigated in both research phases from different perspectives.

Justification for mixed research methodology approach

To answer the research questions identified in section 1.2, neither a qualitative nor a quantitative approach alone is appropriate to achieve this objective. Mixing qualitative and quantitative research methodologies is useful in IS research and the mix 'can yield to a superior piece of research' as the strengths of both methodologies should complement each other (Gable 1994, p. 11).

Table 3.2 summarises a comparison of the relative strengths of the semi-structured interview and survey methods.

Table 3.2 - Summary of the relative strengths of the semi-structured interview and survey methods

	Semi-structured interview	**Survey method**
Controllability	Low	Medium
Deductibility	Low	Medium
Repeatability	Low	Medium
Generalisability	Low	High
Discoverability (Explorability)	High	Medium
Representability	High	Medium

Adapted from Gable (1994, p. 3)

While a quantitative research setting (e.g., an online survey) can compensate for the weaknesses of interview-based research regarding aspects of controllability, deductibility, repeatability and generalisability, semi-structured interviews outperform survey research in terms of discoverability and representability (Gable 1994, p. 3). Thus, it can be concluded that a mixed research methodology combines the relative strengths of semi-structured interviews and online surveys and is thereby considered to be an appropriate approach to achieve the objectives of this study.

Justification for single-case design

For this study, case study research design was considered appropriate, as three conditions proposed by Yin (2003, p. 7) are fulfilled. First, the nature of this study is descriptive and appropriate research questions were stated. Second, the researcher had little control over the influence of the study's dependent and independent variables. Third, the analysis of the perceived usefulness of mobile work support functions and its impact on sales-force worker performance was considered a contemporary event. As the researcher was employed at the case organisation at the time of the research, the investigation of a cross-section of sales-force workers from different (and potentially competing) pharmaceutical companies was considered unrealistic. The researcher would not have gained access to the relevant people, information and data to conduct such a research as he would have been working for a competitor company. For this research, a single case study approach was considered appropriate since two rationales for a single-case design were fulfilled (Yin 2003, pp. 39-42). First, this study represents a ‘critical case’ since it is conducting a critical test of an existing theory (i.e., TTF theory) that tries to challenge and extend this theory (Yin 2003, p. 40) in a real-life organisation. Second, the setting in the case organisation can be considered ‘representative’, as the research results are considered informative and generalisable for other pharmaceutical companies (Yin 2003, p. 41).

3.4 Research design of research phase 1—Semi-structured interviews

The purpose of the first research phase was to collect primarily qualitative data using semi-structured interviews to determine how and why specific mobile work support functions were perceived to be useful and innovative or not in supporting pharmaceutical sales-force worker tasks. To achieve this objective, a qualitative research methodology was considered to be appropriate for the first phase of data collection (Yin 2003). Thereby, Ghauri and Gronhaug (2005) point out that qualitative research is ‘to understand, gain insights and create explanations (theory)…research sampling issues are also important such as who and how many should be included’.

As a source of evidence for the case study research, a series of semi-structured interviews was conducted with the aim of adapting the research’s conceptual model (i.e., TTF theory) to the context of use of MCT by sales-force workers in the pharmaceutical industry. Semi-structured interviews were considered appropriate for this study as the 'interviewer has a series of questions that are in the general form of an interview schedule but is able to vary the sequence of questions' (Bryman 2004).

Based on the data analysis results of the first research phase, real-life usage scenarios of MCT for pharmaceutical sales-force workers were developed that informed the second research phase and provided the potential survey respondents with some examples of how mobile work support functions could facilitate their mobile work so they could make some perceptual judgments guided by a common set of criteria. Thus, the real-life usage scenario approach was used to facilitate the assessment of a technology that was not in place in the case study organisation at the time this research was conducted.

3.4.1 Data collection procedures

Participant selection, semi-structured interview procedures and the semi-structured interview design of the first research phase are discussed in the following subsections.

Participant selection

In the first research phase, 20 sales-force workers in the case organisation were selected and interviewed (N=20). For the semi-structured interviews, a cross-section of sales-force workers was purposively selected to gain a variety and range of viewpoints across the sales-force worker group regarding the perceived fit of mobile work support functions with sales-force worker tasks (Patton 2002). The cross-section of sales-force workers contained two different categories (4 operational sales-force workers, 1 supervisor) from four different pharmaceutical business units and a balanced mix of genders and employees with a range of experience and length of tenure.

Table 3.3 provides an overview of the demographics of the 20 participants interviewed in the first research phase.

Table 3.3 - Overview on the demographics of the 20 interviewees in research phase 1

Number of interviews	20
Number of different business units involved	4
Distribution of genders	10 females (50%) 10 males (50%)
Different job roles of employees	4 supervisors (20%) 16 operational employees (80%)
Length of tenure	4 employees < 5 years (20%) 5 employees 5-10 years (25%) 5 employees 11-20 years (25%) 6 employees > 20 years (30%)

Source: Developed for this research

Semi-structured interview procedures

Before the actual interviews took place, potential interviewees were contacted via email seeking their willingness to participate in such a study. Those participants who were willing to participate received Outlook calendar invitations and were called by the researcher on the day the interview was scheduled to take place. The semi-structured interviews took place in the mobile work setting of the participants (e.g., during lunch break) and were conducted in the form of telephone interviews as the work locations of interviewees were dispersed all over Germany.

To effectively prepare for the semi-structured interviews, the interviewees received the interview protocol via email prior to the actual interview. At the beginning of the interviews, the interviewees were informed about the purpose of the research, that this research has formal ethical clearance from the University of Southern Queensland (USQ) and that the interviews were to be conducted in an ethical manner in adherence with USQ research ethics policy, and key terms used in the interviews. The semi-structured interviews took 30 to 60 minutes to complete, were tape-recorded in German and later transcribed and translated into English.

Semi-structured interview design

The interview questions aimed to collect the necessary data to answer those research questions that were relevant for the first research phase. To achieve this, both qualitative and quantitative data were collected during the semi-structured interview process. Table 3.4 summarises this study's research questions and related sections in the interview protocol used in the first research phase.

Table 3.4 - Summary of research questions and related sections in the interview protocol used in research phase 1

Question ID	Research question	Relevant interview protocol section
RQ1	How useful is each of the mobile work support functions in supporting mobile sales-force worker tasks?	Sections 2.1 - 2.6 (column 'considered useful')
RQ2	To what degree is each of the mobile work support functions innovative in supporting mobile sales-force worker tasks?	Sections 2.1 - 2.6 (column 'considered innovative')
RQ3	Why is each of the mobile work support functions useful or not in supporting mobile sales-force worker tasks?	Section 2.1 - 2.6 (column 'justification/comment')

Source: Developed for this research

Table 3.5 outlines the structure of the interview protocol.

Table 3.5 - Structure of the interview protocol

Section in interview protocol	Data collected	Type of data collected
1. Demographic information	• Gender • Job role • Length of tenure • Type of business unit	Qualitative
2. Ratings for mobile work support functions	Perceived usefulness, perceived degree of innovativeness and justification for the following mobile work support functions: • Mobile communication • Mobile information searching • Mobile transaction processing • Location-related services • Mobile job scheduling & dispatching • Mobile office	Quantitative (perceived usefulness and perceived degree innovativeness) and qualitative (how and why justification)

Source: Developed for this research

First, the interviewees were requested to provide demographic information (gender, job role, length of tenure and type of business unit) about themselves. Second, they were asked to rate perceived usefulness and perceived degree of innovativeness of six mobile work support functions on a seven-point Likert scale. The interviewees were then asked to comment on and justify their rating to gain in-depth information on why they made the respective rating. As suggested by Patton (2002, p. 342), the interviews were conducted in a conversational and situational manner to receive as much information as possible on why mobile work support functions are perceived to be useful and innovative or not in supporting mobile sales-force worker tasks. The entire semi-structured interview questionnaire used in the first research phase is listed in appendix 5.

3.4.2 Data analysis procedures for semi-structured interviews

As outlined in table 3.5, both quantitative and qualitative data were collected in the first research phase.

The quantitative data collected in the first research phase used to rate perceived usefulness and perceived degree of innovativeness was not considered to be statistically significant. To facilitate the interpretation of Likert-scale values collected for perceived usefulness and perceived degree of innovativeness, the following categories were used for data evaluation: very low (0-2), low (2-3), medium (3-5), high (5-6) and very high (6-7).

Qualitative data was collected in a series of semi-structured interviews to determine why specific mobile work support functions were perceived to be useful and innovative or not in supporting mobile sales-force worker tasks. Thereby, interview transcripts for each interviewee were developed from the interview notes and audio files, which is one of three possible strategies when analysing semi-structured interview data (Yin 2003, p. 111-115). To identify common themes, patterns, similarities or differences among the interviewees, content analysis—'a research technique for the objective, systematic, and quantitative description of the manifest content of communication' (Berelson 1952)—was applied to each interview transcript (Yin 2003, p. 116). Qualitative data analysis software, ‘Weft

QDA', was used to support and manage the data analysis process of the semi-structured interviews.

Relevance for research phase two—online survey

The first research phase aimed to inform the second research phase by developing real-life usage scenarios on the usage of mobile work support functions and by establishing further empirical support for the proposed research.

Thereby, real-life usage scenarios were created to facilitate the assessment of the mobile work support functions by sales-force workers and, thus, provide more accurate responses. To develop the usage scenarios, the mobile work support functions with a high rating for perceived usefulness and perceived degree of innovativeness were investigated in more detail. The descriptions of the usage scenarios were developed by considering qualitative information provided by the participants, work experience of the researcher, feedback of the academic supervisor and from sales and IT management of the case organisation. Another assumption of this research was that the results of the first research phase revealed information that has the potential to enhance and modify the conceptual model of this research. The results of the first research phase aimed to provide the foundation to place the proposed research model in the specific context of mobile work support for sales-force workers. In addition, it has been assumed that moderating variables identified in the first research phase may provide more explanation regarding the hypothesised relationships between key variables in the proposed research model tested in the second research phase.

3.5 Research design of research phase 2—Online survey

The purpose of this section is to discuss the research design of the second research phase. The first research phase informed the second research phase by providing support for the conceptual model proposed for this study and assisted in the refinement of the online survey instrument in the context of the case study organisation by developing real-life usage scenarios for each of the mobile work support functions investigated. The second research phase collected quantitative data to validate and test the conceptual model. Thereby, the second research phase sought to determine to what extent mobile work support functions are perceived to be useful in supporting mobile sales-force worker tasks; and to what extent this perceived usefulness and individual characteristics of sales-force workers influences sales-force worker performance and intention to use mobile work support functions. In addition, the moderating effect of the perceived degree of innovativeness on both the relationship between perceived usefulness and intention to use, and the relationship between perceived usefulness and perceived impact on mobile work performance, will be investigated.

For the second research phase, a quantitative research methodology using an online survey as a data collection instrument was considered appropriate to answer the research questions formulated (e.g., 'to what extent' or 'to what degree…'), as listed in the research question section (Dooley 2001; Leedy & Ormrod 2005; Neuman 2003; Zikmund 1997). The following subsections discuss the research design of the second research phase in more detail by outlining relevant data collection procedures and data analysis procedures.

3.5.1 Data collection procedures

In this subsection, the study's sampling design, online survey procedures, online survey questionnaire design and variables and measurement items are described.

Sampling design

The sampling unit for the online survey was pharmaceutical sales-force workers employed at the German division of the case organisation at the time of the research. The sampling frame was the case organisation's internal employee information system. Due to the study's non-disclosure agreement with the case organisation, information about the size of the whole sample population is not provided, as this information might facilitate the identification of the case organisation.

Online survey procedures

The online survey was created with 'Inquisite survey builder' software. As the target population was dispersed across Germany, an online survey was considered appropriate for data collection as evaluation activities can be conducted more quickly and at a lower cost compared to a paper-based survey. Previous research indicates that there are no significant differences in the answering behaviour of participants between online surveys and paper-based surveys (Boyer et al. 2002; Carini et al. 2003).

The online survey was only accessible to the above mentioned sampling population. The whole sample population was informed by sales management via email about the purpose of the research and invited to take part in the online survey. The email contained a link to the online survey. To increase the online survey's response rate, three iPods were randomly awarded to three of the survey participants. After the first email, two follow-up reminders were sent by sales management via email to the sample population at two-week intervals to encourage a better response to the online survey. This was done in accordance with Dillman's (2000) tailored survey design method, which suggests that follow-up reminders to potential survey participants can significantly increase survey response rates.

Online survey questionnaire design

In the invitation email, the online survey participants were informed about (1) the purpose of the research, (2) that this survey had ethical clearance from the University of Southern Queensland Ethics Committee and included information about their rights as potential participants and (3) the key terms used in the online survey. This research adhered to established guidelines regarding the layout and structure of a good questionnaire design (i.e., Albrecht & Jones 2009; Dillman 2000; Lefever et al. 2007; Van Selm & Jankowski 2006). Table 3.6 summarises the structure of the online survey questionnaire.

Table 3.6 - Structure of the online survey questionnaire

Section in online survey	Data collected	Type of data collected
1. Demographic information	• Gender • Job role • Length of tenure • Type of business unit	Quantitative
2. Task characteristics of mobile sales-force workers	• Time criticality • Task complexity • Task interdependence • Location sensitivity	Quantitative

Section in online survey	Data collected	Type of data collected
3. Ratings for mobile work support functions	Perceived usefulness, perceived degree of innovativeness, intention to use and perceived impact on mobile work performance for the following mobile work support functions: • Mobile communication • Mobile information searching • Mobile transaction processing • Location-related services • Mobile job scheduling & dispatching • Mobile office	Quantitative

Source: Developed for this research

Questions in the first section of the online survey aimed to collect demographic information (gender, job role, length of tenure and type of business unit) about the online survey participants. Section two aimed to collect data regarding the task characteristics of mobile sales-force workers in relation to time criticality, task complexity, task interdependence, and location sensitivity of their mobile tasks. Section three aimed to collect data regarding the perceived usefulness, perceived degree of innovativeness, intention to use and perceived impact on mobile work performance of the six mobile work support functions proposed by Zheng (2007). A seven-point Likert scale was used to ensure a more precise measurement of these research constructs (Hair et al. 2008). As the participants had to rate functionalities yet not in place, real-life usage scenarios were used to facilitate the assessment of the mobile work support functions by sales-force workers and to provide more accurate responses. The real-life scenarios were developed from the results of the first research phase and complemented the descriptions of each mobile work support function on the online survey.

The entire online survey questionnaire used in the second research phase is listed in Appendix 6.

Table 3.7 summarises the research questions and related questions of the online survey in the second research phase.

Table 3.7 - Summary of research questions and related questions used in the online survey

RQ	Research question	Relevant questionnaire questions of online survey
RQ1-RQ3	*Not applicable in research phase 2*	*Not applicable in research phase 2*
RQ4	To what degree do task characteristics of mobile sales-force workers influence perceived usefulness of mobile work support functions?	• Questions 2a-i (task characteristic-related research constructs) • Questions 3.1a, 3.2a, 3.3a, 3.4a, 3.5a, 3.6a (Perceived usefulness of mobile work support functions)
RQ5	To what extent does a perceived fit between mobile sales-force worker tasks and use of mobile work support functions influence perceived mobile work performance?	• Questions 3.1a, 3.2a, 3.3a, 3.4a, 3.5a, 3.6a (Perceived usefulness of mobile work support functions) • Questions 3.1d, 3.2d, 3.3d, 3.4d, 3.5d, 3.6d (Perceived impact on mobile work performance)
RQ6	To what extent does a perceived fit between mobile sales-force worker tasks and use of mobile work support functions influence intention to use mobile work support functions?	• Questions 3.1a, 3.2a, 3.3a, 3.4a, 3.5a, 3.6a (Perceived usefulness of mobile work support functions) • Questions 3.1c, 3.2c, 3.3c, 3.4c, 3.5c, 3.6c (Intention to use mobile work support functions)
RQ7	To what extent does the intention to use mobile work support functions by mobile sales-force workers influence perceived mobile work performance?	• Questions 3.1c, 3.2c, 3.3c, 3.4c, 3.5c, 3.6c (Intention to use mobile work support functions) • Questions 3.1d, 3.2d, 3.3d, 3.4d, 3.5d, 3.6d (Perceived impact on mobile work performance)
RQ8	To what extent is the relationship between the perceived usefulness of mobile work support functions and perceived mobile work performance influenced by the perceived degree of innovativeness of mobile work support functions?	• Questions 3.1a, 3.2a, 3.3a, 3.4a, 3.5a, 3.6a (Perceived usefulness of mobile work support functions) • Questions 3.1d, 3.2d, 3.3d, 3.4d, 3.5d, 3.6d (Perceived impact on mobile work performance) • Questions 3.1b, 3.2b, 3.3b, 3.4b, 3.5b, 3.6b (Perceived degree of innovativeness of mobile work support functions)
RQ9	To what extent is the relationship between the perceived usefulness of mobile work support functions and intention to use mobile work support functions influenced by the perceived degree of innovativeness of mobile work support functions?	• Questions 3.1a, 3.2a, 3.3a, 3.4a, 3.5a, 3.6a (Perceived usefulness of mobile work support functions) • Questions 3.1c, 3.2c, 3.3c, 3.4c, 3.5c, 3.6c (Intention to use mobile work support functions) • Questions 3.1b, 3.2b, 3.3b, 3.4b, 3.5b, 3.6b (Perceived degree of innovativeness of mobile work support functions)

RQ	Research question	Relevant questionnaire questions of online survey
RQ10	Do individual characteristics of mobile sales-force workers influence the perceived fit between mobile sales-force worker tasks and use of mobile work support functions?	• Questions 1a-d (demographic information) • Questions 3.1a, 3.2a, 3.3a, 3.4a, 3.5a, 3.6a (Perceived usefulness of mobile work support functions)

Source: Developed for this research

Variables and measurement items

The online survey questions were based on variables and measurement items derived from the adapted TTF model established in section 2.5. Table 3.8 summarises all variables and measurement items used in the second research phase.

Table 3.8 - Variables and measurement items used in research phase 2

Variable in the adapted TTF model	Measurement item	Relevant research question	Source
Mobile sales-force worker task characteristics	**Task complexity:** • Repetitiveness of work* • Amount and handling of unexpected events • Clearly known way to do major types of work* • Reliability on established procedures* • Routineness of work* • Understandable sequence of steps* **Task interdependence:** • Being dependent on work from others* • Need to coordinate with others* • Need for frequent coordination with others • Need to obtain information from others* • Influence of other people's performance* • Being dependent on receiving information from others **Time criticality:** • Urgency of task fulfilment • Average time window to complete a task • Need to start tasks on time • Need to complete tasks on time • Need to start tasks as soon as possible • Need to complete tasks as soon as possible	RQ4	(Goodhue & Thompson 1995; Lee et al. 2005; Perrow 1967; Withey et al. 1983; Zheng 2007)

Variable in the adapted TTF model	Measurement item	Relevant research question	Source
	Location sensitivity: *Location variety* • Extent of work at various locations • Limitation of job to a specific location • Freedom of choosing a place *Location dependence* • Being dependent on information about the current location • Being dependent on the location of customers • Being dependent on the location of colleagues • Being dependent on information about locations of things or equipment • Being dependent on information from travel or navigation guides *(*Items with reverse encoding are marked with an asterisk)*		
Individual characteristics of mobile sales-force workers	• Gender (male, female) • Job role (operational sales-force worker, supervisor) • Length of tenure (< 5 years, 5-10 years, 10-20 years, > 20 years) • Type of business unit (BU1, BU2, BU3 and BU4)	RQ10	(Meyer 2007; Middleton 2007; Middleton & Cukier 2006)
Perceived usefulness of mobile work support functions	• Impact on work productivity of mobile work support functions • Impact on work performance of mobile work support functions • Perceived usefulness of mobile work support functions	RQ1, RQ3-RQ10	(Goodhue & Thompson 1995; Lee et al. 2005; Zheng 2007)
Intention to use mobile work support functions	• Intention to use mobile work support functions • Likelihood to use mobile work support functions • Necessity of using mobile work support functions	RQ5, RQ7, RQ9	(Davis et al. 1989; Dishaw & Strong 1999; Goodhue & Thompson 1995; Zheng 2007)
Perceived impact on mobile work performance	• Mobile work support functions have a strong and positive influence on user work process • Mobile work support functions positively influence work effectiveness • Mobile work support functions positively influence work efficiency	RQ6, RQ7, RQ8	(Davis et al. 1989; Dishaw & Strong 1999; Goodhue & Thompson 1995; Lee et al. 2005; Zheng 2007)

Variable in the adapted TTF model	Measurement item	Relevant research question	Source
Perceived degree of mobile work support functions	• *Perceived degree of innovativeness* of the six mobile work support functions established by Zheng (2007)	RQ8, RQ9	(Adegbesan & Ricart 2007; Rogers 2003; Rogers 1998)
Other	• Amount of dead time available for MCT usage • Percentage of ad-hoc calls in a usual working week	n/a	n/a

Source: Developed for this research

As illustrated above, demographic information was collected (i.e., gender, job role, length of tenure, type of business unit) to measure the impact of the individual characteristics of mobile sales-force workers on the perceived usefulness of mobile work support functions (Meyer 2007; Middleton 2007; Middleton & Cukier 2006). The rationale for the investigation of moderating effects in this research is the fact that such effects are often not considered and 'explain the circumstances that cause a weak or ambiguous association between two variables that were expected to have a strong relationship' (Benet 2000).

The measurement items for the task characteristics-related research constructs (task complexity, time criticality, task interdependence and location sensitivity) were derived from relevant literature in this area (Goodhue & Thompson 1995; Lee et al. 2005; Perrow 1967; Withey et al. 1983; Zheng 2007). Reverse coding was used for certain measurement items to increase the data accuracy of the answers provided.

The perceived fit of mobile work support functions with sales-force worker tasks was measured in terms of their perceived usefulness and is in line with current research in this area (i.e., Dishaw & Strong 1999; Staples & Seddon 2004). Both perceived usefulness and intention to use mobile work support functions were adapted from the measurement items of the original TAM model (Davis et al. 1989; Dishaw & Strong 1999; Goodhue & Thompson 1995; Zheng 2007) such that the researcher conclude that this study's research model is a hybrid of TTF and TAM. Perceived degree of innovativeness of mobile work support functions was measured with a single measurement item (Adegbesan & Ricart 2007; Rogers 2003;

Rogers 1998). Perceived impact on mobile work performance was measured by the survey items adapted from the original TTF model (Davis et al. 1989; Dishaw & Strong 1999; Goodhue & Thompson 1995; Lee et al. 2005; Zheng 2007). Two additional single-item questions were measured in research phase 2 (amount of dead time available for MCT usage; percentage of ad-hoc calls in a usual working week). These questions were not part of the study's research model established in section 2.5 and aimed to collect additional data to support the case organisation's business case to introduce MCT.

3.5.2 Data analysis procedures

The data analysis procedures of the second research phase can be divided into two main activities. First, a descriptive data analysis was conducted to gain a better understanding of the data set and each of the variables. Second, the study's research model established in section 2.5 was assessed based on relevant evaluation criteria for PLS-SEM. Both activities are described in more detail in the following subsections.

3.5.2.1 Descriptive data analysis

Table 3.9 summarises the descriptive data analysis techniques applied in the second research phase.

Table 3.9 - Summary of descriptive data analysis techniques applied in research phase 2

Data analysis technique	Purpose and relevance for this research	Affected variables
Measures of location		
Mean	• Arithmetic average of a variable • Used to gain a better understanding of the ratings for the respective variables	All variables of the research model outlined in section 2.5
Median	• Midpoint of a distribution • Used to gain a better understanding of the ratings for the respective variables	All variables of the research model outlined in section 2.5
Measures of spread		
Variance	• Average of the squared deviation score from the distribution mean • Used to analyse whether and how scores clutter or scatter	All variables of the research model outlined in section 2.5
Standard deviation	• Positive square root of variance • Used to analyse whether and how scores clutter or scatter	All variables of the research model outlined in section 2.5
Skewness	• A measure of the asymmetry of a probability distribution • Used to determine whether issues with normality exist	All variables of the research model outlined in section 2.5
Kurtosis	• A measure of the 'peakedness' of a probability distribution • Used to determine whether issues with normality exist	All variables of the research model outlined in section 2.5

Adapted from (Coakes & Steed 2007; Zikmund 2009)

Thereby, measures of location (mean, median) and measures of spread (standard deviation, variance, skewness and kurtosis) were used to analyse the clustering or scattering of the data collected.

3.5.2.2 Evaluation criteria for research model assessment

Structured equation modelling (SEM) is a second generation multivariate analysis method and 'has become a quasi-standard in marketing and management research when it comes to analysing the cause-effect relations between latent constructs' (Hair et al. 2011). SEM is considered to be an appropriate method to validate the measurement of the study's research model and to test the hypotheses established therein (Bollen & Long 1993; Byrne 2001; Kline 2005). As opposed to other multivariate methods that examine only one single relationship at a time (e.g., factor analysis, multiple regression), SEM is considered to be superior as it can 'examine a series of dependent relationships simultaneously' (Hair et al. 2008). For each of the six mobile work support functions, a separate research model was examined with partial least squares (PLS)-SEM using SmartPLS as the software tool (Ringle et al. 2005). PLS-SEM was chosen over a covariance-based SEM (CB-SEM as e.g., AMOS, LISREL, etc.), as the following criteria for selecting PLS-SEM ,as proposed by Hair et al. (2011, p. 144), were fulfilled:

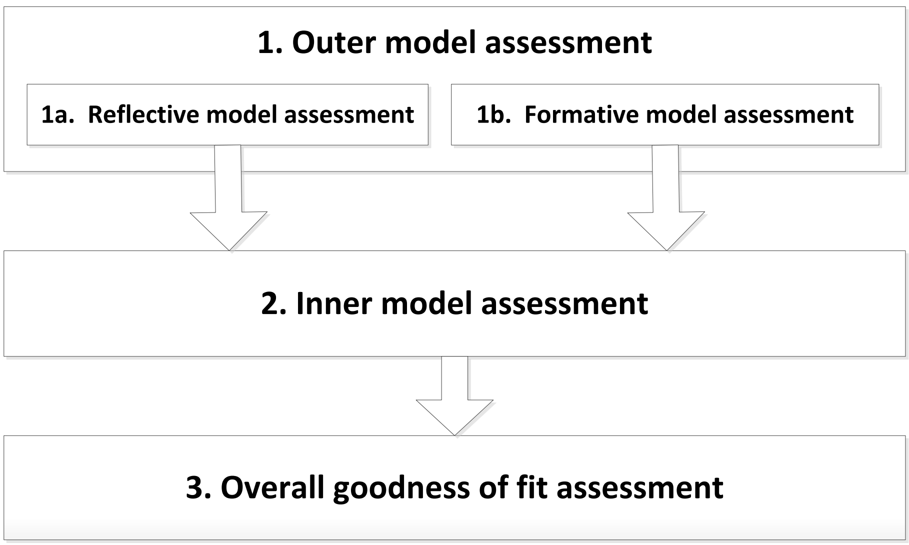
- This study is an extension of an existing model
- The study's structural model is complex
- The data were to some extent skewed

The evaluation criteria for the assessment of PLS-SEM are summarised in the following subsections.

General model assessment approach

Chin (1998) established a set of criteria to evaluate PLS-SEM. Thereby, a three-step approach is suggested by (1) assessing the outer model, (2) the inner model and (3) the overall goodness of fit (Chin 1998; Henseler et al. 2009; Nitzl 2010). Figure 3.2 depicts this approach.

Figure 3.2 - Three-step approach for evaluating PLS-SEM



Adapted from (Chin 1998; Nitzl 2010; Schloderer et al. 2009)

1. Outer model assessment

The assessment of the outer model deals either with the assessment of a reflective or a formative research model (Henseler et al. 2009, p. 289; Nitzl 2010). The study's measurement model is considered to be reflective, as the focus of the research is theory testing and the 'direction of causality is from the construct to the indicators' (Henseler et al. 2009, p. 289).

Table 3.10 summarises the evaluation criteria and thresholds for the reflective measurement model assessment.

Table 3.10 - Evaluation criteria and thresholds for the reflective measurement model assessment

Criterion	Threshold	Relevant for	Report in SmartPLS
Average variance extracted (AVE)	> 0.50	Research constructs	'Overview'
Factor loadings	> 0.70	Indicators	'Outer Loadings'
Composite reliability (CR)	> 0.60	Research constructs	'Overview'
Cronbach's alpha	> 0.70	Research constructs	'Overview'
Discriminant validity	SQRT(AVE) > correlations of research constructs (Fornell-Larcker criterion)	Research constructs	'Latent variable correlation', SQRT(AVE) needs to be calculated manually

Adapted from (Hair 2008; Henseler 2009; Chin 1998; Nunnally, 1978)

Thereby, the research constructs and respective indicators were evaluated with regard to their values for composite reliability (CR), Cronbach's alpha, average variance extracted (AVE), factor loadings and discriminant validity (Chin 1998; Hair et al. 2008; Henseler et al. 2009; Nunnally 1978). For reliability, composite reliability is considered a more accurate measure than Cronbach's alpha as it tends to underestimate the reliability of a construct (Henseler et al. 2009; Nitzl 2010; Werts et al. 1974). All the criteria listed above can be directly determined within SmartPLS (Henseler et al. 2009). With the exception of the analysis of discriminant validity, single-item constructs were not considered in this assessment. Moderating variables were also not assessed at this stage.

2. Inner model assessment

To assess the inner model or structural path model, the current literature suggests examining the coefficient of determination (R^2), path coefficients, effect size (f^2) and prediction relevance (Q^2) (Chin 1998; Henseler et al. 2009; Nitzl 2010). Table 3.11 summarises the evaluation criteria and thresholds for the assessment of the inner model.

Table 3.11 - Evaluation criteria for the inner model assessment

Criterion	Threshold	Calculation
R^2	$R^2 > 0.19$ => weak $R^2 > 0.33$ => moderate $R^2 > 0.67$ => substantial	Directly in SmartPLS
Path coefficients	t > 1.65 (95% significance level) t > 1.96 (99% significance level) t > 2.57 (99.9% significance level) path coefficient >= 0.10	Directly in SmartPLS
Effect size f^2	$f^2 > 0.02$ => weak $f^2 > 0.15$ => medium $f^2 > 0.35$ => large	Formula used for manual calculation: $f^2 = (R^2_{included} - R^2_{excluded}) / (1 - R^2_{included})$
Prediction relevance Q^2 (Stone-Geisser criterion)	$Q^2 > 0$	By using the blindfolding calculation of SmartPLS, the 'construct cross validated redundancy' is determined. Q^2 equals the value for '1-SSE/SSO' for the total sample.

Adapted from (Chin 1998; Henseler 2009; Nitzl 2010)

While R^2 and path coefficients can be directly computed within SmartPLS, both effect size and prediction relevance were calculated manually. Effect sizes were only computed for those variables that were influenced by more than one independent variable.

3. Goodness of fit (GoF)

For PLS-SEM, the determination of an overall goodness of fit (GoF) index is different than for CB-SEM. Thereby, the overall GoF index of a research model needs to be calculated manually and can be determined by the effect size of the measurement model, the effect size of the structural model and the model's overall effect size (Nitzl 2010; Tenenhaus et al. 2005; Wetzels et al. 2009). Table 3.12 summarises the evaluation criteria for the GoF of PLS-SEM.

Table 3.12 - Evaluation criteria for the overall GoF assessment

Criterion	Threshold	Calculation
Average communality (H^2)	$H^2 > 0.10$ => small effect size of measurement model $H^2 > 0.25$ => medium effect size of measurement model $H^2 > 0.36$ => large effect size of measurement model	Average mean communality for all dependent variables
Average redundancy (F^2)	$F^2 > 0.10$ => small effect size of structural model $F^2 > 0.25$ => medium effect size of structural model $F^2 > 0.36$ => large effect size of structural model	Average mean redundancy for all variables
GoF	GoF > 0.10 => small overall effect size GoF > 0.25 => medium overall effect size GoF > 0.36 => large overall effect size	Geometric mean of H^2 and R^2

Adapted from (Nitzl 2010; Tenenhaus et al. 2005; Wetzels et al. 2009)

The effect size of the measurement model can be determined by calculating the average communality (H^2), and the effect size of the structural model by calculating average redundancy (F^2). Then, the overall GoF index can be determined by calculating the geometric mean of the average communality (H^2) and average R^2, which indicates the overall effect size of the model. The determination of an overall GoF index did not consider single-item constructs and moderating variables.

4. Assessment of moderating variables

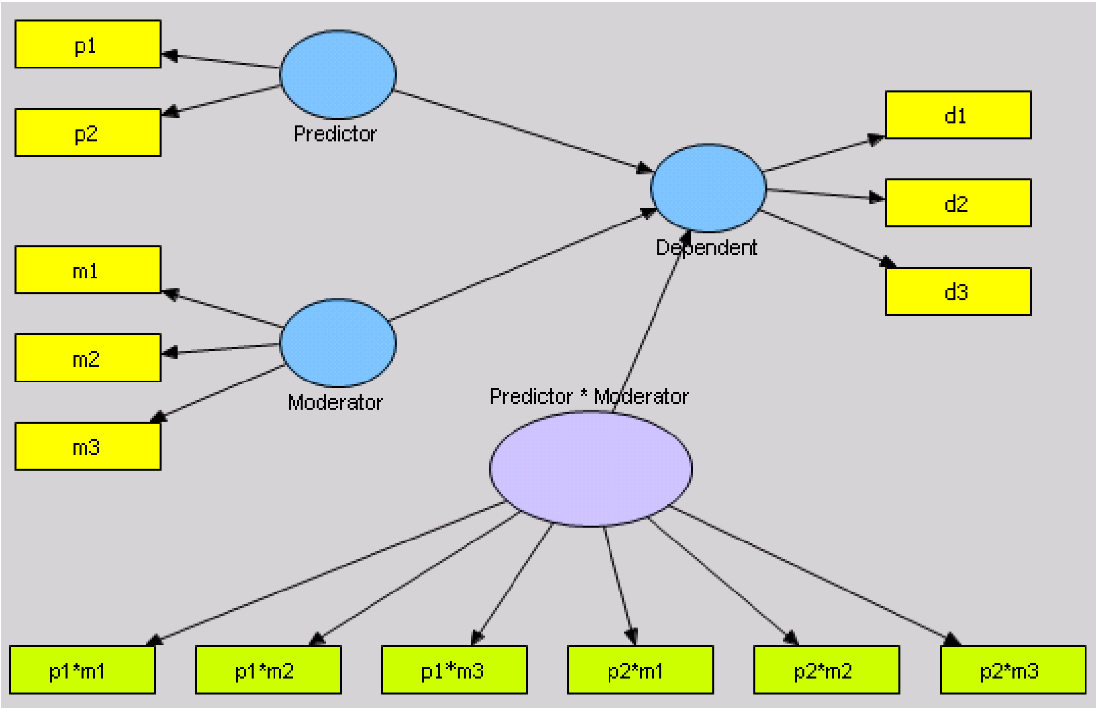
Moderating variables can affect the direction and/or strength of the relation between an independent and a dependent variable and thereby provide information as to the conditions in which a relationship between two variables is expected to exist (Chin et. al 1996, p. 21).

In this study, the moderating effect of individual characteristics (gender, job role, length of tenure and type of business unit) on perceived usefulness of mobile work support functions was examined. Furthermore, the moderating effect of the perceived degree of innovativeness on both the relationship between perceived usefulness and perceived impact on mobile work performance, and the relationship between perceived usefulness and intention to use, were investigated.

Gender, job role and type of business unit were measured as nominal categorical variables while length of tenure and perceived degree of innovativeness were measured as interval variables. Gender (one binary variable), job role (one binary variable) and type of business unit (three binary variables with business unit 4 as the reference variable) were converted into a series of nominal binary variables which are also referred in statistical analysis literature as 'dummy variables' (e.g., Hair 2010; Henseler & Chin 2010). As nominal categorical variables cannot be entered directly into a regression model and be meaningfully interpreted, nominal categorical variables with *k* levels were converted into *k-1* variables each with two levels (Stockburger 2001). Thereby, the author was able to determine whether there were differences across gender, across job roles and across the four business units regarding perceived usefulness of mobile work support functions as well as their moderating effect on the relationship between the task characteristic-related research constructs and perceived usefulness of mobile work support functions.

The moderating effects of the study's dummy and interval variables were measured by comparing the direct impact of these variables on the study's dependent variables (perceived usefulness of six mobile work functions, intention to use, perceived impact on mobile work performance) and the interaction effect of these variables (Hair 2010). To achieve this, product values of the moderating and the predictor variables were created and indicator values were centred around their mean values within SmartPLS (Henseler & Chin 2010; Ringle et al. 2005). A significant moderating effect is determined when the product value of the moderating and the predictor variable is significant. Figure 3.3 depicts this approach.

Figure 3.3 - Moderating variables in SmartPLS



Source: SmartPLS.com (2011)

The actual assessment of the moderating variables was part of the inner model assessment, and the results of the moderating variables assessment were covered as part of the path coefficient analysis.

3.6 Validity and reliability aspects

A study's validity and reliability is determined by investigating its internal validity, external validity, construct validity and reliability. After these terms are defined, these four aspects are discussed for both research phases.

Thereby, internal validity is defined as 'the approximate truth about inferences regarding cause-effect or causal relationships' (Research Methods Knowledge Base 2008). Leedy and Ormrod (2005, p. 99) define external validity as 'the extent to which its results apply to situations beyond the study itself – in other words, the extent to which the conclusions drawn from the data analysis findings can be generalised to other contexts'. Construct validity refers to the degree to which inferences can legitimately be made from the operationalisations in a study to the theoretical constructs on which those operationalisations were based (Research Methods Knowledge Base 2008). A research can be considered reliable if 'an auditor could repeat the procedures (which therefore have to be shown in the report) and arrive at the same results' (Yin 2003, p. 37). Some of these aspects need to be handled differently for quantitative and qualitative research.

Table 3.13 summarises how validity and reliability aspects of both research phases were covered in this study.

Table 3.13 - Validity and reliability aspects of both research phases

	Research phase 1 - Semi-structured interviews	**Research phase 2 - Online survey**
Internal validity	• Triangulation, pattern matching and checking the findings with interviewees were considered appropriate means to achieve internal validity.	• The research is based on an established model that has been tested several times before with regard to its validity and the adaptation of the model was guided by empirical literature on the validity and reliability of measurement models. • Even though the study setting is non-experimental such that no causal relationships can be determined, correlations among the research constructs were determined using SEM.
External validity	• Single-case studies offer poor basis for generalisation. • The questionnaire was partly based on an established model. • Reliance on analytical generalisation from the semi-structured interviews.	• The large-scale online survey covered the whole sample population.
Construct validity	• Core terms and the unit of analysis (namely sales-force workers in the German pharmaceutical industry) were defined and clarified. • Multiple sources of evidence (interviewing different categories of sales-force workers from different business units and combined research approach consisting of a case study research design of semi-structured interviews followed by an online survey) were used. • Quantitative and qualitative data were collected in the interviews.	• Reliance on an established model with constructs that have been tested several times before. • The survey questionnaire was pre-tested within the case organisation with a number of relevant people from the sales-force group including an operational sales-force worker, a supervisor, a sales director and IT staff specialised in sales information systems and a number of academics experienced in conducting qualitative and quantitative research to provide further validation and refinement of this data collection instrument.
Reliability	• A detailed case study protocol was used that documents all relevant activities in detail (interview procedures, scheduling, questions, summary database, etc.).	• The results of the second research phase can be reproduced, as all relevant procedures are described in detail.

Adapted from (Leedy & Ormrod 2005; Miles & Huberman 1994; Yin 2003)

In the first research phase, triangulation, pattern matching and checking the findings with interviewees were considered to be appropriate means to achieve internal validity. In most cases, external validity is an issue for single-case study research as the basis for generalisation is poor (Yin 2003). However, external validity can be achieved as the questionnaire is based on an established model (TTF) and the findings can be generalised to some broader theory through analytical generalisation. With regard to construct validity, core terms and the unit of analysis (namely sales-force workers in the German pharmaceutical industry) were defined and clarified and multiple sources of evidence (interviewing different categories of sales-force workers from different business units and a combined research approach consisting of a case study research design of semi-structured interviews followed by an online survey) were used. In addition, qualitative and quantitative data were collected in the first research phase. Reliability was assured by using a detailed case study protocol that documents all relevant activities in detail (interview procedures, scheduling, questions, summary database, etc.).

In the second research phase, internal validity was achieved as the research is based on an established model that has been tested several times before with regard to its validity, and the adaptation of the model was guided by empirical literature on validity and reliability of measurement models. Even though the study setting is non-experimental such that no causal relationships can be determined, correlations among the research constructs were determined using SEM. By conducting a large-scale online survey that covered the whole sample population (all sales-force workers of the German division of the case organisation), external validity was achieved as the results can be generalised to the whole sample population and, to a certain extent, to the general population of sales-force workers using MCT. Construct validity was achieved by pre-testing the survey questionnaire within the case organisation with a number of relevant people from the sales-force group, including an operational sales-force worker, a supervisor, a sales director and IT staff specialised in sales information systems and a number of academics experienced in conducting qualitative and quantitative research to provide further validation and refinement of this data collection instrument. Reliability in the second research phase was achieved by describing all relevant research procedures and results in detail such that the research can be reproduced.

3.7 Ethical considerations

As human beings were involved in this research, the study adhered to ethical clearance procedures of the University of Southern Queensland (USQ) and ethic clearance was obtained from the USQ Ethics Committee before data collection commenced.

All information collected from and about the research participants has been disguised, and the identification of specific participants is not possible. Thereby, no sales-force worker of the case organisation can be blamed or held responsible for having shared her/his opinion in this study. In addition, no undisguised information was given to a third party or made public. Prior to the actual data collection activities, the Chair of the USQ Fast Track Human Research Ethics Committee (FTHREC) reviewed the study proposal and granted full ethics approval for the study (Approval no.: H09REA099) so the requirements of the Australian National Statement on Ethical Conduct in Human Research were met (Australian Government 2007).

3.8 Chapter summary

This chapter summarised the study's overall research methodology and the specific research designs of both research phases of this two-stage study. 'Critical realism' was identified as an appropriate research paradigm for this study. This study used two phases and methodological approaches in an in-depth case study of the German division of a large pharmaceutical company. The first research phase collected primarily qualitative data using semi-structured interviews to determine how and why specific mobile work support functions are perceived to be useful and innovative or not in supporting mobile sales-force worker tasks.

In the first research phase, data was collected through a series of in-depth semi-structured interviews. To analyse the data collected, summary ratings were determined for each mobile work support function investigated and content analysis was conducted for 20 interviews to determine how and why each of the mobile work support functions were considered to be useful and innovative in supporting mobile sales-force worker tasks. The first research phase aimed to inform the second research phase by developing real-life usage scenarios and by establishing further empirical support for the proposed research.

The second research phase collected quantitative data to validate and test the conceptual model and thereby aimed to determine to what extent there is a perceived fit between mobile sales-force worker tasks and mobile work support functions, and to what extent this fit and individual characteristics of sales-force workers influence sales-force worker performance and intention to use mobile work support functions. A quantitative research methodology using an online survey as a data collection instrument was considered to be appropriate to answer the research questions relevant for the second research phase. All relevant details regarding data collection procedures and data analysis strategies used in this study have been provided.

Issues with the validity and reliability of the research have been thoroughly examined and an explanation provided on how these aspects were addressed in this study. Finally, ethical issues in this research have been carefully considered and the ethics committee of the USQ granted full ethics approval for this study before data collection commenced.

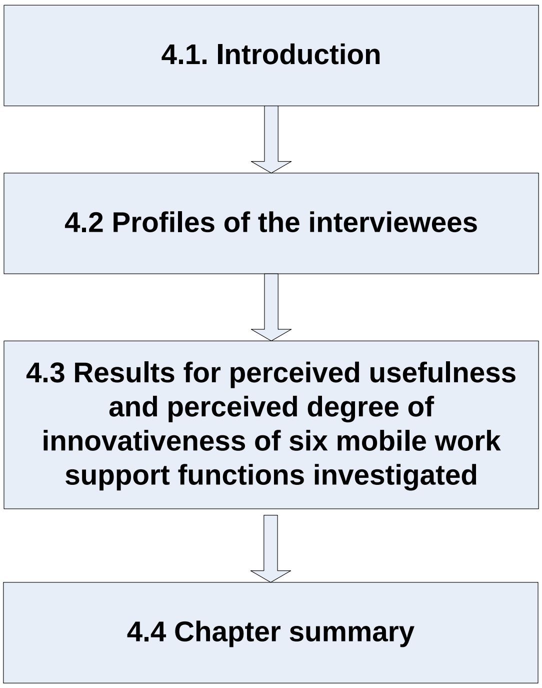
The next chapter will present the results from the data analysis of the first research phase.

4 Data analysis—Research phase 1

4.1 Introduction

The purpose of this chapter is to present and discuss the results of the data analysis for the first research phase—semi-structured interviews of mobile sales-force workers in the case organisation. Figure 4.1 outlines the structure of this chapter.

Figure 4.1 - Structure of data analysis chapter—Research phase 1



Source: Developed for this research

First, descriptive data about the demographics of the interviewees are presented and discussed. Next, the results of the data analysis relating to perceived usefulness and perceived degree of innovativeness of each mobile work support function investigated in this study are presented and discussed. The chapter concludes with a summary of the main findings of the first phase of the data collection and the implications for the second research phase.

4.2 Profiles of the interviewees

Table 4.1 provides an overview of the demographics of the 20 interviewees who participated in the first research phase.

Table 4.1 - Overview on the demographics of the 20 interviewees in research phase 1

Number of interviews	20
Number of different business units involved	4
Distribution of genders	10 females (50%) 10 males (50%)
Different roles of employees	4 supervisors (20%) 16 operational employees (80%)
Job tenure	4 employees < 5 years (20%) 5 employees 5-10 years (25%) 5 employees 11-20 years (25%) 6 employees > 20 years (30%)

Source: Developed for this research

The 20 interviewees consisted of two different categories of sales-force workers (4 operational sales-force workers, 1 supervisor) from each of the four different pharmaceutical business units. There was also a balanced representation of genders and employees with a range of experience and job tenure across the 20 interviewees, as shown in table 4.1. These interviewees were purposively selected to gain a good cross-section of employees and range of viewpoints across the sales-force worker group in the case organisation regarding the perceived usefulness and perceived degree of innovativeness of six mobile work support functions investigated in this study.

4.3 Results for perceived usefulness and perceived degree of innovativeness of six mobile work support functions investigated

The purpose of this subsection is to present and discuss the results of the data analysis relating to the six mobile work support functions investigated in the first research phase. For each of the six mobile work support functions investigated, the ratings of the 20 interviewees with regard to perceived usefulness and perceived degree of innovativeness and frequent response patterns and common themes identified from a content analysis of their responses as to how and why each of these mobile work support functions are considered to be useful and innovative are presented and discussed.

4.3.1 Mobile communication

Tables 4.2 summarises the overall ratings of the 20 interviewees for each mobile communication functionality.

Table 4.2 - Ratings of the 20 interviewees in relation to mobile communication functionalities

Mobile communication functionalities	Already used? Yes	No	Degree of perceived usefulness	Degree of perceived innovativeness
Reading/writing emails	13	7	High	High
Opening email attachments	11	9	High	High
Unified messaging (UM)	3	17	Low	Low
Reading/writing SMS	18	2	High	Medium
Instant messaging (IM)/chat	7	13	Low	Low
Video telephony	6	14	Low	Low
Participating in web conferences/web casts	7	13	Low	Low

Legend:
Range of values -> Interpretation of perceived usefulness/innovativeness

< 2	Very low
2 - 3	Low
3 - 5	Medium
5 - 6	High
> 6	Very high

Source: Developed for this research

The experience with each mobile communication functionality differed considerably for the 20 interviewees. While the majority of the interviewees already had some experience with mobile email communication (65% for reading/writing emails, 55% for opening email attachments) and SMS functionalities (90%), only a small number of interviewees had experience with all the other mobile communication functionalities investigated, such as unified messaging (15%), chatting (35%), video telephony (30%) and web conferencing (35%).

The specific functionalities related to mobile email communication (i.e., reading/writing emails and opening email attachments) were considered by the interviewees as highly useful and innovative. 'Reading/writing SMS' functionality was considered to be highly useful and moderately innovative. However, unified messaging, chatting, video telephony and web conferencing functionalities were considered neither useful nor innovative.

Table 4.3 summarises the most frequent response patterns and themes for each of the mobile communication functionalities identified from the content analysis of the 20 interviews of sales-force workers as to how and why these mobile communication functionalities were considered useful and innovative.

Table 4.3 - Common themes and patterns in relation to mobile communication functionalities

	Mobile communication functionalities						
Common themes and patterns	Email	UM	SMS	IM/ Chat	Video telephony	Web conferences /casts	General feedback/ comment*
Accelerated communication with customers, colleagues and office personnel	6		1				2
Improved information delivery to customers	2						2
More efficient usage of dead times	2						4
Reduction of administrative work	2						3
No usage scenario could be determined		2		3	4	2	2
Functionality would be better used in the home office				2	2	2	
Increased workload and stress caused by MCTs always connected and in contactable states	1						2

Legend:
UM = Unified messaging
IM = Instant messaging

*- The 'General feedback/comment' column refers to feedback that could not be directly assigned to a specific functionality

Source: Developed for this research

From the results of the content analysis of the interview transcripts, four common patterns and themes were identified that explain how and why certain mobile communication functionalities are perceived to be useful and innovative by the 20 interviewees. Thereby, mobile communication functionalities are assumed:

- to accelerate communication with customers, colleagues and office personnel;
- to enable a more efficient usage of dead times;
- to improve information delivery to customers; and
- to reduce administrative work.

However, for unified messaging, chatting, video telephony and web conferencing functionalities, no usage scenarios could be determined, or the interviewees indicated a preference for using the functionality in the home office and not in the mobile work setting. The following subsections discuss these findings in more detail by drawing on the specific responses of 20 interviewees as to how and why they considered these mobile communication functionalities to be useful and innovative in their work.

Mobile email communication functionalities

More than half of the interviewees already had some experience with mobile email functionalities (i.e., reading/writing emails and opening email attachments) in their mobile work setting and considered them to be highly useful and innovative, as dead times can be used more effectively for handling administrative work and time-critical email conversations. Several interviewees noted that mobile email communication functionalities are perceived to be useful and innovative as they accelerate communication with customers, colleagues and office personnel. In addition, mobile email communication is also perceived to improve information delivery to the customer that might eventually affect customer service and customer satisfaction.

The following quotes from interviewees support this assumption:

- *'Some emails cannot wait until the evening to be written. Waiting times can effectively be used for such purposes. With this increased flexibility, I can concentrate more effectively on my daily work.' (P10)*
- *'Dead times can be used for administrative work. Reading and writing email is the major part of my main administrative work'. (P4)*
- *'Reading emails would be beneficial, as communication among colleagues and with customers could be enhanced' (P15)*

A small number of the interviewees with a greater length of tenure had some scepticism regarding mobile email communication. They argued that a well-prepared sales-force worker does not need to check emails in the mobile work setting:

> *'In my 20 years of work in this company, there was no email that could not wait until the evening to be written.' (P3)*

Furthermore, a small number of interviewees feared that mobile communication in general will increase their workload and stress levels as they will be expected to use them. As one interviewee put it:

> *'The company would better be off with concentrating on effective email communication—this will definitely increase both workload and information overload!' (P19)*

Reading/writing SMS functionality

'Reading/writing SMS' was a functionality that was considered by the interviewees to have a high degree of usefulness but a medium degree of innovativeness as they have already been using this technology for some time and are quite familiar with this technology. The difference between the ratings in usefulness and innovativeness might be explained by the wide adoption of this functionality, as 90% of the interviewees had already used this functionality before. As one interviewee explained:

> *'This functionality is quite useful but not really innovative as I have been using it already for years ...' (P9)*

Thereby, reading and writing SMSs can be considered a successor of the mobile email communication functionality and is still considered appropriate for the communication of short messages (e.g., information about the delay of a meeting/appointment).

Unified messaging, chatting, video telephony and web conferencing functionalities

Unified messaging, chatting, video telephony and web conferencing functionalities were neither considered to be useful nor innovative. These ratings can be explained by the fact that the interviewees did not see a usage scenario for this specific functionality in their mobile work setting (e.g., for unified messaging, chatting) or preferred participating in video telephony calls or web conferences in their home office, as they fear that the state of distraction might be too high when using this functionality in the mobile work setting. The following direct quotes from the interviews support these notions:

- *'Do not see a usage scenario for this (i.e., unified messaging and chatting).' (P4)*
- *'Interesting function, but irrelevant for my mobile tasks. I would prefer using it at home.' (P7)*

4.3.2 Mobile information searching

Table 4.4 summarises the quantitative ratings of the 20 interviewees in relation to the perceived usefulness and perceived degree of innovativeness of mobile information searching functionality.

Table 4.4 - Ratings of the 20 interviewees in relation to mobile information searching functionalities

Mobile information searching functionalities	Already used? Yes	No	Degree of perceived usefulness	Degree of perceived innovativeness
Online access to intranet	7	13	High	High
Online access to corporate databases	4	16	High	High
Online access to CRM system	5	15	High	High
Online access to ERP system	2	18	Medium	Medium
M-learning: accessing learning modules	0	20	Medium	Medium
Internet search	12	8	High	High
Accessing e-books with medical/product-related information	3	17	Medium	Medium
Accessing video, audio content (e.g., IPTV broadcast, online videos, podcasts etc.)	5	15	Low	Low

Legend:
Range of values -> Interpretation of perceived usefulness/innovativeness

< 2	Very low
2 - 3	Low
3 - 5	Medium
5 - 6	High
> 6	Very high

Source: Developed for this research

Except for Internet search via a mobile device, the majority of the interviewees did have not any experience with other mobile information searching functionalities such as online access to corporate information systems, video access, e-book access, audio content or m-learning content. Online access to corporate information systems (i.e. intranet, CRM, ERP, corporate databases, etc.) and to the Internet in the mobile work setting is considered to be highly useful and innovative by the sales-force workers. Practically no support could be determined for the usefulness and innovativeness of accessing video and audio files, but medium support could be determined for accessing e-books and m-learning content.

Table 4.5 summarises common themes and patterns related to mobile information searching functionalities in terms of how and why the 20 interviewees considered these to be useful and innovative in supporting their mobile work tasks.

Table 4.5 - Common themes and patterns in relation to mobile information searching functionalities

	Mobile information searching functionalities								
Common themes and patterns	Intranet	Corp. data-bases	CRM	ERP	M-learning	Internet search	E-books	Video & audio content	General feedback/ comment*
Real-time access to time-critical information	2	1	4	2		4			
Improved preparation for ad-hoc sales calls			4						3
Improved customer service & customer satisfaction through improved information delivery		3							2
Efficient usage of dead times					3	1	3		3
No usage scenario could be determined								4	
*- The 'General feedback/comment' column refers to feedback that could not be directly assigned to a specific functionality									

Source: Developed for this research

Several functionalities listed above (e.g., online access to the intranet, Internet, corporate databases, CRM system and ERP system) were considered to provide real-time access to time-critical information and thereby to improve information delivery and enable sales-force workers to use their dead times more efficiently. With regard to the access of audio and video content, no appropriate usage scenarios could be determined for the next data collection phase, as they were considered irrelevant for use in the mobile work setting. Accessing e-books and m-learning in dead times was considered to be useful and innovative by the participants. The following subsections discuss these findings in more detail.

Online access to the intranet, Internet, corporate databases, CRM system & ERP system

The interviewees provided a number of reasons why the online access to the intranet, Internet, corporate databases, CRM system and ERP system were perceived to be moderately to highly useful and innovative. First, sales-force workers can prepare more effectively for ad-hoc sales calls using mobile information searching functionalities as they can gather new information in real time by accessing corporate information systems (i.e., Intranet, CRM, ERP, corporate databases, etc.) and the Internet in the mobile work setting. By having online access to customer-related data from the company's CRM system, a sales-force worker can look up basic customer data (address, opening hours, prescribing behaviour, customer value/priority, turnover, etc.) and the latest activities (last visits, last feedback, open issues from the last call, etc.) relating to a specific customer. The results indicate that there is a business need to support ad-hoc sales calls, as highlighted in the following quotes from interviewees:

- *'MCT is the appropriate tool in order to prepare for ad-hoc sales calls.' (P4)*
- *'Especially for my business unit, current knowledge about our competitor's products is crucial during the sales call. Mobile information searching could help solving knowledge gaps during the working day. Reality is too complex to prepare for all unexpected events in advance.' (P6)*

Second, a sales-force worker might receive time-critical information during a usual working day that might be of value for upcoming sales calls. The following quotes from interviewees support this notion:

- *‘Information delivery is a key task of a pharmaceutical sales-force worker. MCT can help me to be even better prepared for a sales call that can eventually change the perception of a customer. As the customers only have a short amount of time to talk, they will prefer those sales-force workers that deliver to them the best and most current information.’ (P7)*
- *'A critical part of pharmaceutical sales-force work is to provide new information to the customer. If this is not the case, the sales call is a waste of time.' (P1)*

Third, customer inquiries (e.g., product-related questions or specific services offered by the case organisation) that cannot be solved in advance can either be handled during the sales call by accessing online systems in the presence of the customer or directly after a sales call has taken place. All necessary information can be collected and delivered by the sales-force worker to the customer, either by revisiting, calling or emailing. The customer might feel more valued and will receive the information requested more quickly if mobile information searching functionalities are used in combination with mobile communications functionalities. A well-prepared pharmaceutical sales-force worker is assumed to add value to the sales call by providing additional information collected through mobile information searching functionalities. Based on the explanations provided by the interviewees, it can be concluded that accessing and delivering information in real time—anytime, anywhere—is a key task of pharmaceutical sales-force workers in the case organisation that can be supported by MCT.

Accessing m-learning content and e-books

Pharmaceutical sales-force work is a learning-intensive profession at the case organisation. Thereby, sales-force workers need to devote a considerable amount of time in learning activities (e.g., introduction of a new product), often resulting in lost calls. Thereby, e-learning programs have been used extensively in the case organisation to fill training gaps of sales-force workers and to reduce travelling costs associated with face-to-face training. M-learning as a specific form of e-learning was considered to provide a new learning channel for the sales-force workers. Similar to m-learning, accessing e-books with job-relevant information was considered to provide an opportunity for the continuous education of sales-force workers during dead times in their mobile work setting. The ratings from the interviewees indicated that they did consider accessing e-books and m-learning modules to be somehow innovative and useful. The following direct quote supports this finding:

> *'Might be a good idea to train sales-force workers in their dead times.' (P11)*

A small number of sales-force workers with a greater length of tenure preferred printed material over online content, even though this might be enriched by multimedia components via MCT. As one interviewee puts it:

> *'I prefer learning with printed-out materials.' (P20)*

Accessing video and audio content

The intention of this functionality was to provide a new channel for the case organisation to communicate information more quickly from the headquarters (and other locations) to the sales-force workers. However, similar to web conferencing or webcasting functionalities, this functionality was not perceived to be useful or innovative. The interviewees did not see the added value behind this sub-functionality. As one interviewee put it:

> *'Never had the need to watch videos in the mobile work setting.' (P20)*

4.3.3 Mobile transaction processing

Table 4.6 summarises quantitative ratings of the 20 interviewees regarding their perceptions of usefulness and innovativeness of mobile transaction processing functionalities.

Table 4.6 - Ratings of the 20 interviewees in relation to mobile transaction processing functionalities

Mobile transaction processing functionalities	Already used? Yes	No	Degree of perceived usefulness	Degree of perceived innovativeness
Entering data in online systems instead of making paper-based notes	1	19	High	High
Supporting specific business processes on the spot	1	19	Medium	Medium

Legend:
Range of values -> Interpretation of perceived usefulness/innovativeness

< 2	Very low
2 - 3	Low
3 - 5	Medium
5 - 6	High
> 6	Very high

Source: Developed for this research

The results indicate that almost none of the interviewees had any experience with mobile transaction processing functionalities. However, there is strong support from the 20 interviewees for the usefulness and innovativeness of mobile transaction processing functionalities to collect business-relevant data in real time instead of making paper-based notes and feeding the data into a system at the end of the working day. Medium support from the 20 interviewees could be found for the perceived usefulness and innovativeness of mobile transaction processing to support specific business processes on the spot.

Table 4.7 summarises common response patterns and themes from the 20 interviewee's responses regarding how and why they considered mobile transaction processing functionalities to be useful and innovative.

Table 4.7 - Common themes and patterns in relation to mobile transaction processing functionalities

	Mobile transaction processing functionalities		
Common themes and patterns	Entering data in online-systems instead of making paper-based notes	Supporting specific business processes on the spot	General feedback/ comment*
Improved data quality			2
Reduction of paper-based work	4		
Reduced double-handling of data entries by entering sales-process related data on the spot	7	1	2
No usage scenarios could be determined			3
* - The 'General feedback/comment' column refers to feedback that could not be directly assigned to a specific functionality			

Source: Developed for this research

The results from table 4.7 indicate that there are three common themes and patterns in relation to the mobile transaction processing functionality. Thereby, this functionality is considered to reduce paper-based work, to improve data quality and to reduce double-handling of data entries by entering sales-process related data on the spot. The following subsections discuss these aspects in more detail.

Entering data in online-systems as an alternative to making paper-based notes

Mobile transaction processing is considered to be useful and innovative when CRM-relevant customer data (e.g., customer feedback, plans for the next sales call, inquiry data, amount of medical samples handed out, participation in company-sponsored events) can be captured via MCT on the spot and in real time during a sales call or after a sales call has taken place. According to the interviewees, mobile transaction processing has the potential to increase overall data quality (as data is still in the sales-force worker's short-term memory), reduce the amount of paper-based notes and, thereby, increase a sales-force worker's overall efficiency as double handling will be reduced. Currently, sales-force workers make paper-based notes of their sales activities. All sales-/CRM-relevant data (call feedback, customer response, plans for the next sales calls, customer network information, etc.) are entered in appropriate systems at the end of a working day.

Most of the interviewees welcome the use of mobile transaction processing functionality in their mobile work as evidenced in the following quotes:

- *'Great idea—double work will be significantly reduced!' (P17)*
- *'This can definitely facilitate the way I work. I would not have to enter the sales-relevant data after a sales call but could enter it when it is still 'fresh in my head'. And if you do it this way, the overall quality of the data entered might also be improved.' (P13)*

Supporting specific business processes on the spot

Pharmaceutical sales-force work in Germany focuses on the promotion of products and the relationship between sales-force workers and customers. As German law does not allow a sales-force worker to directly sell products to a physician, the selling process cannot be supported by MCT—a key usage scenario in other industries. Nevertheless, the interviewees identified certain support processes where efficiency gains can be leveraged. For example, customer service can be increased as specific medical inquiries that cannot be clarified during a sales call could be typed into an online system (in front of the physician or directly after a sales call). The case organisation's specific event management process is another process that could be supported by MCT. Process steps in this application and customer-specific data can be handled via the mobile transaction processing functionality.

4.3.4 Mobile job scheduling and dispatching

The quantitative ratings of the 20 interviewees in relation to their perceptions of the usefulness and innovativeness of mobile job scheduling and dispatching functionalities are summarised in table 4.8.

Table 4.8 - Ratings of the 20 interviewees in relation to mobile job scheduling and dispatching functionalities

Mobile job scheduling & dispatching functionalities	Already used? Yes	No	Degree of perceived usefulness	Degree of perceived innovativeness
Receiving sales call appointments arranged by a centrally coordinated unit	0	20	Low	Low
Assigning new mobile work tasks to colleagues automatically	0	20	Low	Low
Receiving new mobile work tasks from colleagues automatically	0	20	Low	Low

Legend:
Range of values -> Interpretation of perceived usefulness/innovativeness

< 2	Very low
2 - 3	Low
3 - 5	Medium
5 - 6	High
> 6	Very high

Source: Developed for this research

None of the interviewees had previous experience with using any of the three sub functionalities of this specific mobile work support function. The perceived usefulness and perceived degree of innovativeness of all these functionalities were rated low by all of the interviewees.

Common themes and patterns identified in the content analysis of the 20 interviewees' responses as to how and why they considered mobile job scheduling and dispatching functionalities to be useful and innovative are summarised in table 4.9.

Table 4.9 - Common themes and patterns in relation to mobile job scheduling and dispatching functionalities

	Mobile job scheduling and dispatching functionalities			
Common themes and patterns	Receiving sales call appointments arranged by a centrally coordinated unit	Assigning new mobile work tasks to colleagues automatically	Receiving new mobile work tasks from colleagues automatically	General feedback/ comment*
No usage scenario could be determined	2	2	2	5
There is no business need to automatically assign/receive/coordinate tasks				8
Fear that work autonomy might be negatively affected by MCT	6			2
* - The 'General feedback/comment' column refers to feedback that could not be directly assigned to a specific functionality				

Source: Developed for this research

In general, the interviewees did not see any usage scenario for the proposed sub functionalities and feared that their autonomous way of working might be jeopardised. The interviewees emphasized that pharmaceutical sales-force workers are used to working with a high degree of autonomy and do not like the idea that someone else would organise with whom they have to visit. They make weekly plans to determine which customers they are going to visit and they align these plans with their colleagues and customers in advance. They are convinced that they know their customers best and that no other colleague would be able to guide them better. Thereby, the interviewees did not see a need for the automation of job scheduling and dispatching, and feared losing parts of their work autonomy if this mobile work support function was introduced. To arrange an ad-hoc sales call, a phone call is considered sufficient by many of interviewees.

The following interviewee quotes provide further support for these findings:

- *'In the field, we are 'lone wolves'. We do not need someone who tells us whom to visit/what to do. We know where our customers are located and if not, we have a navigation system to find this out.' (P12)*
- *'I know my customers best—why should someone else decide who I should visit?' (P2)*
- *'Don't like the idea of losing my 'mobile work autonomy.' (P19)*

While mobile job scheduling and dispatching functionalities might be useful in other industries with different business models, it can be concluded that it does not provide added value in the examined business environment in this study as there is no need to dynamically assign tasks to sales-force workers in their mobile work setting.

4.3.5 Location-related services

Table 4.10 summarises the ratings of the 20 interviewees regarding the perceived usefulness and perceived degree of innovativeness of location-related services functionalities.

Table 4.10 - Ratings of the 20 interviewees in relation to location-related services functionalities

Location-related services functionalities	Already used? Yes	No	Degree of perceived usefulness	Degree of perceived innovativeness
Receiving information about the location of colleagues or customers	2	18	Low	Low
Receiving information from a navigation system regarding the current position and the distance to a specific location	20	0	High	Medium
Receiving additional information about the current location such as hotels, gas stations, restaurants, etc. that are within reach	20	0	High	Medium

Legend:
Range of values -> Interpretation of perceived usefulness/innovativeness
< 2 Very low
2 - 3 Low
3 - 5 Medium
5 - 6 High
> 6 Very high

Source: Developed for this research

The results of the quantitative ratings of location-related services functionalities in terms of their perceived usefulness and innovativeness were divergent across the 20 interviewees. On the one hand, the navigation-system related functionalities were perceived to be highly useful and perceived to be innovative at a medium level. On the other hand, the location-tracking functionality (e.g., receiving information about the location of colleagues or customers) was perceived to be neither innovative nor useful. Thus, even though these functionalities are closely related from a technical standpoint, the location-tracking functionality is considered by the 20 interviewees to be more intrusive than the other functionalities.

In addition, while only two interviewees (10%) had experience with location-tracking functionalities of MCTs, every interviewee already had experience with the navigation system functionalities installed in every company car used by pharmaceutical sales-force workers.

Table 4.11 summarises common themes and perceptions identified in the content analysis of the 20 interviewees' responses as to how and why location-related service functionalities are considered to be useful and innovative.

Table 4.11 - Common themes and patterns in relation to location-related services functionalities

	Location-related services functionalities			
Common themes and patterns	Receiving information about the location of colleagues or customers	Receiving information from the navigation system	Receiving additional information about the current location, such as hotels, gas stations, restaurants, etc. that are within reach	General feedback/ comment*
Standard functionality used for many years		8	2	
No usage scenario could be determined	4			
Fear that work autonomy might be negatively affected by MCT				3
Misuse of MCT as a control tool	2			8
* - The 'General feedback/comment' column refers to feedback that could not be directly assigned to a specific functionality				

Source: Developed for this research

Four common themes and patterns could be determined from a content analysis of 20 interviewees' responses as to how and why they considered location-related service functionalities to be useful and innovative. First, regarding navigation system-related functionalities, several interviewees stated that these are standard functionalities that have been used in every company for many years. Second, no appropriate usage scenario could be determined for the location-tracking functionality. Third, similar to the findings for mobile job scheduling and dispatching functionalities, the interviewees feared that their work autonomy might be negatively affected by the introduction of MCT. Last but not least, the interviewees feared that the location-tracking functionality might be misused as a control tool. The following subsections discuss these findings in more detail.

Location-tracking functionalities

A number of interviewees were quite hostile to location-tracking functionalities (especially regarding receiving information about the location of colleagues) being imposed on their mobile work and current work autonomy and freedom; they asked the interviewer whether this functionality complies with German law and whether the workers' council is involved in this study. It was noted that there was strong resistance to using location-tracking functionalities. The following interview quotations underline this strong sentiment:

- *'Sounds like George Orwell in his novel '1984'—Big brother is watching you!' (P12)*
- *'What's the workers council's opinion on that?' (P8)*
- *'Abuse (by the employer) is certain.' (P20)*
- *'Do you want to spy on me?' (P9)*
- *'Does the organisation want to hand out electronic ankle manacles?' (P3)*

Due to the high work autonomy of the pharmaceutical sales-force workers in the case organisation, there is no specific business need to know the location of another working colleague. Again, a phone call is considered sufficient to find out the location of a specific colleague. This idea is supported by the following quote:

> *'In my opinion, it's not necessary to be 'locatable'. In a functional working team, it's not necessary to know in real time where a specific colleague is locatable. You need to know where your customers are located and the tools we currently have to find it out are more than sufficient!' (P6)*

While this functionality might be useful in other industries with different business models (e.g., in the utilities industries), it can be concluded that location-tracking functionalities do not fit with pharmaceutical sales-force work.

Navigation system-related functionalities

As mentioned previously, navigation-system related functionalities were perceived to be highly useful and moderately innovative by the interviewees. As an interviewee stated:

'Cannot imagine my work without this. How else should I quickly find out the way to my customers?' (P5)

As these functionalities have already been in use for many years and installed in all the sales-force workers' company vehicles, these specific sub-functionalities of location-based services are not discussed in more detail here.

4.3.6 Mobile office

Table 4.12 summarises the ratings of the 20 interviewees in relation to how and why they considered mobile office functionalities to be useful and innovative in supporting their mobile work tasks.

Table 4.12 - Ratings of the 20 interviewees in relation to mobile office functionalities

Mobile office functionalities	Already used? Yes	No	Degree of perceived usefulness	Degree of perceived innovativeness
Outlook: Accessing online calendar, arranging appointments	12	8	Medium	Medium
Excel: Using calculating software while on the move	9	11	Medium	Medium
PowerPoint: Reading, editing and creating presentations	4	16	Medium	Medium
Holding presentations in front of customers	2	8	Low	Low
Accessing and editing online task lists	6	14	Medium	Medium
Using mobile device as a dictation machine (speech recognition)	4	16	Medium	Medium
Accessing and manipulating documents that are stored online	7	13	Medium	Medium

Legend:
Range of values -> Interpretation of perceived usefulness/innovativeness

< 2	Very low
2 - 3	Low
3 - 5	Medium
5 - 6	High
> 6	Very high

Source: Developed for this research

Based on the data displayed above, it is evident that more than half of the interviewees did not have any experience with most mobile office functionalities. Holding presentations in front in the customer was neither perceived to be useful nor innovative. All the other functionalities (Microsoft Office-related functionalities, accessing and editing online task lists, using mobile devices such as a dictation machine, accessing and manipulating documents stored online) were perceived to be moderately useful and innovative. The interview data also revealed that mobile office functionalities are more useful for supervisors than operational sales-force workers (all mobile office-related sub functionalities were perceived to be highly useful by the supervisors interviewed), as supervisors have more contact with colleagues at the headquarter, make fewer sales calls and have more administrative and reporting responsibilities.

Table 4.13 summarises common themes and patterns identified in the content analysis of the interview transcripts as to how and why sales-force workers considered mobile office functionalities to be useful and innovative in their mobile work setting.

Table 4.13 - Common themes and patterns in relation to mobile office functionalities

	Mobile office functionalities							
Common themes and patterns	Outlook	Excel	Power Point	Holding present-ations in front of customers	Using online task lists	Speech recognition	Accessing online documents	General comment/ feedback*
Efficient use of dead times	3	3			3			3
Reduction of administrative work			2				2	
No usage scenario could be determined						5		
Holding presentations is not allowed in certain business units				8				
Reduction of paper-based work					2		2	
A calm work environment is necessary to handle office-related tasks in the mobile work setting								4
* - The 'General feedback/comment' column refers to feedback that could not be directly assigned to a specific functionality								

Source: Developed for this research

Mobile office functionalities are perceived to facilitate the efficient use of dead times and to reduce administrative work. According to the interviewees, no usage scenario could be determined for speech recognition functionalities. Several interviewees stated that holding presentations in front of the customer is not allowed in certain business units. In addition, a calm work environment where sales-force workers can effectively handle office-related tasks in the mobile work setting and are thereby not distracted (e.g., by noise from cafés or waiting rooms) was considered to be a necessary precondition for the effective use of mobile office functionalities.

The following subsections discuss these investigated functionalities in more detail.

Microsoft Office-related functionalities

All Microsoft Office-related sub functionalities (Outlook, Excel & PowerPoint) were perceived to be overall moderately useful and innovative. According to the interviewees, there are several scenarios for mobile office functionalities that add value to their tasks conducted in the mobile work setting. First, office-related work that is normally handled in the home office after a usual working day could now be handled in the dead times in a sales-force worker’s mobile work setting. Beyond that, additional data can be captured via mobile office functionality (e.g., Excel) when no corporate system is available to sales-force workers. Third, some interviewees already take their laptops with them and use mobile office functionalities, but offline. The following quotes support these findings:

- *'Accessing mobile office functionalities in my dead times (e.g., after lunch break) would be helpful as I would not have to do all administrative tasks (e.g., expense reports) late at night in my home office. Headquarter colleagues could receive the information they requested more quickly.' (P13)*
- *'Mobile office can help me to accomplish tasks during dead times in my mobile work environment that I would have to do otherwise at home. Great!' (P18)*
- *'As my subordinates usually have a working week of 60 hours and more, it’s [in] my personal interest to reduce their working hours at home and thereby to have more satisfied and motivated employees!' (P16)*
- *'Please fill my dead times with life.' (P12)*
- *'Day-to-day work can be done during the day during dead times–and not in the evening hours.' (P3)*

Holding presentations in front of customers

This functionality was not considered to be useful and innovative by the interviewees. In two of the four business units investigated in this study, sales-force workers were not allowed to hold presentations in front of customers, as this is not part of their predefined selling process. In addition, the interviewees did not trust the technology and argued that laptop booting times might take too long. As the following interviewee put it:

> *'There is no time available for this (booting etc.). One should use printed material that you can leave with the physician …' (P4)*

With the recent advent of tablet PCs (e.g., iPads), some of these technical limitations may no longer exist.

Accessing and editing online task lists

In general, this functionality was considered to be overall somewhat useful and innovative. Thereby, sales-force workers can access their task lists and edit them on the spot and online and thus reduce paper-based notes. The following direct quote supports this idea:

> *'Very good idea!' (P14)*

> *'Great. Do not have to put my thoughts on these paper-based notes any longer.' (P15)*

Using a mobile device as a dictation machine

Medium support could be found for the usefulness or innovativeness of the usage of a mobile device as a dictation machine. One interviewee mentioned that this functionality might be more appropriate for supervisors, as they have to handle more administrative work compared to the operational sales-force workers:

> *'Not useful for me but maybe for the supervisors ….' (P5)*

However, a minority of the interviewees did not trust the capabilities of speech recognition software, as they did not consider it to work properly:

> *'Did not work properly when I made my first tries. And do not underestimate the typing capabilities of a sales-force worker … :)' (P14)*

At the time these interviews were conducted, advanced speech recognition software was not available in mobile devices such as smartphones. For instance, the iPhone 4S was not launched yet, so these ratings might differ if one replicates the interviews, considering recent advances in MCT such as the SIRI and iPhone 4S.

Accessing and manipulating documents stored online

Some limited support overall could be found from the 20 interviewees for the usefulness and innovativeness of the modification of Microsoft Office documents in the mobile work setting as this also is designed to reduce the creation of paper-based notes and the double handling associated with it. This idea is nowadays part of the 'cloud computing' concept and is considered to be helpful, especially when collaborating with colleagues on a specific document (e.g., over a Microsoft SharePoint site). As one interviewee put it:

> *'Helpful when collaborating with headquarter colleagues.' (P15)*

4.3.7 Summary of findings and implications for research phase 2

Table 4.14 summarises the main common themes and patterns concerning why certain mobile work support functions are perceived to be useful and innovative or not, grouped by facilitating and inhabiting factors.

Table 4.14 - Common themes and patterns concerning why certain mobile work support functions are perceived to be useful and innovative or not

	Mobile work support functions					
Common themes and patterns	**MC**	**MIS**	**MTP**	**MJS**	**LRS**	**MO**
Facilitating factors						
Accelerated communication with customers, colleagues and office personnel	X					
Improved customer service and customer satisfaction through improved information delivery	X	X				
Reduced double-handling of data entries by entering sales process-related data on the spot			X			
Reduction of paper-based work			X			X
Improved preparation for ad-hoc sales calls		X				
More efficient usage of dead times causing a reduction of administrative work to be handled at home and an increase in work-life balance	X	X				X
Improved data quality			X			
A calm work environment is necessary to handle office-related tasks in the mobile work setting						X
Inhibiting factors						
Misuse of MCT as a control tool					X	
Increased workload and stress caused by MCT always connected and in a contactable state	X					X
Fear that work autonomy might be negatively affected by MCT				X		

Legend:
MC Mobile communication functionalities
MIS Mobile information searching functionalities
MTP Mobile transaction processing functionalities
MJS Mobile job scheduling & dispatching functionalities
LRS Location-related services functionalities
MO Mobile office functionalities

Source: Developed for this research

On the one hand, mobile work support functions are perceived to:

- accelerate communication with customers, colleagues and office personnel;
- improve information delivery to the customer;
- reduce double-handling of data entries by entering sales-process related data on the spot;
- reduce paper-based work;
- improve preparation for ad-hoc sales calls and to facilitate a more efficient usage of dead times causing a reduction of administrative work to be handled at home and an increase in work-life balance.

On the other hand, the interviewees feared that

- MCT might be misused as a control tool;
- their work autonomy might be reduced by MCT; and
- that the workload and stress might increase as a result of the invasive nature of MCT.

Section 6.2.3 discusses the above findings in more detail.

This chapter also revealed several implications for the second research phase. At first, even though the quantitative findings of the first research phase were not statistically significant due to the low sample size and thereby cannot be generalised to the whole sample population, the results summarised above show some indication that there might be a positive correlation between perceived usefulness and perceived degree of innovativeness of mobile work support functions. Therefore, this relationship is investigated in more detail in the second research phase. Second, the results from the first research phase indicate that a further investigation of individual characteristics of mobile sales-force workers is needed. Moreover, the interviews revealed that mobile office functionalities were considered to be more useful by supervisors than by operational sales-force workers. In addition, interviewees from business unit four rated all mobile work support functions lower than the interviewees from the other business units. While employees with a higher length of tenure considered some mobile work support functions less useful than their colleagues, no differences in the ratings across gender could be determined.

4.4 Chapter summary

In this chapter, the results of the analysis interview data in the first research phase (semi-structured interviews) were presented and discussed. The findings indicate that mobile work support functions such as mobile communication, mobile information searching, mobile transaction processing and mobile office can accelerate email communication with customers and colleagues, reduce double-handling of data entries by entering sales-process related data on the spot, improve preparation for ad-hoc sales calls, improve customer service and facilitate the handling of administrative work during dead times. This research also revealed that mobile work support functions such as location-tracking functionalities and mobile job scheduling and dispatching of work are not a good fit with the way tasks are conducted in the field and are likely to be strongly resisted by sales-force workers. Some sales-force workers interviewed showed a strong resistance to using these functionalities as they fear that their autonomous way of work could be changed (through mobile job scheduling) and they feared that their employer might misuse the tool for unnecessary controlling purposes (e.g., using location-tracking functionalities). Based on these results, usage scenarios were developed that were integrated into the online survey used in the second research phase.

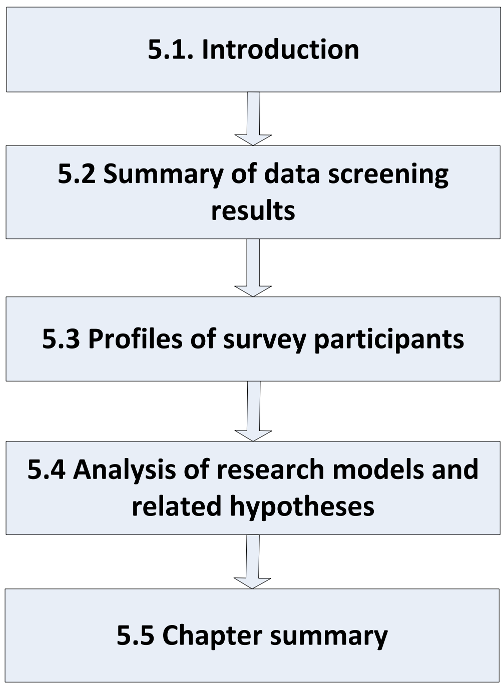
The next chapter discusses the results from the data analysis of the second research phase.

5 Data analysis—Research phase 2

5.1 Introduction

The purpose of this chapter is to present and discuss the results of the data analysis from the second research phase (an online survey). Figure 5.1 outlines the structure of this chapter.

Figure 5.1 - Structure of data analysis chapter—Research phase 2



Source: Developed for this research

First, results of the data screening procedures are summarised. Second, the profiles of the survey participants are summarised and examined. Third, the study's research models are evaluated and associated hypotheses are tested. The last section presents a summary of the main findings of this second data analysis chapter.

5.2 Summary of data screening results

To assure that the data collected in research phase 2 is clean and ready before conducting the quantitative data analyses, data screening of the survey data set was undertaken. The purpose of this subsection is to present the results for the data screening and to provide the rationale for using PLS-SEM as an advanced multivariate statistical technique in this research. In this study, the investigation of missing data, outliers, normality, and multicollinearity are considered appropriate data screening activities (StatWiki 2011; Tabachnick & Fidell 2006) before conducting a multivariate analysis using PLS-SEM. Thereby, research construct variable items (i.e., indicators) are investigated with regard to missing data, outliers and normality; and research constructs are investigated with regard to multicollinearity. In the following subsections, missing data will not be examined as its occurrence was prevented by using mandatory fields for all relevant items in the online survey questionnaire.

The following subsections will discuss the results for the data screening of this study's research constructs. The respective data tables and figures can be found in appendix 3.

Task characteristics-related research constructs

With regard to issues with normality, skewness was detected for certain items, namely, task complexity (TC2), time criticality, (TCR1, TCR2, TCR6) and location variance (LOCVAR2). Kurtosis was detected for certain items of task complexity (TC2, TC3) and time criticality (TCR2). Besides item TC2, this research acknowledges slight issues with normality for the above listed items, but retains them for SEM. As TC2 will be dropped for all of the models investigated, no further transformations are made at this stage.

No outliers could be determined for the indicators of location variance, location dependence and task interdependence. Outliers could be determined for two indicators of task complexity (TC2, TC3) and for four indicators of the time criticality construct (TC1, TC2, TC5, TC6). As most of the indicators were dropped due to low factor loadings (cf. section 5.4) and the relatively small sample size, no outliers were deleted.

Last but not least, no issues with multicollinearity could be detected for the task characteristics-related research constructs; and the variance inflation factor (VIF) for all relevant dependent variables was below the threshold of 10.

Mobile technology-related research constructs

While issues with skewness were determined for one item (MJSPI3), issues with kurtosis were determined for several items of location dependence (LOCDEP4, LOCDEP5), intention use to mobile communication functionalities (MCITU1, MCITU3), intention to use mobile transaction processing functionalities (MTPITU1, MTPITU3), perceived usefulness of location-related services functionalities (LRSPU1, LRSPU2, LRSPU3), perceived degree of innovativeness of location-related services functionalities (LRSPIN), intention to use location-related services functionalities (LRSITU1, LRSITU2, LRSITU3), perceived impact on mobile work performance of location-related services functionalities (LRSPI1, LRSPI2, LRSPI3), perceived impact on mobile work performance of mobile job scheduling and dispatching functionalities (MJSPI3), and intention to use mobile office functionalities (MOITU1, MOITU2, MOITU3). As all the values were below threshold (+/-2) and common data transformation approaches (e.g., using square root, logarithm and inverse) did not improve normality, this study accepted this issue with normality given the data set was above 200 cases; and considered these issues when selecting PLS-SEM as the multivariate statistical technique for evaluating the measurement model and testing the hypothesized relationships in the proposed research model.

With the exception of two outliers for one indicator item (MJSPI3), no outliers could be determined for the indicators of the mobile technology-related research constructs.

With regard to multicollinearity, all VIF values were below the threshold of 10, except for the perceived impact on mobile work performance construct of three mobile work support functions, namely, mobile information searching (13.18), mobile office (27.70) and mobile job scheduling and dispatching (27.70). This research acknowledges that despite the value for this dependent variable being above the specified threshold, it nonetheless retains these constructs for the final structural model of the respective mobile work support functions. The rationale for retaining this construct is the homogenous group of sales-force workers in one specific company and that the research's model is considered to be highly established and verified by numerous prior studies.

Justification for using PLS-SEM in this study

AS PLS-SEM is not susceptible to classical linear regression problems like heteroscedasticity, abnormal distribution of errors or autocorrelation (Lohmöller 1989), PLS-SEM was chosen in this study over a covariance-based SEM (CB-SEM as e.g., AMOS, LISREL etc.), as the following criteria for selecting PLS-SEM as proposed by Hair et al. (2011, p. 144) were fulfilled:

- This study is an extension of an existing model
- The study's structural model is complex
- The data set revealed issues with normality (cf. above).

5.3 Profiles of survey participants

In this subsection, the following tables summarise the profiles of the survey participants. Due to the study’s non-disclosure agreement with the case organisation, information about the size of the whole sample population is not provided, as this information might facilitate the identification of the case organisation. As information about a study’s response rate is critical in judging its validity, the researcher assures that the overall response rate was above 20%. Such a response rate was considered acceptable as it lies within the expected range for this kind of quantitative research. As the overall number of responses is above 200, it is possible to use a structured equation modelling approach to test the research model and associated hypotheses (cf. section 5.4) (Tabachnick & Fidell 2006).

Table 5.1 summarises the distribution of participants for each of the four business units investigated.

Table 5.1 - Distribution of participants for each business unit investigated

Business unit	Frequency	Percentage
BU 1	141	67.79%
BU 2	23	11.06%
BU 3	29	13.94%
BU 4	15	7.21%
Total	208	100.00%

Source: Developed for this research

Regarding the distribution of the participants across business units, it was established that about two thirds (67.79%) of the participants belonged to business unit 1 and the overall results are dominated by the participants of this business unit. Business units 2 and 3 are represented with 11.06% and 13.94%, and the fewest number of participants came from business unit 4 (7.21%). This result is considered representative of the whole sample population, as business unit 1 has the highest head count of sales-force workers in the case organisation, while the other business units have a significantly smaller head count.

Table 5.2 summarises the distribution of the participants between supervisors and operational sales-force workers.

Table 5.2 - Distribution of participants across job roles

Job role	Frequency	Percentage
Supervisors	29	13.94%
Operational sale-force workers	179	86.06%
Total	208	100.00%

Source: Developed for this research

Regarding the different job roles of sales-force workers investigated in this research, a majority of the participants were operational sales-force workers (86.06%). Due to an average span of command of 8-12 employees within the sales force of the case organisation, supervisors (13.94%) are sufficiently represented in the respondent population.

Table 5.3 describes the distribution of male and female participants.

Table 5.3 - Distribution of participants across gender

Gender	Frequency	Percentage
Male	119	57.21%
Female	89	42.79%
Total	208	100.00%

Source: Developed for this research

With regard to the percentage distribution across gender, it can be concluded that women were sightly underrepresented (42.75%) in the respondent population, as opposed to their male counterparts (57.21%). This proportion is in line with the overall proportion of male and female workers within the sales force of the case organisation.

Table 5.4 summarises the distribution of participants within the four groups relating to employee length of tenure.

Table 5.4 - Distribution of participants across length of tenure

Tenure	Frequency	Percentage
< 5 years	17	8.17%
5 - 10 years	69	33.17%
10 - 20 years	96	46.15%
> 20 years	26	12.50%
Total	208	100.00%

Source: Developed for this research

The participants with length of tenure of under five years (8.17%) and participants with length of tenure of more than 20 years (12.50%) were the smallest groups in the respondent population. Participants with length of tenure between 10 and 20 years are the biggest group in the sample (46.15%), followed by those employees with length of tenure between five and 10 years (33.17%). This distribution for the different groups can be considered representative for the case organisation.

5.4 Analysis of research models and related hypotheses

The previous sections primarily focused on the analysis of individual research constructs. This section focuses on the analysis of the research model as a whole, as established in section 2.5. For each mobile work support functions investigated in this research, six separate research models were developed and analysed, based on the evaluation criteria for research model assessment outlined in section 3.5.2.2. The rationale for developing and analysing six different research models is that perceived usefulness of each of the six mobile work support functions needs to be investigated separately regarding the influence of the study's independent variables (Individual characteristics, task characteristics) on perceived usefulness of mobile work support functions and the impact of perceived usefulness of mobile work support functions on the study's dependent variables (intention to use, perceived impact on mobile work performance). This approach is in line with previous research in this area (Yuan et al. 2010; Zheng 2007).

5.4.1 Mobile communication

Outer model assessment of the mobile communication functionality

Table 5.5 presents the factor loadings of those indicators that have met the recommended threshold of 0.7 (Hair 2008; Henseler 2009; Chin 1998; Nunnally, 1978).

Table 5.5 - Factor loadings of the measurement model for the mobile communication functionality

	LOCDEP	LOCVAR	MCITU	MCPI	MCPU	TC	TCR	TI
LOCDEP1	0.76							
LOCDEP2	0.81							
LOCDEP3	0.72							
LOCDEP4	0.83							
LOCVAR3_RC		1.00						
MCITU1			0.98					
MCITU2			0.97					

	LOCDEP	LOCVAR	MCITU	MCPI	MCPU	TC	TCR	TI
MCITU3			0.98					
MCPI1				0.97				
MCPI2				0.97				
MCPI3				0.98				
MCPU1					0.98			
MCPU2					0.97			
MCPU3					0.96			
TC1_RC						0.81		
TC4_RC						0.71		
TC5_RC						0.88		
TC6_RC						0.70		
TCR1							0.87	
TCR2							0.88	
TCR3							0.90	
TCR4							0.90	
TI3								0.86
TI6								0.84

Legend:

LOCDEP	Location dependence
LOCVAR	Location variety
MCITU	Intention to use mobile communication functionalities
MCPI	Perceived impact on mobile work performance of mobile communication functionalities
MCPIN	Perceived degree of innovativeness of mobile communication functionalities
MCPU	Perceived usefulness of mobile communication functionalities
TC	Task complexity
TCR	Time criticality
TI	Task interdependence
_RC	(recoded indicator)

Source: Developed for this research

The indicators not listed in the above table were dropped due to a factor loading below 0.7 (i.e., LOCVAR1, LOCVAR2, TC2, TC3_RC, TCR5, TCR6, TI1_RC, TI2_RC, TI4_RC, TI5) and the adapted model was recalculated. Except for location variety, two or more indicators could be retained. As location variety is considered a crucial construct of the task model that is supposed to be correlated with other constructs, a decision was made to retain the third indicator and location variety construct as a single-item construct.

Based on the adapted model, AVE (average variance extracted), CR (composite reliability) and Cronbach's alpha of the measurement model for mobile communication were calculated.

Table 5.6 presents the AVE, CR and Cronbach’s alpha score for each construct in the mobile communication functionality model.

Table 5.6 - AVE, CR and Cronbach's alpha of the measurement model for the mobile communication functionality

	AVE	CR	Cronbach's alpha
LOCDEP	0.61	0.86	0.79
MCITU	0.95	0.98	0.99
MCPI	0.95	0.98	0.98
MCPU	0.94	0.98	0.97
TC	0.61	0.86	0.64
TCR	0.78	0.94	0.91
TI	0.72	0.84	0.62

Legend:
AVE Average variance extracted
CR Composite reliability
LOCDEP Location dependence
MCITU Intention to use mobile communication functionalities
MCPI Perceived impact on mobile work performance of mobile communication functionalities
MCPU Perceived usefulness of mobile communication functionalities
TC Task complexity
TCR Time criticality
TI Task interdependence

Source: Developed for this research

Thereby, it is concluded that the AVE and CR are within acceptable ranges for all research constructs examined. For Cronbach's alpha, the values for task complexity (0.64) and task interdependence (0.62) are slightly below the threshold of 0.7. As CR is considered a more appropriate measure for reliability than Cronbach's alpha—which has been found to underestimate the reliability of a construct (Henseler et al. 2009; Nitzl 2010; Werts et al. 1974)—no further modifications to the measurement model were made at this stage.

Table 5.7 summarises the results for discriminant validity analysis.

Table 5.7 - Discriminant validity of the measurement model for the mobile communication functionality

	LOCDEP	LOCVAR	MCITU	MCPI	MCPIN	MCPU	TC	TCR	TI
LOCDEP	**(0.78)**								
LOCVAR	-0.59	**(1.00)**							
MCITU	0.39	-0.20	**(0.97)**						
MCPI	0.40	-0.18	0.86	**(0.97)**					
MCPIN	0.39	-0.24	0.80	0.82	**(0.97)**				
MCPU	0.34	-0.19	0.79	0.77	0.80	**(0.97)**			
TC	-0.05	0.04	-0.17	-0.11	-0.09	-0.12	**(0.88)**		
TCR	0.35	-0.15	0.45	0.52	0.44	0.40	-0.27	**(0.85)**	
TI	0.46	-0.16	0.39	0.49	0.38	0.36	-0.12	0.47	**(0.78)**

Legend:

LOCDEP	Location dependence
LOCVAR	Location variety
MCITU	Intention to use mobile communication functionalities
MCPI	Perceived impact on mobile work performance of mobile communication functionalities
MCPIN	Perceived degree of innovativeness of mobile communication functionalities
MCPU	Perceived usefulness of mobile communication functionalities
TC	Task complexity
TCR	Time criticality
TI	Task interdependence

Source: Developed for this research

Based on the results shown in table 5.7, discriminant validity is established for all research constructs as the square root of the AVE is larger than the correlations among the respective research constructs. So far, no further modifications to the model are necessary.

Inner model assessment of the mobile communication functionality

Table 5.8 summarises the path coefficients of the structural model for the mobile communication functionality for the significant relationships. Associated hypotheses and respective support can also be derived from the data. Table A4.1 in appendix 4 summarises the results for all relationships in this specific model.

Table 5.8 - Path coefficients of the structural model for the mobile communication functionality

Relationship investigated	Original sample (208)	Sample mean (500)	T Statistics (|O/STERR|)
BU3 -> MCPU	0.26	0.25	2.87***
LOCDEP -> MCPU	0.25	0.25	3.65***
LOCVAR -> LOCDEP	-0.59	-0.60	13.13***
MCITU -> MCPI	0.52	0.52	7.02***
MCPIN -> MCITU	0.46	0.45	4.95***
MCPIN -> MCPI	0.32	0.32	4.10***
MCPU -> MCITU	0.43	0.43	4.42***
MCPU -> MCPI	0.10	0.10	2.84***
TC -> TCR	-0.22	-0.23	3.13***
TCR -> MCPU	0.34	0.35	4.78***
TI -> TCR	0.45	0.45	6.98***

Legend:

LOCDEP	Location dependence
LOCVAR	Location variety
MCITU	Intention to use mobile communication functionalities
MCPI	Perceived impact on mobile work performance of mobile communication functionalities
MCPIN	Perceived degree of innovativeness of mobile communication functionalities
MCPU	Perceived usefulness of mobile communication functionalities
TC	Task complexity
TCR	Time criticality
TI	Task interdependence
*	95% significance level
**	99% significance level
***	99.9% significance level

Source: Developed for this research

Thereby, it was determined that perceived usefulness of the mobile communication functionalities is significantly affected by location dependence (0.25) and time criticality (0.34). In addition, perceived usefulness of the mobile communication function significantly affects perceived impact on mobile work performance (0.10) and intention to use (0.43) mobile communications functionalities. Intention to use the mobile communication functionalities also affects perceived impact on mobile work performance (0.52). Time criticality is affected by both task complexity (-0.22) and task interdependence (0.45). Location variance significantly affects location dependence (-0.59) in a negative way.

In addition, support could be found for a significant difference in the ratings between business unit 3 and business unit 4. On average, participants from business unit 3 rated perceived usefulness of mobile communication functionalities 26% more useful than reference category business unit 4. No differences across gender, across different job roles and across employees with different lengths of tenure could be identified. In addition, perceived innovativeness directly affects perceived impact on mobile work performance (0.32) and intention to use mobile communication functionalities (0.46). A significant moderating effect of perceived degree of innovativeness, the relationship between perceived usefulness and intention to use, and the relationship between perceived usefulness and perceived impact of mobile work support functions could not be determined.

Table 5.9 summarises the analysis for the coefficient of determination (R^2) for this study's dependent variables.

Table 5.9 - R^2 of structural model for the mobile communication functionality

Dependent variable	R^2	Interpretation
LOCDEP	0.34	Moderate
MCITU	0.70	Substantial
MCPI	0.79	Substantial
MCPU	0.26	Weak
TCR	0.27	Weak

Legend:
LOCDEP Location dependence
MCITU Intention to use mobile communication functionalities
MCPI Perceived impact on mobile work performance of mobile communication functionalities
MCPU Perceived usefulness of mobile communication functionalities
TCR Time criticality

Source: Developed for this research

R^2 indicates the amount of variance in the dependent variable that can be explained by the model—the higher a dependent variable's R^2 value, the higher is its prediction accuracy (Tabachnick & Fidell 2006). Based on the information provided above, it can be concluded that the values of R^2 for all dependent variables are above the critical threshold of 0.19 (Chin 1998; Henseler 2009; Nitzl 2010). The results for the R^2 values of time criticality (0.27) and perceived usefulness of mobile communication functions (0.26) are considered to be weak; for location dependence (0.34) to be moderate; and for perceived impact on mobile work performance (0.79) and intention to use (0.70) to be substantial.

Table 5.10 summarises the total effect size of the structural model investigated.

Table 5.10 - Total effects of the structural model for the mobile communication functionality

Dependent variable	$R^2_{included}$	$R^2_{excluded}$	f^2	Interpretation of effect size
LOCDEP -> MCPU	0.26	0.20	0.08	Weak
TCR -> MCPU	0.26	0.16	0.14	Weak
MCPU -> MCPI	0.79	0.76	0.14	Weak
MCITU -> MCPI	0.79	0.71	0.38	Large
TI -> TCR	0.27	0.01	0.27	Medium
TC -> TCR	0.27	0.23	0.05	Weak

Legend:
LOCDEP Location dependence
MCITU Intention to use mobile communication functionalities
MCPI Perceived impact on mobile work performance of mobile communication functionalities
MCPU Perceived usefulness of mobile communication functionalities
TC Task complexity
TCR Time criticality
TI Task interdependence

Source: Developed for this research

Furthermore, perceived usefulness of the mobile communication function is affected by time criticality (0.14) and location dependence (0.08) with a weak size effect. A weak size effect can also be determined for the impact of perceived usefulness on perceived impact on mobile work performance (0.14). A large size effect could be determined for the influence of intention to use on perceived impact on mobile work performance (0.38). Time criticality is influenced by task interdependence with a medium size effect (0.27) and by task complexity with a weak effect size (0.05).

Table 5.11 summarises the results for prediction relevance of this study's dependent variables.

Table 5.11 - Prediction relevance of the structural model for the mobile communication functionality

Dependent variable	Q^2	Has prediction relevance?
LOCDEP	0.21	Yes
MCITU	0.67	Yes
MCPI	0.72	Yes
MCPU	0.26	Yes
TCR	0.21	Yes

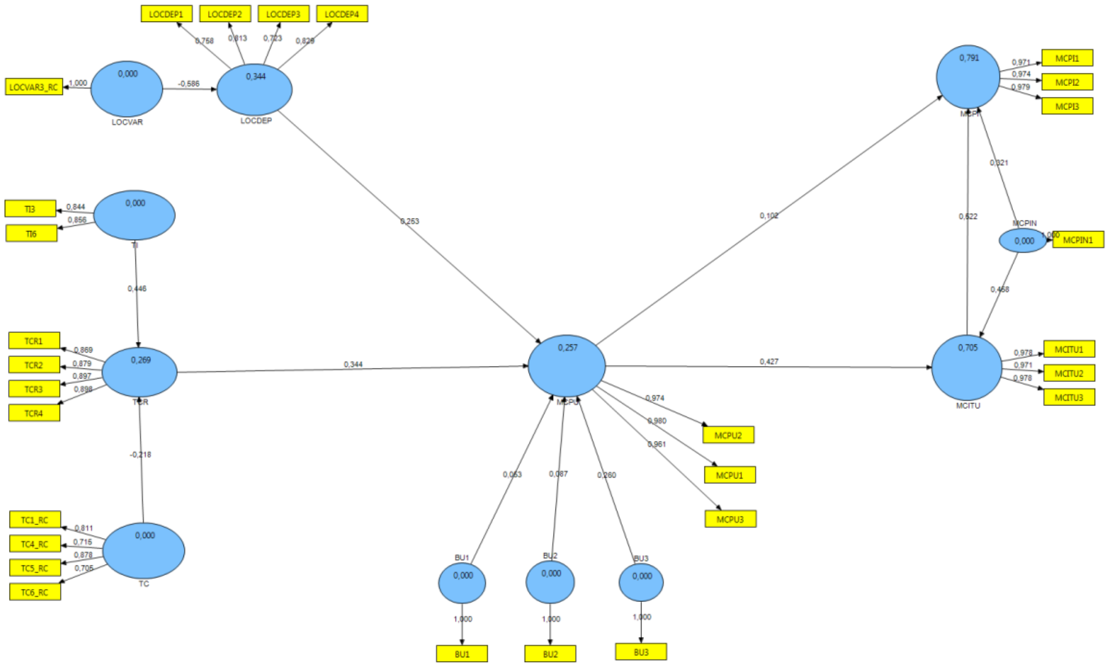
Legend:
LOCDEP Location dependence
MCITU Intention to use mobile communication functionalities
MCPI Perceived impact on mobile work performance of mobile communication functionalities
MCPU Perceived usefulness of mobile communication functionalities
TCR Time criticality

Source: Developed for this research

As all values for prediction relevance Q^2 are above the threshold of 0, the model's prediction relevance is granted.

Now that the assessment of the inner and outer model has been completed, the final structural model with all valid indicators and relationships can be presented. Figure 5.2 depicts the final structural model for the mobile communication functionality.

Figure 5.2 - Final structural model for the mobile communication functionality



Source: Developed for this research

Overall goodness of fit (GoF) of the mobile communication functionality

Table 5.12 summarises the results for R^2, communality and redundancy of the relevant research constructs to assess the overall GoF of the structural model for the mobile communication functionality.

Table 5.12 - R^2, communality, redundancy and GoF of the structural model for the mobile communication functionality

	R^2	Communality	Redundancy
LOCDEP	0.34	0.61	0.21
MCITU	0.70	0.95	0.50
MCPI	0.79	0.95	0.59
MCPU	0.31	0.94	-0.02
TC		0.61	
TCR	0.27	0.78	0.06
TI		0.72	
Average	0.47	0.80	0.27
Goodness of fit (GoF)	0.61		

Legend:
LOCDEP Location dependence
LOCVAR Location variety
MCITU Intention to use mobile communication functionalities
MCPI Perceived impact on mobile work performance of mobile communication functionalities
MCPIN Perceived degree of innovativeness of mobile communication functionalities
MCPU Perceived usefulness of mobile communication functionalities
TC Task complexity
TCR Time criticality
TI Task interdependence

Source: Developed for this research

Therefore, the results show that for mobile communication functionality, the model's overall effect size can be considered large (0.61). In addition, the effect size of the structural model is considered small (0.27) and the effect size of the measurement model is considered large (0.80).

5.4.2 Mobile information searching

Outer model assessment for the mobile information searching functionality

Table 5.13 presents the factor loadings for the indicators that meet the recommended threshold of 0.7 for factor loadings.

Table 5.13 - Factor loadings of the measurement model for the mobile information searching functionality

	LOCDEP	LOCVAR	MISITU	MISPI	MISPU	TC	TCR	TI
LOCDEP1	0.75							
LOCDEP2	0.80							
LOCDEP3	0.73							
LOCDEP4	0.84							
LOCVAR3_RC		1.00						
MISITU1			0.99					
MISITU2			0.98					
MISITU3			0.98					
MISPI1				0.98				
MISPI2				0.99				
MISPI3				0.99				
MISPU1					0.96			
MISPU2					0.96			
MISPU3					0.96			
TC1_RC						0.84		
TC5_RC						0.68		
TCR1							0.85	
TCR2							0.86	
TCR3							0.90	
TCR4							0.90	

	LOCDEP	LOCVAR	MISITU	MISPI	MISPU	TC	TCR	TI
TI3								0.83
TI6								0.87

Legend:
LOCDEP Location dependence
LOCVAR Location variety
MISITU Intention to use mobile information searching functionalities
MISPI Perceived impact on mobile work performance of mobile information searching functionalities
MISPIN Perceived degree of innovativeness of mobile information searching functionalities
MISPU Perceived usefulness of mobile information searching functionalities
TC Task complexity
TCR Time criticality
TI Task interdependence
_RC (recoded indicator)

Source: Developed for this research

Thereby, several indicators were dropped, namely two indicators from the location variance (LOCVAR1, LOCVAR2), four indicators from task complexity (TC2, TC3_RC, TC4_RC, TC6_RC), two indicators from time criticality (TCR6, TCR6) and four indicators from task interdependence (TI1_RC, TI2_RC, TI4_RC, TI5_RC) because factor loadings were below the recommended threshold of 0.7.

Based on the adapted model, the following values for AVE, CR and Cronbach's alpha were calculated.

Table 5.14 presents the AVE, CR and Cronbach’s alpha for the constructs in the mobile information searching functionality model.

Table 5.14 - AVE, CR and Cronbach's alpha of the measurement model for the mobile information searching functionality

	AVE	CR	Cronbach's alpha
LOCDEP	0.61	0.86	0.79
MISITU	0.97	0.99	0.98
MISPI	0.97	0.99	0.99
MISPU	0.92	0.97	0.96
TC	0.73	0.85	0.64
TCR	0.78	0.94	0.91
TI	0.72	0.84	0.62

Legend:

AVE	Average variance extracted
CR	Composite reliability
LOCDEP	Location dependence
MISITU	Intention to use mobile information searching functionalities
MISPI	Perceived impact on mobile work performance of mobile information searching functionalities
MISPU	Perceived usefulness of mobile information searching functionalities
TC	Task complexity
TCR	Time criticality
TI	Task interdependence

Source: Developed for this research

All values for CR and AVE for the outer model of mobile information searching functionalities are within the predefined thresholds. For Cronbach's alpha, the values for task complexity and task interdependence were slightly below the threshold of 0.7. As Cronbach's alpha has been found to underestimate the reliability of a construct, CR is considered a more appropriate measure for reliability (Henseler et al. 2009; Nitzl 2010; Werts et al. 1974). Thereby, the analysis for discriminant validity can proceed.

Table 5.15 summarises the results for the discriminant validity analysis of the measurement model of the mobile information searching functionality.

Table 5.15 - Discriminant validity of the measurement model for the mobile information searching functionality

	LOCDEP	LOCVAR	MISITU	MISPI	MISPIN	MISPU	TC	TCR	TI
LOCDEP	**(0.78)**								
LOCVAR	-0.58	**(1.00)**							
MISITU	0.43	-0.16	**(0.98)**						
MISPI	0.41	-0.10	0.92	**(0.98)**					
MISPIN	0.44	-0.19	0.91	0.89	**(1.00)**				
MISPU	0.40	-0.10	0.94	0.96	0.92	**(0.96)**			
TC	-0.05	0.03	-0.07	-0.08	-0.10	-0.05	**(0.85)**		
TCR	0.36	-0.15	0.43	0.45	0.46	0.43	-0.30	**(0.88)**	
TI	0.47	-0.17	0.47	0.51	0.44	0.49	-0.13	0.47	**(0.85)**

Legend:

LOCDEP	Location dependence
LOCVAR	Location variety
MISITU	Intention to use mobile information searching functionalities
MISPI	Perceived impact on mobile work performance of mobile information searching functionalities
MISPIN	Perceived degree of innovativeness of mobile information searching functionalities
MISPU	Perceived usefulness of mobile information searching functionalities
TC	Task complexity
TCR	Time criticality
TI	Task interdependence

Source: Developed for this research

As no correlations between each construct could be determined—and other constructs are above the square root of AVE of each construct—the measurement model displays adequate discriminant validity and inner model assessment can proceed.

Inner model assessment of the mobile information searching functionality

Next, the significance of the model’s path coefficients is examined.

Table 5.16 summarises the results for the path coefficients of the structural model for the mobile information searching functionality and considers only significant relationships. Table A4.2 (appendix 4) summarises the results for all relationships in this specific model.

Table 5.16 - Path coefficients of the structural model for the mobile information searching functionality

Relationship investigated	Original sample (208)	Sample mean (500)	T Statistics (|O/STERR|)
BU3 -> MISPU	0.23	0.23	2.11**
Job role -> MISPU	0.11	0.11	2.58***
LOCDEP -> MISPU	0.22	0.22	2.91***
LOCVAR -> LOCDEP	-0.58	-0.58	11.53***
MISITU -> MISPI	0.18	0.18	3.28***
MISPIN -> MISITU	0.30	0.30	4.13***
MISPU -> MISITU	0.66	0.67	9.24***
MISPU -> MISPI	0.79	0.79	14.97***
TC -> TCR	-0.24	-0.25	3.74***
TCR -> MISPU	0.23	0.24	2.85***
TI -> MISPU	0.26	0.26	3.02***
TI -> TCR	0.44	0.44	6.81***
Tenure -> MISPU	-0.14	-0.14	2.14**

Legend:

LOCDEP	Location dependence
LOCVAR	Location variety
MISITU	Intention to use mobile information searching functionalities
MISPI	Perceived impact on mobile work performance of mobile information searching functionalities
MISPIN	Perceived degree of innovativeness of mobile information searching functionalities
MISPU	Perceived usefulness of mobile information searching functionalities
TC	Task complexity
TCR	Time criticality
TI	Task interdependence
*	95% significance level
**	99% significance level
***	99.9% significance level

Source: Developed for this research

Based on the assessment of the structural model using bootstrapping to determine the significance of the hypothesised relationships by calculating T-values, the following conclusions can be drawn. Perceived usefulness of the mobile information searching functionality is positively affected by location dependence (0.22), time criticality (0.23) and task interdependence (0.26). In addition, both task complexity (-0.24) and task interdependence (0.44) affect time criticality negatively and positively respectively. Furthermore, location dependence is strongly negatively affected by location variance (-0.58).

Perceived usefulness of mobile information searching functionalities positively affects intention to use (0.66); and perceived impact on mobile work performance (0.79) which is also directly positively affected by intention to use (0.18).

Furthermore, supervisors perceive mobile information searching functionalities to be 11% more useful than the operational sales-force workers. Participants from business unit 3 perceive mobile information searching functionalities to be 23% more useful than the participants from business unit 4. In addition, the higher length of tenure, the less useful mobile information searching functionalities are perceived (-0.14). Perceived degree of innovativeness of the mobile information searching functionality positively affects intention to use mobile information searching functionalities (0.30).

Table 5.17 summarises the results for the coefficient of determination (R^2) of this research's dependent variables.

Table 5.17 - R^2 of structural model for mobile information searching functionality

Dependent variable	**R^2**	**Interpretation**
LOCDEP	0.34	Moderate
MISITU	0.89	Substantial
MISPI	0.92	Substantial
MISPU	0.37	Moderate
TCR	0.28	Weak

Legend:
LOCDEP Location dependence
MISITU Intention to use mobile information searching functionalities
MISPI Perceived impact on mobile work performance of mobile information searching functionalities
MISPU Perceived usefulness of mobile information searching functionalities
TCR Time criticality

Source: Developed for this research

Based on the above results, a substantial value for R^2 for intention to use (0.89), perceived impact on mobile work performance (0.92) and a moderate value for R^2 for location dependence (0.34) and perceived usefulness (0.37) was determined. For the time criticality construct (0.28), a weak value for R^2 was calculated.

Table 5.18 summarises the total effect size of the structural model investigated.

Table 5.18 - Total effects of the structural model for the mobile information searching functionality

	$R^2_{included}$	$R^2_{excluded}$	f^2	Interpretation of effect size
LOCDEP -> MISPU	0.37	0.34	0.06	Weak
TCR -> MISPU	0.37	0.33	0.06	Weak
MISPU -> MISPI	0.92	0.85	0.98	Large
MISITU -> MISPI	0.92	0.92	0.05	Weak
TI -> MISPU	0.37	0.32	0.07	Weak
TI -> TCR	0.28	0.10	0.26	Medium
TC -> TCR	0.28	0.23	0.08	Weak

Legend:
LOCDEP Location dependence
LOCVAR Location variety
MISITU Intention to use mobile information searching functionalities
MISPI Perceived impact on mobile work performance of mobile information searching functionalities
MISPIN Perceived degree of innovativeness of mobile information searching functionalities
MISPU Perceived usefulness of mobile information searching functionalities
TC Task complexity
TCR Time criticality
TI Task interdependence

Source: Developed for this research

Thereby, perceived usefulness of the mobile information searching functionality is affected by time criticality (0.06), location dependence (0.06) and task interdependence (0.07) with a small size effect. Perceived impact on mobile work performance of the mobile information searching functionality is affected by perceived usefulness with a large size effect (0.98) and by intention to use with a weak size effect (0.05). Time criticality is affected by task interdependence with a medium size effect (0.26) and by task complexity with a weak size effect (0.08).

Table 5.19 summarises the results for the prediction relevance of the dependent variables of the current model investigated.

Table 5.19 - Prediction relevance of the structural model for the mobile information searching functionality

Dependent variable	Q^2	Has prediction relevance?
LOCDEP	0.35	Yes
MISITU	0.87	Yes
MISPI	0.97	Yes
MISPU	0.92	Yes
TCR	0.79	Yes

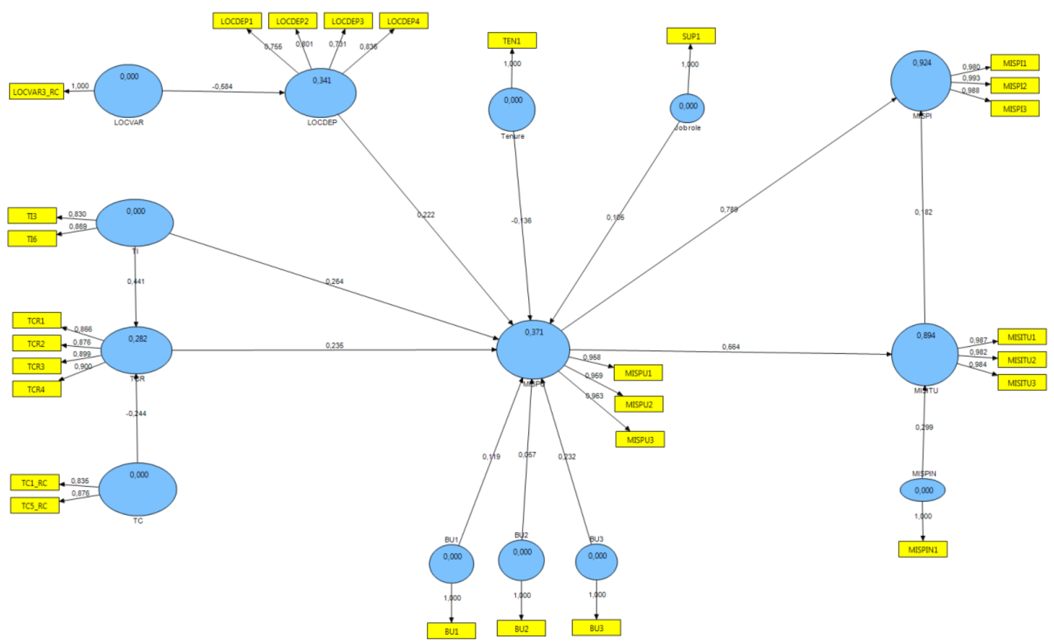
Legend:
LOCDEP Location dependence
MISITU Intention to use mobile information searching functionalities
MISPI Perceived impact on mobile work performance of mobile information searching functionalities
MISPU Perceived usefulness of mobile information searching functionalities
TCR Time criticality

Source: Developed for this research

For all dependent variables investigated, prediction relevance can be determined.

Figure 5.3 shows the final structural model for the mobile information searching functionality.

Figure 5.3 - Final structural model for the mobile information searching functionality



Source: Developed for this research

Overall GoF of the mobile information searching functionality

Table 5.20 summarises the results for R^2, communality and redundancy for the constructs investigated to determine the model's overall GoF.

Table 5.20 - R^2, communality, redundancy and GoF of the structural model for the mobile information searching functionality

	R^2	Communality	Redundancy
LOCDEP	0.34	0.61	0.21
MISITU	0.89	0.97	0.44
MISPI	0.92	0.97	0.29
MISPU	0.37	0.92	-0.03
TC		0.73	
TCR	0.28	0.78	0.07
TI		0.72	
Average	0.56	0.82	0.20
Goodness of fit (GoF)	0.68		

Legend:
LOCDEP Location dependence
LOCVAR Location variety
MISITU Intention to use mobile information searching functionalities
MISPI Perceived impact on mobile work performance of mobile information searching functionalities
MISPIN Perceived degree of innovativeness of mobile information searching functionalities
MISPU Perceived usefulness of mobile information searching functionalities
TC Task complexity
TCR Time criticality
TI Task interdependence

Source: Developed for this research

The results show that there is a large size effect for the overall model (0.68), a large size effect for the measurement model (0.82) and a small size effect for the structural model (0.20).

5.4.3 Mobile transaction processing

Outer model assessment for the mobile transaction processing functionality

Table 5.21 summarises the factor loadings of all indicators that meet the threshold of 0.7 for the measurement model discussed in this subsection.

Table 5.21 - Factor loadings of the measurement model for the mobile transaction processing functionality

	LOCDEP	LOCVAR	MTPITU	MTPPI	MTPPU	TC	TCR	TI
LOCDEP1	0.77							
LOCDEP2	0.80							
LOCDEP3	0.71							
LOCDEP4	0.84							
LOCVAR3_RC		1.00						
MTPITU1			0.99					
MTPITU2			0.98					
MTPITU3			0.99					
MTPPI1				0.99				
MTPPI2				0.99				
MTPPI3				0.99				
MTPPU1					0.98			
MTPPU2					0.98			
MTPPU3					0.98			
TC1_RC						0.81		
TC4_RC						0.71		
TC5_RC						0.88		
TC6_RC						0.70		
TCR1							0.87	
TCR2							0.87	
TCR3							0.90	

	LOCDEP	LOCVAR	MTPITU	MTPPI	MTPPU	TC	TCR	TI
TCR4							0.90	
TI3								0.84
TI6								0.86

Legend:

LOCDEP	Location dependence
LOCVAR	Location variety
MTPITU	Intention to use mobile transaction processing functionalities
MTPPI	Perceived impact on mobile work performance of mobile transaction processing functionalities
MTPPIN	Perceived degree of innovativeness of mobile transaction processing functionalities
MTPPU	Perceived usefulness of mobile transaction processing functionalities
TC	Task complexity
TCR	Time criticality
TI	Task interdependence

Source: Developed for this research

All indicators listed in table 5.21 were considered valid. Thereby, two indicators from location variety (LOCVAR1, LOCVAR2), two indicators from task complexity (TC2, TC3_RC), two indicators from time criticality (TCR5, TCR6) and four indicators from task interdependence (TI1_RC, TI2_RC, TI4_RC, TI5_RC) were dropped because they were below the recommended level of 0.7.

Table 5.22 summarises the values for AVE, CR and Cronbach's alpha of the measurement model for the mobile transaction processing functionality.

Table 5.22 - AVE, CR and Cronbach's alpha of the measurement model for the mobile transaction processing functionality

	AVE	CR	Cronbach's alpha
LOCDEP	0.61	0.86	0.79
MTPITU	0.97	0.99	0.99
MTPPI	0.98	0.99	0.99
MTPPU	0.96	0.99	0.98
TC	0.61	0.86	0.64
TCR	0.78	0.94	0.91
TI	0.72	0.84	0.62

Legend:
AVE Average variance extracted
CR Composite reliability
LOCDEP Location dependence
LOCVAR Location variety
MTPITU Intention to use mobile transaction processing functionalities
MTPPI Perceived impact on mobile work performance of mobile transaction processing functionalities
MTPPIN Perceived degree of innovativeness of mobile transaction processing functionalities
MTPPU Perceived usefulness of mobile transaction processing functionalities
TC Task complexity
TCR Time criticality
TI Task interdependence

Source: Developed for this research

For AVE and CR values of the constructs in the model, no reliability or validity issues could be identified, as all defined thresholds were met. For Cronbach's alpha, the values for task complexity and task interdependence were slightly below the threshold of 0.7. Compared to Cronbach's alpha, CR is considered a more appropriate measure for reliability (Henseler et al. 2009; Nitzl 2010; Werts et al. 1974). Thereby, no further modifications to the outer model are necessary at this stage.

Table 5.23 summarises the results for the discriminant validity analysis.

Table 5.23 - Discriminant validity of the measurement model for the mobile transaction processing functionality

	LOCDEP	LOCVAR	MTPITU	MTPPI	MTPPIN	MTPPU	TC	TCR	TI
LOCDEP	**(0.78)**								
LOCVAR	-0.58	**(1.00)**							
MTPITU	0.42	-0.17	**(0.98)**						
MTPPI	0.38	-0.09	0.93	**(0.99)**					
MTPPIN	0.35	-0.05	0.90	0.91	**(1.00)**				
MTPPU	0.39	-0.12	0.94	0.98	0.92	**(0.98)**			
TC	-0.05	0.03	-0.15	-0.11	-0.17	-0.15	**(0.78)**		
TCR	0.35	-0.15	0.44	0.40	0.44	0.37	-0.30	**(0.88)**	
TI	0.46	-0.16	0.36	0.36	0.43	0.36	-0.14	0.47	**(0.85)**

Legend:

LOCDEP	Location dependence
LOCVAR	Location variety
MTPITU	Intention to use mobile transaction processing functionalities
MTPPI	Perceived impact on mobile work performance of mobile transaction processing functionalities
MTPPIN	Perceived degree of innovativeness of mobile transaction processing functionalities
MTPPU	Perceived usefulness of mobile transaction processing functionalities
TC	Task complexity
TCR	Time criticality
TI	Task interdependence

Source: Developed for this research

Thereby, all correlations are below the value of the square root of AVE and discriminant validity can be established for the mobile transaction processing functionality.

Inner model assessment of the mobile transaction processing functionality

Table 5.24 summarises the path coefficients of the mobile transaction processing functionality and lists only significant relationships. Table A4.3 in appendix 4 summarises the results for all relationships in this specific model.

Table 5.24 - Path coefficients of the structural model for the mobile transaction processing functionality

Relationship investigated	Original sample (208)	Sample mean (500)	T Statistics (|O/STERR|)
BU3 -> MTPPU	0.26	0.26	2.49**
LOCDEP -> MTPPU	0.34	0.34	6.01***
LOCVAR -> LOCDEP	-0.58	-0.59	11.74***
MTPITU -> MTPPI	0.12	0.13	3.01***
MTPPIN -> MTPITU	0.20	0.20	3.16***
MTPPU -> MTPITU	0.76	0.75	12.62***
MTPPU -> MTPPI	0.86	0.86	21.61***
TC -> TCR	-0.22	-0.23	3.27***
TCR -> MTPPU	0.30	0.30	4.18***
TI -> TCR	0.45	0.45	7.49***
Tenure -> MTPPU	-0.10	-0.09	2.35**

Legend:

LOCDEP	Location dependence
LOCVAR	Location variety
MTPITU	Intention to use mobile transaction processing functionalities
MTPPI	Perceived impact on mobile work performance of mobile transaction processing functionalities
MTPPIN	Perceived degree of innovativeness of mobile transaction processing functionalities
MTPPU	Perceived usefulness of mobile transaction processing functionalities
TC	Task complexity
TCR	Time criticality
TI	Task interdependence
*	95% significance level
**	99% significance level
***	99.9% significance level

Source: Developed for this research

Perceived usefulness of the mobile transaction processing functionality is significantly positively affected by location dependence (0.34) and time criticality (0.30) and positively affects perceived impact on mobile work performance (0.86) and intention to use (0.76) mobile transaction processing functionalities. In addition, intention to use of this construct also has a direct positive effect on perceived impact on mobile work performance (0.12). Furthermore, time criticality is negatively affected by task complexity (-0.22) and positively affected by task interdependence (0.45).

In addition, perceived degree of innovativeness of mobile transaction processing functionalities directly positively impacts on intention to use (0.20). In addition, business unit 3 perceives mobile transaction processing to be 26 percent more useful than the reference category business unit 4. Last but not least, length of tenure and perceived usefulness of mobile transaction processing functionalities are inversely related (-0.10).

Table 5.25 summarises the results for R^2 of the dependent variables of the mobile transaction processing functionality.

Table 5.25 - R^2 of the structural model for the mobile transaction processing functionality

Dependent variable	**R^2**	**Interpretation**
LOCDEP	0.34	Moderate
MTPITU	0.89	Substantial
MTPPI	0.96	Substantial
MTPPU	0.27	Weak
TCR	0.27	Weak

Legend:
LOCDEP Location dependence
MTPITU Intention to use mobile transaction processing functionalities
MTPPI Perceived impact on mobile work performance of mobile transaction processing functionalities
MTPPU Perceived usefulness of mobile transaction processing functionalities
TCR Time criticality

Source: Developed for this research

Based on the analysis for the coefficient of determination (R^2) for all dependent variables, it was determined that location dependence (0.34) has a moderate value for R^2, while intention to use (0.89) and perceived impact on mobile work performance (0.96) have a substantial value for R^2. A weak value for R^2 was calculated for perceived usefulness (0.27) and time criticality (0.27).

Table 5.26 summarises the results for total effects.

Table 5.26 - Total effects of the structural model for the mobile transaction processing functionality

Dependent variable	$R^2_{included}$	$R^2_{excluded}$	f^2	Interpretation of effect size
LOCDEP -> MTPPU	0.34	0.18	0.25	Medium
TCR -> MTPPU	0.27	0.20	0.10	Weak
MTPPU -> MTPPI	0.96	0.94	0.46	Large
MTPITU -> MTPPI	0.96	0.96	0.05	Weak
TI -> TCR	0.27	0.08	0.27	Medium
TC -> TCR	0.27	0.23	0.06	Weak

Legend:
LOCDEP Location dependence
MTPITU Intention to use mobile transaction processing functionalities
MTPPI Perceived impact on mobile work performance of mobile transaction processing functionalities
MTPPU Perceived usefulness of mobile transaction processing functionalities
TC Task complexity
TCR Time criticality
TI Task interdependence

Source: Developed for this research

A weak effect size could be determined for the impact of time criticality on perceived usefulness, for task complexity on time criticality and for intention to use on perceived impact on mobile work performance. A medium effect size could be determined for the influence of location dependence on perceived usefulness and for the impact of task interdependence on time criticality. A large effect size could be determined for the impact of perceived usefulness on perceived impact on mobile work performance.

Table 5.27 summarises the results for the prediction relevance of the current model investigated.

Table 5.27 - Prediction relevance of the structural model for the mobile transaction processing functionality

Dependent variable	Q^2	Has prediction relevance?
LOCDEP	0.61	Yes
MTPITU	0.97	Yes
MTPPI	0.98	Yes
MTPPU	0.96	Yes
TCR	0.79	Yes

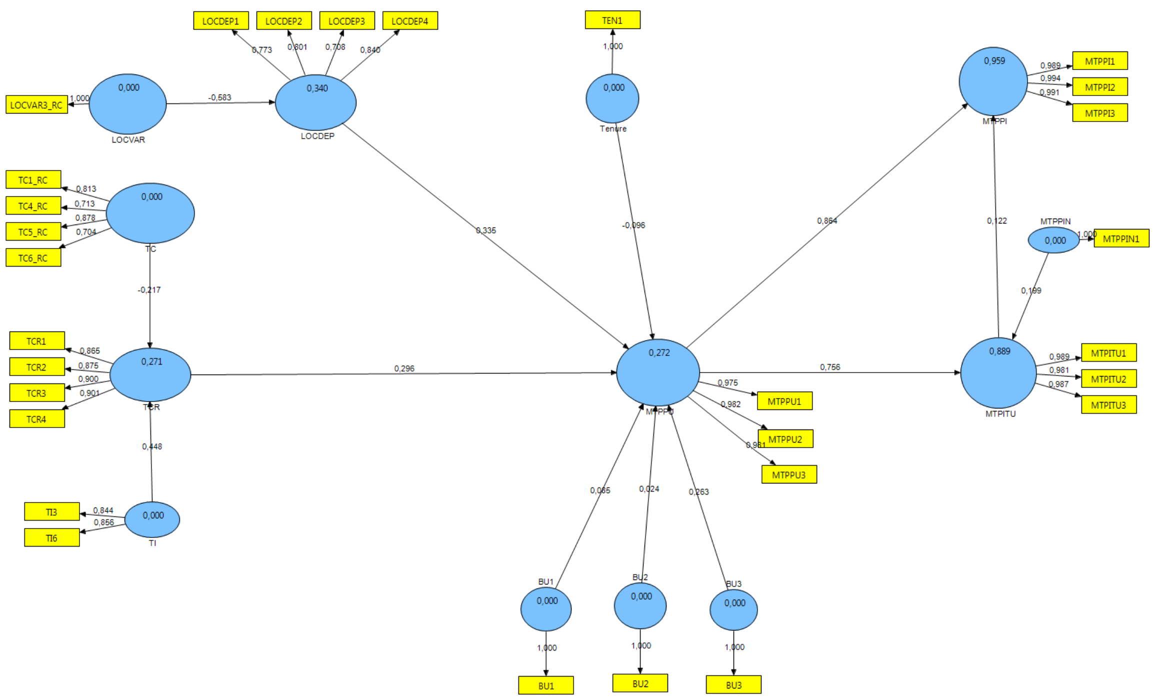
Legend:
LOCDEP Location dependence
MTPITU Intention to use mobile transaction processing functionalities
MTPPI Perceived impact on mobile work performance of mobile transaction processing functionalities
MTPPU Perceived usefulness of mobile transaction processing functionalities
TCR Time criticality

Source: Developed for this research

Thereby, the Stone-Geisser criterion (Q^2) calculated for all dependent variables is above the threshold of 0 such that the prediction relevance of the dependent variables is established.

Figure 5.4 depicts the final structural model for the mobile transaction processing functionality.

Figure 5.4 - Final structural model for the mobile transaction processing functionality



Source: Developed for this research

Overall GoF

Table 5.28 summarises the results for the average R^2, communality, redundancy and the calculation of the final GoF index.

Table 5.28 - R^2, communality, redundancy and GoF of the structural model for the mobile transaction processing functionality

	R^2	Communality	Redundancy
LOCDEP	0.34	0.61	0.21
MTPITU	0.89	0.97	0.31
MTPPI	0.96	0.98	0.21
MTPPU	0.27	0.96	-0.01
TC		0.73	
TCR	0.27	0.78	0.07
TI		0.72	
Average	0.55	0.82	0.16
Goodness of fit (GoF)	0.67		

Source: Developed for this research

Thereby, the model's overall effect size of the model for mobile transaction processing is considered large (0.67), with a small size effect for the structural model (0.16) and a large-size effect for the measurement model (0.82).

5.4.4 Mobile job scheduling and dispatching

Outer model assessment of the mobile job scheduling and dispatching functionality

Table 5.29 presents the factor loadings of the measurement model for the mobile job scheduling and dispatching functionality.

Table 5.29 - Factor loadings of the measurement model for the mobile job scheduling and dispatching functionality

	LOCDEP	LOCVAR	MJSITU	MJSPI	MJSPU	TC	TCR	TI
LOCDEP1	0.77							

	LOCDEP	LOCVAR	MJSITU	MJSPI	MJSPU	TC	TCR	TI
LOCDEP2	0.81							
LOCDEP3	0.72							
LOCDEP4	0.83							
LOCVAR3_RC		1.00						
MJSITU1			0.94					
MJSITU2			0.93					
MJSITU3			0.93					
MJSPI1				0.90				
MJSPI2				0.91				
MJSPI3				0.89				
MJSPU1					0.93			
MJSPU2					0.94			
MJSPU3					0.92			
TC1_RC						0.81		
TC4_RC						0.71		
TC5_RC						0.89		
TCR1							0.86	
TCR2							0.87	
TCR3							0.90	
TCR4							0.90	
TI3								0.83
TI6								0.87

Legend:

LOCDEP	Location dependence
LOCVAR	Location variety
MJSITU	Intention to use mobile job scheduling and dispatching functionalities
MJSPI	Perceived impact on mobile work performance of mobile job scheduling and dispatching functionalities
MJSPIN	Perceived degree of innovativeness of mobile job scheduling and dispatching functionalities
MJSPU	Perceived usefulness of mobile job scheduling and dispatching functionalities
TC	Task complexity
TCR	Time criticality
TI	Task interdependence

Source: Developed for this research

As with the other mobile work support functions, several indicators needed to be dropped, as their factors loadings did not meet the predefined threshold of 0.7.

Table 5.30 shows the results for AVE, CR and Cronbach's alpha.

Table 5.30 - AVE, CR and Cronbach's alpha of the measurement model for the mobile job scheduling and dispatching functionality

	AVE	CR	Cronbach's alpha
LOCDEP	0.61	0.86	0.79
MJSITU	0.86	0.95	0.92
MJSPI	0.81	0.93	0.89
MJSPU	0.87	0.95	0.92
TC	0.73	0.85	0.64
TCR	0.78	0.94	0.94
TI	0.72	0.84	0.62

Legend:
AVE Average variance extracted
CR Composite reliability
LOCDEP Location dependence
MJSITU Intention to use mobile job scheduling and dispatching functionalities
MJSPI Perceived impact on mobile work performance of mobile job scheduling and dispatching functionalities
MJSPU Perceived usefulness of mobile job scheduling and dispatching functionalities
TC Task complexity
TCR Time criticality
TI Task interdependence

Source: Developed for this research

For Cronbach's alpha, the values for task complexity and task interdependence were slightly below the threshold of 0.7. Compared to Cronbach's alpha, CR is considered a more appropriate measure for reliability. As the thresholds for AVE and CR were met for all constructs, no further modification to the outer model are necessary at this stage.

Table 5.31 summarises the results of the discriminant validity analysis.

Table 5.31 - Discriminant validity of the measurement model for the mobile job scheduling and dispatching functionality

	LOCDEP	LOCVAR	MJSITU	MJSPI	MJSPIN	MJSPU	TC	TCR	TI
LOCDEP	**(0.78)**								
LOCVAR	-0.58	**(1.00)**							
MJSITU	0.35	-0.14	**(0.93)**						
MJSPI	0.26	-0.07	0.85	**(0.93)**					
MJSPIN	0.32	-0.11	0.78	0.77	**(1.00)**				
MJSPU	0.29	-0.09	0.87	0.91	0.80	**(0.93)**			
TC	-0.05	0.03	-0.12	-0.05	-0.17	-0.09	**(0.85)**		
TCR	0.35	-0.15	0.40	0.32	0.32	0.34	-0.30	**(0.88)**	
TI	0.46	-0.16	0.35	0.28	0.39	0.31	-0.14	0.47	**(0.85)**

Legend:

LOCDEP	Location dependence
LOCVAR	Location variety
MJSITU	Intention to use mobile job scheduling and dispatching functionalities
MJSPI	Perceived impact on mobile work performance of mobile job scheduling and dispatching functionalities
MJSPIN	Perceived degree of innovativeness of mobile job scheduling and dispatching functionalities
MJSPU	Perceived usefulness of mobile job scheduling and dispatching functionalities
TC	Task complexity
TCR	Time criticality
TI	Task interdependence

Source: Developed for this research

The investigation of discriminant validity reveals that all correlations were below the threshold calculated from the square root of AVE.

Inner model assessment of the mobile job scheduling and dispatching functionality

Table 5.32 summarises the results for the path coefficients analysis and lists only significant relationships. In appendix 4, table A4.4 summarises the results for all relationships in this specific model.

Table 5.32 - Path coefficients of the structural model for the mobile job scheduling and dispatching functionality

Relationship investigated	Original sample (208)	Sample mean (500)	T Statistics (|O/STERR|)
BU3 -> MJSPU	0.29	0.29	3.27***
Job role -> MJSPU	0.11	0.11	1.84*
LOCDEP -> MJSPU	0.22	0.22	3.27***
LOCVAR -> LOCDEP	-0.58	-0.59	11.73***
MJSITU -> MJSPI	0.22	0.22	3.68***
MJSPIN -> MJSITU	0.24	0.24	3.81***
MJSPU -> MJSITU	0.68	0.68	11.31***
MJSPU -> MJSPI	0.72	0.73	13.12***
TC -> TCR	-0.23	-0.24	3.62***
TCR -> MJSPU	0.27	0.28	3.93***
TI -> TCR	0.44	0.45	7.15***

Legend:
LOCDEP Location dependence
LOCVAR Location variety
MJSITU Intention to use mobile job scheduling and dispatching functionalities
MJSPI Perceived impact on mobile work performance of mobile job scheduling and dispatching functionalities
MJSPIN Perceived degree of innovativeness of mobile job scheduling and dispatching functionalities
MJSPU Perceived usefulness of mobile job scheduling and dispatching functionalities
TC Task complexity
TCR Time criticality
TI Task interdependence

* 95% significance level
** 99% significance level
*** 99.9% significance level

Source: Developed for this research

Time criticality is negatively affected by task complexity (-0.23) and positively affected by task interdependence (0.44). Perceived usefulness of mobile job scheduling and dispatching is positively affected by location dependence (0.22) and time criticality (0.27). Furthermore, perceived usefulness positively affects perceived impact on mobile work performance (0.72) and intention to use (0.68) this specific mobile work support function. Intention to use also directly positively affects perceived impact on mobile work performance (0.22).

The perceived degree of innovativeness directly affects intention to use on a significant level (0.24). Business 3 perceives mobile job scheduling and dispatching to be 29% more useful than the reference category (business unit 4).

Last but not least, supervisors perceive mobile job scheduling and dispatching functionalities to be 11% more useful than operational sales-force workers.

Table 5.33 summarises the results for R^2 of the current structural model investigated.

Table 5.33 - R^2 of the structural model for the mobile job scheduling and dispatching functionality

Dependent variable	R^2	Interpretation
LOCDEP	0.34	Moderate
MJSITU	0.78	Substantial
MJSPI	0.84	Substantial
MJSPU	0.21	Weak
TCR	0.28	Weak

Legend:
LOCDEP Location dependence
MJSITU Intention to use mobile job scheduling and dispatching functionalities
MJSPI Perceived impact on mobile work performance of mobile job scheduling and dispatching functionalities
MJSPU Perceived usefulness of mobile job scheduling and dispatching functionalities
TCR Time criticality

Source: Developed for this research

Thereby, the results for R^2 of all dependent variables is above the defined threshold of 0.19, with a weak R^2 value for perceived usefulness (0.21) and time criticality (0.28), a moderate R^2 value for location dependence (0.34) and substantial R^2 values for intention to use (0.78) and perceived impact on mobile work performance (0.84).

Table 5.34 summarises the results for the total effects analysis.

Table 5.34 - Total effects of the structural model for the mobile job scheduling and dispatching functionality

	$R^2_{included}$	$R^2_{excluded}$	f^2	Interpretation of effect size
LOCDEP -> MJSPU	0.21	0.17	0.05	Weak
TCR -> MJSPU	0.21	0.15	0.07	Weak
MJSPU -> MJSPI	0.84	0.72	0.80	Strong
MJSITU -> MJSPI	0.84	0.84	0.06	Weak
TI -> TCR	0.28	0.10	0.26	Medium
TC -> TCR	0.28	0.23	0.07	Weak

Legend:
LOCDEP Location dependence
MJSITU Intention to use mobile job scheduling and dispatching functionalities
MJSPI Perceived impact on mobile work performance of mobile job scheduling and dispatching functionalities
MJSPU Perceived usefulness of mobile job scheduling and dispatching functionalities
TC Task complexity
TCR Time criticality
TI Task interdependence

Source: Developed for this research

Perceived usefulness of mobile job scheduling and dispatching is affected by location dependence and by time criticality with a weak effect size. Perceived impact on mobile work performance is affected by perceived usefulness (strong size effect) and intention to use (weak size effect). Time criticality is affected by task interdependence (medium size effect) and by task complexity (weak size effect).

Table 5.35 summarises the results for prediction relevance.

Table 5.35 - Prediction relevance of the structural model for the mobile job scheduling and dispatching functionality

Dependent variable	Q^2	Has prediction relevance?
LOCDEP	0.61	Yes
MJSITU	0.86	Yes
MJSPI	0.81	Yes
MJSPU	0.87	Yes
TCR	0.73	Yes

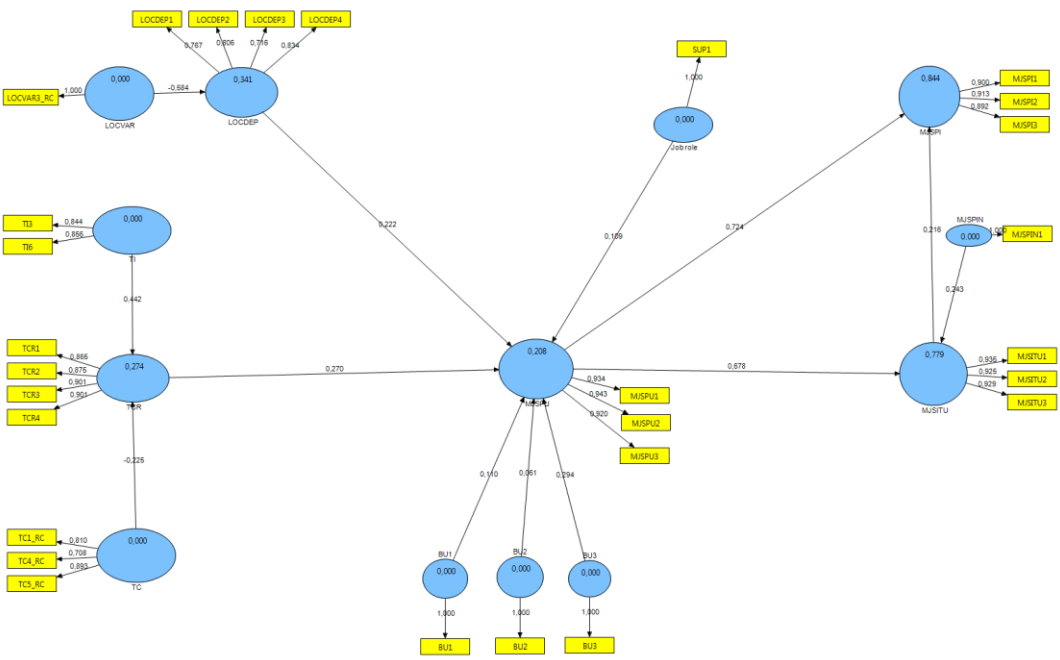
Legend:
LOCDEP Location dependence
MJSITU Intention to use mobile job scheduling and dispatching functionalities
MJSPI Perceived impact on mobile work performance of mobile job scheduling and dispatching functionalities
MJSPU Perceived usefulness of mobile job scheduling and dispatching functionalities
TCR Time criticality

Source: Developed for this research

Thereby, prediction relevance for all dependent variables could be determined.

Figure 5.5 shows the final structural model for the mobile job scheduling and dispatching functionality.

Figure 5.5 - Final structural model for the mobile job scheduling & dispatching functionality



Source: Developed for this research

Overall GoF for the mobile job scheduling and dispatching functionality

Table 5.36 summarises the results for all relevant indices for the determination of overall GoF of the mobile job scheduling and dispatching functionality model.

Table 5.36 - R^2, communality, redundancy and GoF of the structural model for the mobile job scheduling & dispatching functionality

	R^2	Communality	Redundancy
LOCDEP	0.34	0.61	0.21
MJSITU	0.78	0.86	0.28
MJSPI	0.84	0.81	0.26
MJSPU	0.21	0.87	-0.02
TC		0.73	
TCR	0.28	0.78	0.07
TI		0.72	
Average	0.49	0.77	0.16
Goodness of fit (GoF)	0.62		

Legend:
LOCDEP Location dependence
MJSITU Intention to use mobile job scheduling and dispatching functionalities
MJSPI Perceived impact on mobile work performance of mobile job scheduling and dispatching functionalities
MJSPU Perceived usefulness of mobile job scheduling and dispatching functionalities
TC Task complexity
TCR Time criticality
TI Task interdependence

Source: Developed for this research

Based on the results for the average R^2, communality and redundancy, it was established that for the mobile job scheduling and dispatching functionality there is a strong effect size of the measurement model (0.77), a weak effect size of the structural model (0.16) and a strong effect size of the whole model (0.62).

5.4.5 Location-related services

Outer model assessment of the location-related services functionality

Table 5.37 shows the factor loadings of the measurement model for the location-related services functionality that met the threshold of 0.7.

Table 5.37 - Factor loadings of the measurement model for the location-related services functionality

	LOCDEP	LOCVAR	LRSITU	LRSPI	LRSPU	TC	TCR	TI
LOCDEP1	0.77							
LOCDEP2	0.80							
LOCDEP3	0.72							
LOCDEP4	0.84							
LOCVAR3_RC		1.00						
LRSITU1			0.96					
LRSITU2			0.95					
LRSITU3			0.95					
LRSPI1				0.95				
LRSPI2				0.95				
LRSPI3				0.95				
LRSPU1					0.95			
LRSPU2					0.94			
LRSPU3					0.95			
TC1_RC						0.81		
TC4_RC						0.71		
TC5_RC						0.89		
TCR1							0.86	
TCR2							0.87	
TCR3							0.90	
TCR4							0.90	

	LOCDEP	LOCVAR	LRSITU	LRSPI	LRSPU	TC	TCR	TI
TI3								0.84
TI6								0.86

Legend:
LOCDEP Location dependence
LOCVAR Location variety
LRSITU Intention to use location-related services functionalities
LRSPI Perceived impact on mobile work performance of location-related services functionalities
LRSPIN Perceived degree of innovativeness of location-related services functionalities
LRSPU Perceived usefulness of location-related services functionalities
TC Task complexity
TCR Time criticality
TI Task interdependence

Source: Developed for this research

All the indicators listed in table 5.37 were retained; all other indicators were dropped due to low factor loadings below the recommended threshold of 0.7. These were LOCVAR1, LOCVAR2, TC2, TC3, TC6 ,TI1_RC, TI2_RC, TI4_RC and TI5_RC.

Table 5.38 summarises the results for AVE, CR and Cronbach's alpha to determine reliability and validity of the measurement model of location-related services functionality.

Table 5.38 - AVE, CR and Cronbach's alpha of measurement model for the location-related services functionality

	AVE	CR	Cronbach's alpha
LOCDEP	0.61	0.86	0.79
LRSITU	0.91	0.97	0.91
LRSPI	0.91	0.97	0.91
LRSPU	0.90	0.96	0.90
TC	0.73	0.85	0.64
TCR	0.78	0.94	0.91
TI	0.72	0.84	0.62

Legend:
AVE Average variance extracted
CR Composite reliability
LOCDEP Location dependence
LRSITU Intention to use location-related services functionalities
LRSPI Perceived impact on mobile work performance of location-related services functionalities
LRSPU Perceived usefulness of location-related services functionalities
TC Task complexity
TCR Time criticality
TI Task interdependence

Source: Developed for this research

As with the other mobile work support functions discussed earlier, acceptable results for AVE and CR could be determined. For Cronbach's alpha, the values for task complexity and task interdependence were slightly below the threshold of 0.7. Compared to Cronbach's alpha, CR is considered a more appropriate measure for reliability (Henseler et al. 2009; Nitzl 2010; Werts et al. 1974). Thereby, no further modifications to the outer model are made at this stage.

Table 5.39 examines discriminant validity of the measurement model for the location-related services functionality.

Table 5.39 - Discriminant validity of the measurement model for the location-related services functionality

	LOCDEP	**LOCVAR**	**LRSITU**	**LRSPI**	**LRSPIN**	**LRSPU**	**TC**	**TCR**	**TI**
LOCDEP	**(0.78)**								
LOCVAR	-0.58	**(1.00)**							
LRSITU	0.37	-0.17	**(0.95)**						
LRSPI	0.33	-0.11	0.90	**(0.95)**					
LRSPIN	0.34	-0.11	0.84	0.86	**(1.00)**				
LRSPU	0.36	-0.14	0.92	0.93	0.86	**(0.95)**			
TC	-0.05	0.03	-0.16	-0.09	-0.16	-0.13	**(0.85)**		
TCR	0.35	-0.15	0.39	0.39	0.34	0.35	-0.30	**(0.88)**	
TI	0.46	-0.16	0.32	0.31	0.38	0.31	-0.14	0.47	**(0.85)**

Legend:

LOCDEP	Location dependence
LOCVAR	Location variety
LRSITU	Intention to use location-related services functionalities
LRSPI	Perceived impact on mobile work performance of location-related services functionalities
LRSPIN	Perceived degree of innovativeness of location-related services functionalities
LRSPU	Perceived usefulness of location-related services functionalities
TC	Task complexity
TCR	Time criticality
TI	Task interdependence

Source: Developed for this research

For all investigated relationships, the square root of AVE is always higher than the correlations between constructs and, thereby, no issues with discriminant validity could be identified.

Inner model assessment of location-related services functionality

Table 5.40 summarises the results for the path coefficient analysis and summarises the significant relationships. Table A4.5 in appendix 4 summarises the results for all relationships in this specific model.

Table 5.40 - Path coefficients of the structural model for the location-related services functionality

Relationship investigated	Original sample (208)	Sample mean (500)	T Statistics (|O/STERR|)
BU3 -> LRSPU	0.28	0.28	2.79***
Job role -> LRSPU	0.11	0.10	1.89*
LOCDEP -> LRSPU	0.31	0.31	4.86***
LOCVAR -> LOCDEP	-0.58	-0.59	11.48***
LRSITU -> LRSPI	0.19	0.19	2.85***
LRSPIN -> LRSITU	0.20	0.21	3.82***
LRSPIN -> LRSPI	0.18	0.18	3.86***
LRSPU -> LRSITU	0.75	0.75	15.39***
LRSPU -> LRSPI	0.60	0.60	10.15***
TC -> TCR	-0.23	-0.24	3.60***
TCR -> LRSPU	0.28	0.27	3.65***
TI -> TCR	0.44	0.44	7.16***
Tenure -> LRSPU	-0.12	-0.12	1.66*

Legend:

LOCDEP	Location dependence
LOCVAR	Location variety
LRSITU	Intention to use location-related services functionalities
LRSPI	Perceived impact on mobile work performance of location-related services functionalities
LRSPIN	Perceived degree of innovativeness of location-related services functionalities
LRSPU	Perceived usefulness of location-related services functionalities
TC	Task complexity
TCR	Time criticality
TI	Task interdependence
*	95% significance level
**	99% significance level
***	99.9% significance level

Source: Developed for this research

Based on the above results, the following significant relationships could be determined for the location-related services functionality. Time criticality is negatively affected by task complexity (-0.23) and positively affected by task interdependence (0.44). Location variance negatively affects location dependence (-

0.58). Both time critically (0.28) and location dependence (0.31) positively affect perceived usefulness of location-related services, which itself strongly positively affects its intention to use (0.75) and its perceived impact on mobile work performance (0.60). In addition, intention to use location-related services also positively affects directly on perceived impact on mobile work performance (0.19).

Moreover, participants from business unit 3 perceived location-related services to be 28% more useful than the participants from business unit 4. Perceived degree of innovativeness directly positively affects perceived impact on mobile work performance (0.18) and intention to use (0.20) location-related service functionalities. Length of tenure and location-related service functionalities are inversely related (-0.12). Supervisors perceive location-related service functionalities to be 11% more useful than operational sales-force workers.

Table 5.41 summarises the results for the calculation of the coefficient of determination.

Table 5.41 - R^2 of the structural model for the location-related services functionality

Dependent variable	R^2	Interpretation
LOCDEP	0.34	Moderate
LRSITU	0.86	Substantial
LRSPI	0.88	Substantial
LRSPU	0.25	Weak
TCR	0.27	Weak

Legend:
LOCDEP Location dependence
LRSITU Intention to use location-related services functionalities
LRSPI Perceived impact on mobile work performance of location-related services functionalities
LRSPU Perceived usefulness of location-related services functionalities
TCR Time criticality

Source: Developed for this research

Thereby, weak values for R^2 could be determined for perceived usefulness (0.25) and time criticality (0.27). For location dependence, a moderate value for R^2 could be determined, while a substantial value for R^2 could be determined for intention to use (0.86) and perceived impact on mobile work performance (0.88).

Table 5.42 summarises the results of the total effects analysis for location-related services functionality.

Table 5.42 - Total effects of the structural model for the location-related services functionality

Dependent variable	$R^2_{included}$	$R^2_{excluded}$	f^2	Interpretation of effect size
LOCDEP -> LRSPU	0.25	0.17	0.11	Weak
TCR -> LRSPU	0.25	0.18	0.09	Weak
LRSITU -> LRSPI	0.88	0.88	0.04	Weak
LRSPU -> LRSPI	0.88	0.84	0.40	Large
TI -> TCR	0.27	0.09	0.26	Moderate
TC -> TCR	0.27	0.23	0.06	Weak

Legend:
LOCDEP Location dependence
LRSITU Intention to use location-related services functionalities
LRSPI Perceived impact on mobile work performance of location-related services functionalities
LRSPU Perceived usefulness of location-related services functionalities
TC Task complexity
TCR Time criticality
TI Task interdependence

Source: Developed for this research

Thereby, the effect sizes for all relationships within this model have a sufficient effect size and it is not necessary to drop any relationship for the final model.

Table 5.43 summarises the results for the prediction relevance of the structural model for location-related services functionality.

Table 5.43 - Prediction relevance of structural model for location-related services functionality

Dependent variable	Q^2	Has prediction relevance?
LOCDEP	0.35	Yes
LRSITU	0.91	Yes
LRSPI	0.91	Yes
LRSPU	0.90	Yes
TCR	0.79	Yes

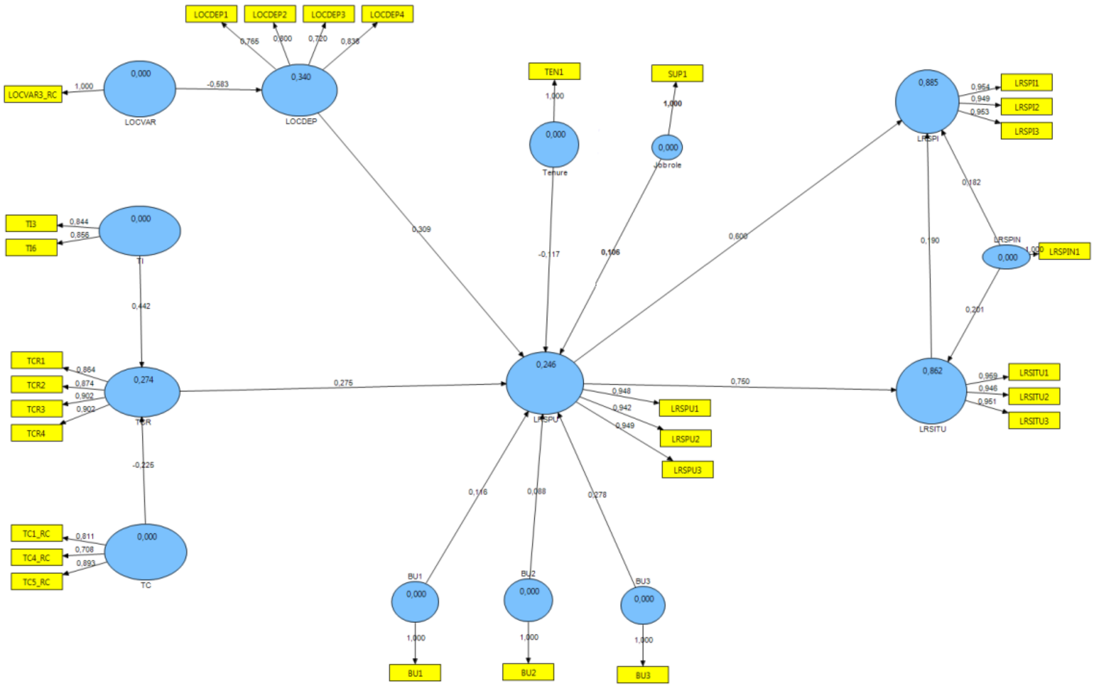
Legend:
LOCDEP Location dependence
LRSITU Intention to use location-related services functionalities
LRSPI Perceived impact on mobile work performance of location-related services functionalities
LRSPU Perceived usefulness of location-related services functionalities
TCR Time criticality

Source: Developed for this research

As with the other mobile work support functions investigated, the results for Q^2 are all above the specified threshold of zero such that the model prediction relevance can be considered valid.

Figure 5.6 depicts the final structural model for the location-related services functionality.

Figure 5.6 - Final structural model for the location-related services functionality



Source: Developed for this research

Overall GoF for the location-related services functionality

Table 5.44 summarises the model's overall goodness of fit indices.

Table 5.44 - R^2, communality, redundancy and GoF of the structural model for the location-related services functionality

	R^2	Communality	Redundancy
LOCDEP	0.34	0.61	0.21
LRSITU	0.86	0.91	0.27
LRSPI	0.88	0.91	0.28
LRSPU	0.25	0.90	-0.03
TC		0.73	
TCR	0.27	0.78	0.07
TI		0.72	
Average	0.52	0.79	0.16
Goodness of fit (GoF)	**0.64**		

Legend:
LOCDEP Location dependence
LRSITU Intention to use location-related services functionalities
LRSPI Perceived impact on mobile work performance of location-related services functionalities
LRSPU Perceived usefulness of location-related services functionalities
TC Task complexity
TCR Time criticality
TI Task interdependence

Source: Developed for this research

Thus, the results show that the structural model has a weak size effect (0.16), the measurement model has a large size effect (0.79) and the model's overall effect size can be considered large (0.64).

5.4.6 Mobile office

Outer model assessment for the mobile office functionality

Table 5.45 summarises the factor loadings of the structural model for the mobile office functionality that met the threshold of 0.7.

Table 5.45 - Factor loadings of the measurement model for the mobile office functionality

	LOCDEP	LOCVAR	MOITU	MOPI	MOPU	TC	TCR	TI
LOCDEP1	0.74							
LOCDEP2	0.81							

	LOCDEP	LOCVAR	MOITU	MOPI	MOPU	TC	TCR	TI
LOCDEP3	0.74							
LOCDEP4	0.83							
LOCVAR3_RC		1.00						
MOITU1			0.99					
MOITU2			0.98					
MOITU3			0.99					
MOPI1				0.98				
MOPI2				0.99				
MOPI3				0.99				
MOPU1					0.97			
MOPU2					0.99			
MOPU3					0.98			
TC1_RC						0.81		
TC4_RC						0.71		
TC5_RC						0.88		
TC6_RC						0.70		
TCR1							0.86	
TCR2							0.87	
TCR3							0.90	
TCR4							0.90	
TI3								0.83
TI6								0.87

Legend:

LOCDEP	Location dependence
LOCVAR	Location variety
MOITU	Intention to use mobile office functionalities
MOPI	Perceived impact on mobile work performance of mobile office functionalities
MOPIN	Perceived degree of innovativeness of mobile office functionalities
MOPU	Perceived usefulness of mobile office functionalities
TC	Task complexity
TCR	Time criticality
TI	Task interdependence

Source: Developed for this research

Similar to previous results, the indicators retained are displayed in the above table. The other indicators not listed above were dropped due to their low factor loadings below the recommended threshold of 0.7. These were LOCVAR1, LOCVAR2, TC2, TC3_RC, TC6 ,TI1_RC, TI2_RC, TI4_RC and TI5_RC.

Table 5.46 summarises the results for AVE, CR and Cronbach's alpha.

Table 5.46 - AVE, CR and Cronbach's alpha of the measurement model for the mobile office functionality

	AVE	CR	Cronbach's alpha
LOCDEP	0.61	0.86	0.79
MOITU	0.98	0.99	0.99
MOPI	0.97	0.99	0.98
MOPU	0.96	0.99	0.98
TC	0.61	0.86	0.64
TCR	0.78	0.94	0.91
TI	0.72	0.84	0.62

Legend:
AVE Average variance extracted
CR Composite reliability
LOCDEP Location dependence
MOITU Intention to use mobile office functionalities
MOPI Perceived impact on mobile work performance of mobile office functionalities
MOPU Perceived usefulness of mobile office functionalities
TC Task complexity
TCR Time criticality
TI Task interdependence

Source: Developed for this research

For Cronbach's alpha, the values for task complexity and task interdependence were slightly below the threshold of 0.7. Compared to Cronbach's alpha, CR is considered a more appropriate measure for reliability (Henseler et al. 2009; Nitzl 2010; Werts et al. 1974). The thresholds for AVE and CR were met, and established adequate reliability and internal validity for all constructs investigated in this study.

Table 5.47 summarises the results for the analysis of discriminant validity.

Table 5.47 - Discriminant validity of the measurement model for the mobile office functionality

	LOCDEP	LOCVAR	MOITU	MOPI	MOPIN	MOPU	TC	TCR	TI
LOCDEP	**(0.78)**								
LOCVAR	-0.59	**(1.00)**							
MOITU	0.37	-0.09	**(0.99)**						
MOPI	0.41	-0.12	0.94	**(0.98)**					
MOPIN	0.35	-0.09	0.89	0.92	**(1.00)**				
MOPU	0.39	-0.12	0.91	0.97	0.96	**(0.98)**			
TC	-0.05	0.03	-0.10	-0.08	-0.02	-0.07	**(0.78)**		
TCR	0.36	-0.15	0.44	0.49	0.40	0.47	-0.30	**(0.88)**	
TI	0.47	-0.17	0.43	0.48	0.38	0.45	-0.13	0.47	**(0.85)**

Legend:
LOCDEP Location dependence
LOCVAR Location variety
MOITU Intention to use mobile office functionalities
MOPI Perceived impact on mobile work performance of mobile office functionalities
MOPIN Perceived degree of innovativeness of mobile office functionalities
MOPU Perceived usefulness of mobile office functionalities
TC Task complexity
TCR Time criticality
TI Task interdependence

Source: Developed for this research

No issues with regard to discriminant validity could be identified for the mobile office functionality.

Inner model assessment of the mobile office functionality

The inner model assessment of the mobile office functionality starts with an analysis of the results of the path coefficients. Table 5.48 summarises the results of this analysis and lists only significant relationships. Table A4.6 in appendix 4 summarises the results for all relationships in this specific model.

Table 5.48 - Path coefficients of the structural model for the mobile office functionality

Relationship investigated	Original sample (208)	Sample mean (500)	T Statistics (|O/STERR|)
BU3 -> MOPU	0.24	0.23	2.26**
Job role -> MOPU	0.14	0.13	2.87***
LOCDEP -> MOPU	0.23	0.23	3.49***
LOCVAR -> LOCDEP	-0.59	-0.59	12.77***
MOITU -> MOPI	0.34	0.33	8.01***
MOPIN -> MOITU	0.26	0.27	2.86***
MOPIN -> MOPI	0.18	-0.18	4.40***
MOPU -> MOITU	0.66	0.65	7.27***
MOPU -> MOPI	0.83	0.84	17.76***
TC -> TCR	-0.22	-0.24	3.41***
TCR -> MOPU	0.29	0.29	3.76***
TI -> MOPU	0.19	0.19	2.38**
TI -> TCR	0.45	0.45	7.48***
Tenure -> MOPU	-0.13	-0.12	1.89*

Legend:
LOCDEP Location dependence
LOCVAR Location variety
MOITU Intention to use mobile office functionalities
MOPI Perceived impact on mobile work performance of mobile office functionalities
MOPIN Perceived degree of innovativeness of mobile office functionalities
MOPU Perceived usefulness of mobile office functionalities
TC Task complexity
TCR Time criticality
TI Task interdependence

* 95% significance level
** 99% significance level
*** 99.9% significance level

Source: Developed for this research

Location variety negatively affects location dependence (-0.59), and time criticality is positively and negatively affected respectively by task interdependence (0.45) and by task complexity (-0.29). Location dependence (0.23), task interdependence (0.19) and time criticality (0.29) positively affect perceived usefulness of mobile office functionalities. Perceived usefulness of mobile office functionalities positively affects intention to use (0.66) and perceived impact on mobile work performance

(0.83). Perceived performance impact is also directly positively impacted by the intention to use construct (0.34).

Perceived degree of innovativeness significantly positively affects both intention to use (0.26) and perceived impact on mobile work performance (0.18). The higher the length of tenure, the less useful mobile office functionalities are perceived (-0.13). Supervisors perceive mobile office functionalities to be 14% more useful than operations sales-force workers. Last but not least, participants from business unit 3 perceive mobile office functionalities to be 24% more useful than the participants from the reference group (i.e., business unit 4).

Table 5.49 summarises the results for R^2 of the model's dependent variables.

Table 5.49 - R^2 of the structural model for the mobile office functionality

Dependent variable	R^2	Interpretation
LOCDEP	0.34	Moderate
MOITU	0.83	Substantial
MOPI	0.96	Substantial
MOPU	0.37	Moderate
TCR	0.27	Weak

Legend:
LOCDEP Location dependence
MOITU Intention to use mobile office functionalities
MOPI Perceived impact on mobile work performance of mobile office functionalities
MOPU Perceived usefulness of mobile office functionalities
TCR Time criticality

Source: Developed for this research

Thereby, moderate values for R^2 could be determined for location dependence (0.34) and perceived usefulness (0.37); substantial values for R^2 could be determined for intention to use (0.83) and perceived impact on mobile work performance (0.96); and a weak value for R^2 was calculated for time criticality (0.27).

Table 5.50 summarises the results of the analysis of the structural model's total effects.

Table 5.50 - Total effects of the structural model for the mobile office functionality

	$R^2_{included}$	$R^2_{excluded}$	f^2	Interpretation of effect size
LOCDEP -> MOPU	0.37	0.33	0.06	Weak
TCR -> MOPU	0.37	0.31	0.10	Weak
MOPU -> MOPI	0.96	0.94	0.80	Large
MOITU -> MOPI	0.96	0.95	0.52	Large
TI -> MOPU	0.37	0.31	0.10	Weak
TI -> TCR	0.27	0.07	0.27	Medium
TC -> TCR	0.27	0.23	0.06	Weak

Legend:
LOCDEP Location dependence
MOITU Intention to use mobile office functionalities
MOPI Perceived impact on mobile work performance of mobile office functionalities
MOPU Perceived usefulness of mobile office functionalities
TC Task complexity
TCR Time criticality
TI Task interdependence

Source: Developed for this research

Thereby, for all relationships investigated in this specific model, effect sizes from weak to strong could be determined.

Table 5.51 summarises the results for the Stone-Geisser criterion.

Table 5.51 - Prediction relevance of the structural model for the mobile office functionality

Research construct	Q^2	Has prediction relevance?
LOCDEP	0.61	Yes
MOITU	0.98	Yes
MOPI	0.97	Yes
MOPU	0.96	Yes
TCR	0.78	Yes

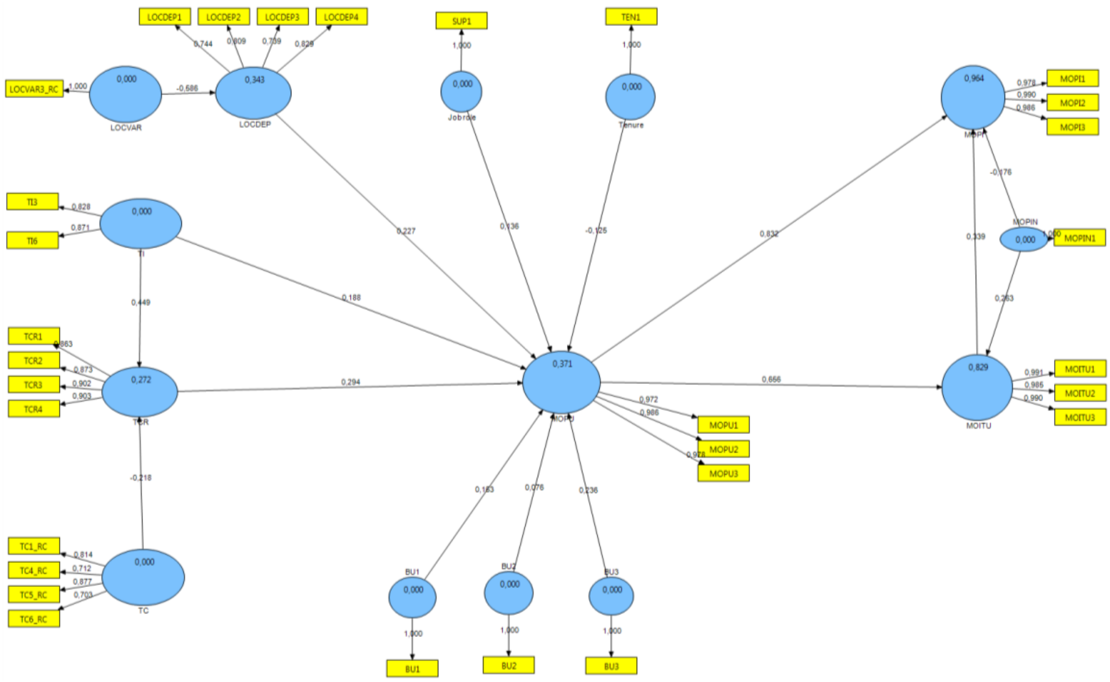
Legend:
LOCDEP Location dependence'
MOITU Intention to use mobile office functionalities
MOPI Perceived impact on mobile work performance of mobile office functionalities
MOPU Perceived usefulness of mobile office functionalities
TCR Time criticality

Source: Developed for this research

As with all the other structural models investigated, the results for Q^2 were all above the threshold of 0 and thereby the model's prediction relevance is established.

Figure 5.7 depicts the final structural model of the mobile office functionality.

Figure 5.7 - Final structural model for the mobile office functionality



Source: Developed for this research

Overall GoF for the mobile office functionality

Table 5.52 summarises all relevant values to determine the overall GoF of the structural model for the mobile office functionality.

Table 5.52 - R^2, communality, redundancy and GoF of the structural model for the mobile office functionality

	R^2	Communality	Redundancy
LOCDEP	0.34	0.61	0.21
MOITU	0.83	0.98	0.39
MOPI	0.96	0.97	0.50
MOPU	0.37	0.96	-0.03
TC		0.73	
TCR	0.27	0.78	0.07
TI		0.72	
Average	0.56	0.82	0.23
Goodness of fit (GoF)	0.68		

Legend:
LOCDEP Location dependence
MOITU Intention to use mobile office functionalities
MOPI Perceived impact on mobile work performance of mobile office functionalities
MOPU Perceived usefulness of mobile office functionalities
TC Task complexity
TCR Time criticality
TI Task interdependence

Source: Developed for this research

The results for the model's overall goodness of fit are similar to the previous models investigated. Thereby, the model's overall effect size (0.68) indicates a high overall GoF, with a large-size effect for the measurement model (0.82) and a small size effect for the structural model (0.23).

5.5 Chapter summary

This chapter summarised the results of the second research phase of this study in which quantitative data was collected to test six proposed research models.

Research data indicates that two specific task characteristics of mobile sales-force workers (i.e., location dependence and time criticality) positively correlate with perceived usefulness of all mobile work support functions investigated and that this perceived fit is also positively correlated with intention to use and perceived impact on mobile work performance of mobile work support functions. Task complexity and task interdependence indirectly affect perceived usefulness of mobile work support functions as both positively affect time criticality for all six research models investigated. Location variety does not directly affect perceived usefulness of mobile work support functions, but does negatively affect location dependence. Perceived usefulness of mobile work support functions positively correlates with perceived impact on mobile work performance and with intention to use mobile work support functions. In addition, intention to use mobile work support functions positively affects its perceived impact on mobile performance.

No moderating effect of perceived degree of innovativeness on both the influence of perceived usefulness on intention to use and the influence of intention to use on perceived impact on mobile work performance could be determined. Instead, the results of the data analysis reveal that perceived degree of innovativeness has a strong direct effect on intention to use for all mobile work support functions investigated and a direct effect on perceived impact on mobile work performance for some mobile work support functions investigated in this research (i.e., mobile communication, location-related services and mobile office).

In addition, the data analysis identified that there are differences in perceived usefulness of mobile work support functions across different job roles, across different business units and across participants with different lengths of tenure—but not across gender.

The next chapter of this dissertation interprets and discusses the results from both data collection phases to provide answers to this study's research questions and hypotheses; and establishes and discusses the relationship between the key findings of this study and the relevant literature.

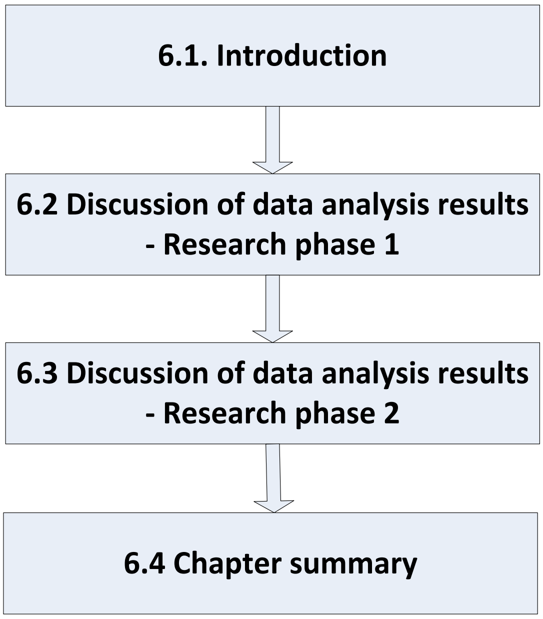
6 Discussion of data analysis and findings

6.1 Introduction

Based on the results of data analysis for research phase 1 (Chapter 4) and research phase 2 (Chapter 5), the purpose of this chapter is to interpret the results from both data collection phases to answer this study's research questions and to establish and discuss the relationship between the key findings of this study and the relevant literature. To achieve this, two separate subsections will discuss the relevant research questions and hypotheses for each research phase.

Figure 6.1 outlines the structure of this chapter.

Figure 6.1 - Structure of the discussion of data analysis and findings chapter



Source: Developed for this research

6.2 Discussion of data analysis results—Research phase 1

The purpose of this subsection is to discuss the data analysis results and key findings from the first research phase in relation to the following three interrelated research questions:

- **RQ1: How useful is each of the mobile work support functions in supporting mobile sales-force worker tasks?**
- **RQ2: To what degree is each of the mobile work support functions innovative in supporting mobile sales-force worker tasks?**
- **RQ3: Why is each of the mobile work support functions useful or not in supporting mobile sales-force worker tasks?**

Each research question is discussed in a separate subsection.

6.2.1 Perceived usefulness of mobile work support functions

The first research phase investigated perceived usefulness for each of the six mobile work support functions through 20 semi-structured interviews with sales-force workers in operational and managerial roles. Table 6.1 summarises the results of the aggregated ratings for perceived usefulness of the mobile work support functions.

Table 6.1 - Aggregated ratings for perceived usefulness of the mobile work support functions from research phase 1

Mobile work support function	Degree of perceived usefulness
Mobile communication	Medium
Mobile information searching	Medium
Mobile transaction processing	Medium
Mobile job scheduling & dispatching	Low
Location-related services	Medium
Mobile office	Medium
Legend: Range of values -> Interpretation of perceived usefulness < 2 Very low 2 - 3 Low 3 - 5 Medium 5 - 6 High > 6 Very high	

Source: Developed for this research

Overall, with the exception of mobile job scheduling and dispatching functionalities, the perceived usefulness of all mobile work support functions was considered to be of a medium level for sales-force tasks in a mobile work setting, whereas the degree of usefulness was considered to be low (cf. chapter 4 for a more detailed summary of these results). The reasons for the differences in the ratings are discussed in section 6.2.3.

In most cases, the results from the second research phase confirmed the results from the first research phase; only location-related services functionalities were rated lower and mobile communication functionalities were rated higher compared to the results from the first research phase (cf. appendix 3, table A3.1). These findings might be explained by the fact that the survey scenario for location-related service functionalities did not consider navigation system functionalities (which were perceived to be highly useful by the interviewees) and that the survey scenario for mobile communication functionalities did not consider those sub-functionalities with a low level of usefulness (e.g., web conferencing). All things considered, the results from the second research phase are considered to be more valid, and a more representative sample of sales-force workers has been surveyed.

The results above are similar to other studies in this area where comparable ratings for perceived usefulness of these mobile work support functions were determined (Yuan et al. 2010; Zheng 2007).

The results provided in table 6.1 indicate that, overall, certain mobile work support functions investigated are perceived to be somehow useful. Therefore, it can be concluded that MCT will most likely not radically change the way sales-force work is conducted in the pharmaceutical industry—but it does have the potential to moderately affect the work performance of mobile sales-force workers, as suggested by the TTF theory (e.g., Gebauer et al. 2010; Goodhue & Thompson 1995; Lee et al. 2005).

6.2.2 Perceived degree of innovativeness of mobile work support functions

Table 6.2 summarises the aggregated ratings for perceived degree of innovativeness from the first research phase.

Table 6.2 - Aggregated ratings for perceived degree of innovativeness of mobile work support functions from research phase 1

Mobile work support function	Perceived degree of innovativeness
Mobile communication	Medium
Mobile information searching	Medium
Mobile transaction processing	Medium
Mobile job scheduling & dispatching	Low
Location-related services	Medium
Mobile office	Medium
Legend: Range of values -> Interpretation of perceived usefulness < 2 Very low 2 - 3 Low 3 - 5 Medium 5 - 6 High > 6 Very high	

Source: Developed for this research

Similar to the results for perceived usefulness, the perceived degree of innovativeness for the mobile work support functions was considered to be medium, except for the mobile job scheduling and dispatching functionalities where the perceived degree of innovativeness was considered to be low. In most cases, the results from the second research phase (details, cf. appendix 3) confirm these findings. It is apparent that both the constructs of perceived usefulness and perceived degree of innovativeness are highly correlated for all mobile work support functions investigated. While the interview data indicated a relationship between perceived usefulness of mobile work support functions and the perceived degree of innovativeness, it was also apparent that many of the interviewees felt that perceived usefulness and perceived degree of innovativeness were difficult to separate as constructs. As one interviewee put it:

'In my humble opinion, your differentiation between usefulness and innovativeness is only of academic nature.' (P16*)*

Even though there are studies that have identified a link between innovativeness and performance (e.g., Adegbesan & Ricart 2007; Rogers 1998), there is a lack of research that has empirically analysed perceived degree of innovativeness in relation to the six specific mobile work support functions investigated in this research such that it is not appropriate to compare this research's findings with other studies. A discussion about the recent literature on the impact and moderating effect of perceived degree of innovativeness on intention to use and perceived impact on mobile work performance of mobile work support functions can be found in section 6.3.5.

6.2.3 Reasons why specific mobile work support functions are perceived to be useful or not in supporting mobile sales-force worker tasks

The purpose of this subsection is to summarise the main reasons identified in the interviews why the six mobile work support functions investigated in this study are perceived to be useful or not in supporting mobile sales-force worker tasks. To achieve this, common themes and patterns identified in the content analysis of the transcripts of the 20 semi-structured interviews are discussed, and the key findings from the results are compared to recent literature in this field of research.

Table 6.3 provides an overview of the common themes and patterns identified in the content analysis of the interview transcripts.

Table 6.3 - Common themes and patterns on why certain mobile work support functions are perceived to be useful or not

	Mobile work support functions					
Common themes and patterns	**MC**	**MIS**	**MTP**	**MJS**	**LRS**	**MO**
Facilitating factors						
Accelerated communication with customers, colleagues and office personnel	✔					
Improved customer service & customer satisfaction through improved information delivery	✔	✔				
Reduced double-handling of data entries by entering sales process-related data on the spot			✔			
Reduction of paper-based work			✔			✔
Improved preparation for ad-hoc sales calls		✔				
More efficient usage of dead times causing a reduction of administrative work to be handled at home and an increase in work-life balance	✔	✔				✔
Improved data quality			✔			
A calm work environment is necessary to handle office-related tasks in the mobile work setting						✔
Inhibiting factors						
Misuse of MCT as a control tool					✘	
Increased work load and stress caused by MCT always connected and in a contactable state	✘					✘
Fear that work autonomy might be negatively affected by MCT				✘		

Legend:
MC Mobile communication functionalities
MIS Mobile information searching functionalities
MTP Mobile transaction processing functionalities
MJS Mobile job scheduling & dispatching functionalities
LRS Location-related services functionalities
MO Mobile office functionalities

Source: Developed for this research

Based on the common themes and patterns summarised above, the following reasons were identified relating to why certain mobile work support functions are perceived to be useful and others not.

Accelerated communication

Mobile communication and mobile office functionalities are perceived to be useful as they enable an accelerated communication with customers, colleagues and office personnel. This finding is supported by recent literature (e.g., IBM Cooperation 2004; Yuan et al. 2010; Zheng 2007). As information providers for physicians, pharmaceutical sales-force workers can use mobile communication functions (e.g., email) to respond more quickly to customer inquiries. As 89% of German physicians use the Internet at least once a day and 85% check their emails at least once a day (DocCheck 2009), it can be assumed that email-based communication is an essential communication channel used by physicians and, consequently, needs to be considered by sales-force workers.

Similar to the communication with physicians, inquiries from sales-force colleagues and office personnel from the case organisation's head office can be handled more effectively via email when in a mobile setting. Furthermore, emails can be complemented with attachments created via mobile office functionalities.

Improved information delivery

According to the interviewees, a well-prepared pharmaceutical sales-force worker can add value to a sales call by providing new and relevant information for the customer. From a tool perspective, the information delivery process can be supported by mobile information searching (e.g., by accessing corporate databases in real time) and mobile communication functionalities (e.g., by responding more quickly to customer inquiries). Thereby, the customer might feel more valued as a result of receiving the information requested more quickly. Current research on physician Internet usage might be an indicator for their increased information needs (DocCheck 2009). The general finding that improved information delivery increases customer service is in line with recent research in this area (Accenture 2004; IBM Cooperation 2004; Koschembahr 2005).

More efficient usage of dead times

Mobile communication, mobile information searching, mobile transaction processing and mobile office functionalities are perceived to be useful, as they enable sales-force workers to use their dead times more efficiently. This finding is consistent with recent literature in this field (Henri & Aurelie 2006; IBM Cooperation 2004; Liang & Wei 2004; Perry et al. 2001; Schierholz et al. 2007; Sheng et al. 2005). As a consequence, several interviewees argued that this increase in work efficiency will reduce administrative work (i.e., all office-related tasks that are usually conducted in the home office) and may eventually improve the work-life balance of sales-force workers. In contrast, a minority of sales-force workers argued that mobile communication functionalities especially have the potential to further increase work load and stress as they fear their employer may expect them to use these functionalities in their mobile work setting beyond the dead times. The latter notion is supported by recent research (e.g., Middleton & Cukier 2006).

Reduction of double-handling of data entries and reduction of paper-based work in the mobile work setting

Based on the interview results, it appears that mobile transaction processing functionalities are perceived to be useful as they enable data entry of sales process-related data on the spot and reduces the double-handling of data entries. This finding is supported by a number of previous empirical studies (Henri & Aurelie 2006; IBM Cooperation 2004; Perry et al. 2001; Pousttchi & Thurnher 2005; Schierholz et al. 2007; Sheng et al. 2005). In addition, mobile communication, mobile information searching, mobile transaction processing and mobile office functionalities are perceived to be useful in supporting the reduction of paper-based information handling. Paper-based information includes notes that are put on a piece of paper during a usual mobile working day (e.g., customer-relevant notes, to-do lists); and information printed out before the actual working day starts in anticipation it will be needed during the working day (customer-related information, emails, learning material, profession journals, etc.). The idea that MCT has the potential to reduce paper-based work is supported by recent literature (Accenture 2004; Henri & Aurelie 2006; IBM Cooperation 2004; Liang & Wei 2004; Perry et al. 2001; Schierholz et al. 2007; Sheng et al. 2005).

Improved preparation for ad-hoc sales calls

Sales-force workers are required to spend a lot of time on information-gathering tasks such as collecting information about customers, etc. (Saxe & Weitz 1982). Thereby, improved preparation for ad-hoc sales calls involving specific mobile work support functions was considered useful in supporting sales-force workers tasks. In the situation where a sales-force worker is instructed to make an unplanned sales call while already in the mobile work setting, mobile communication and mobile information searching functionalities facilitate customer-specific information gathering activities to prepare the sales-force worker more effectively for the upcoming call. This finding is supported by recent literature in this specific field (IBM Cooperation 2004; Perry et al. 2001; Pousttchi & Thurnher 2005; Sheng et al. 2005). A precondition for this case in point is the availability of relevant customer data that is accessible (online) via MCT.

Specific issues with mobile scheduling dispatching functionalities

Based on the results from the first research phase, it can be concluded that mobile job scheduling and dispatching functionalities were not perceived to be useful, as there is no need to dynamically assign tasks to sales-force workers in their mobile work setting. Findings from the first research phase indicate that the weekly planning process (where upcoming sales calls are planned in each sales area and stored in the CRM system) does not need further automation, as ad-hoc calls take place only seldom (11-20%, cf. appendix 3). In addition, if a sales-force worker wants another sales-force worker to spontaneously visit a certain customer, a phone call is considered sufficient. Thus, mobile job scheduling and dispatching functionalities can add value in those businesses where there is a high time criticality of tasks and personal customer relations are of minor importance, as is the case in the utilities and transportation industries (Accenture 2004; IBM Cooperation 2004).

Another important issue that became apparent during the interviews is the fear of several interviewees that their autonomous way of working could be negatively affected. Such fears need to be taken seriously when introducing MCT, as this might affect the adoption and/or acceptance of MCT.

Specific issues with location-related service functionalities

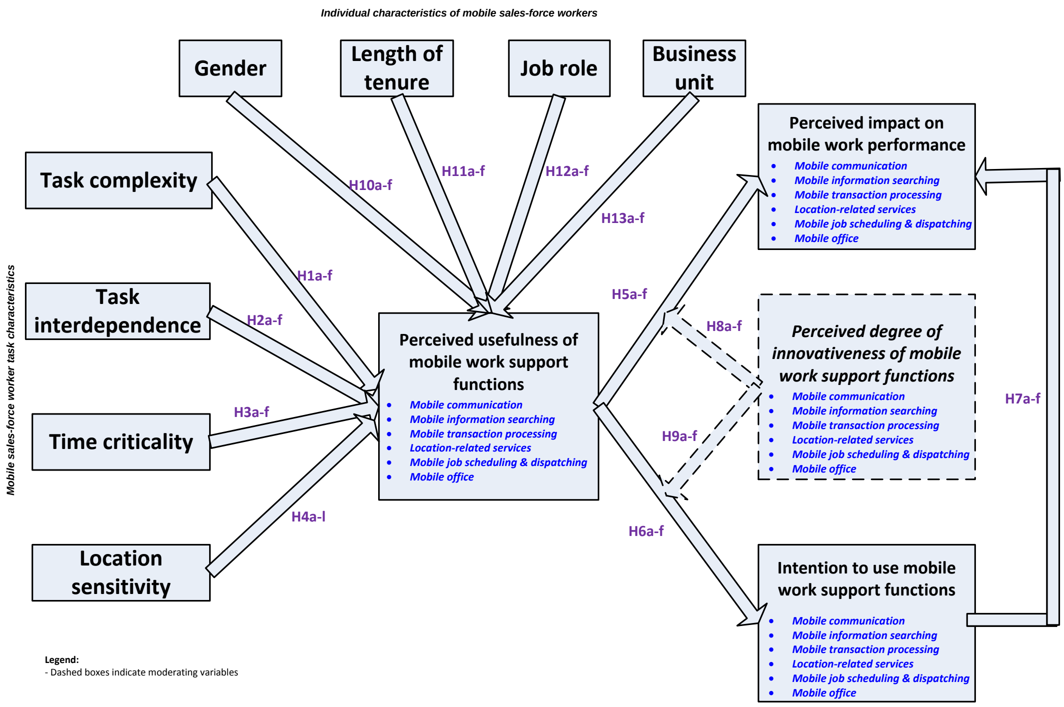
Even though perceived usefulness of navigation-system related location-based services functionalities were rated medium on average, the location-tracking functionality was considered negatively by the interviewees. Due to the high work autonomy of pharmaceutical sales-force workers, there is no specific business need to know the location of another sales-force colleague. While this functionality might be useful in other industries with different business models (e.g., Accenture 2004; IBM Cooperation 2004), the results indicate that location-tracking functionalities do not fit with pharmaceutical sales-force workers' tasks. Navigation system-related functionalities were perceived to be highly useful, but not considered in more detail in the second research phase as these systems have already been installed in every company car within the case organisation for several years. Last but not least, many interviewees feared that their employer might needlessly misuse location-tracking functionalities of MCT for controlling purposes (Shilton 2009). This fear of mobile work monitoring might be another indicator why certain sales-force workers did not consider location-related services to be useful.

6.3 Discussion of data analysis results—Research phase 2

The second research phase collected quantitative data using an online survey and analysed that data to answer the study's research questions RQ3-RQ10 (cf. Appendix 1) and proposed hypothesised relationships. Thereby, the purpose of this section is to summarise the results of the hypotheses testing and to discuss the key findings of the second research phase in relation to the respective research questions and underlying hypothesised relationships in the proposed research model.

Figure 6.2 outlines all hypothesised relationships tested in the proposed research model for this study.

Figure 6.2 - Research model



Source: Developed for this research

In the following subsections, all 13 hypotheses and respective sub hypotheses are discussed in relation to the existing literature.

6.3.1 Influence of task characteristic-related research constructs on perceived usefulness of mobile work support functions

In this subsection, the following research question is examined:

RQ4: To what degree do task characteristics of mobile sales-force workers influence perceived usefulness of mobile work support functions?

Results for hypotheses H1a-f, H2a-f, H3a-f and H4a-l provide the empirical basis to answer research question RQ4. In the following sections, each task characteristic-related research construct is discussed separately.

6.3.1.1 Task complexity

The influence of task complexity on perceived usefulness of six mobile work support functions is examined by hypotheses H1a-f, namely:

H1a-f: Task complexity has a positive impact on perceived usefulness of mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office).

Table 6.4 summarises the results for the hypotheses testing.

Table 6.4 - Influence of task complexity on perceived usefulness of mobile work support functions

Hypotheses	Relationship investigated	Original sample (208)	Sample mean (500)	T Statistics (|O/STERR|)	Supported?
H1a	TC -> MCPU	-0.09	-0.09	0.87	No
H1b	TC -> MISPU	0.00	-0.01	0.05	No
H1c	TC -> MTPPU	-0.09	-0.09	1.05	No
H1d	TC -> MJSPU	-0.02	-0.03	0.32	No
H1e	TC -> LRSPU	-0.08	-0.08	1.04	No
H1f	TC -> MOPU	0.04	0.04	0.50	No

Legend:

LRSPU	Perceived usefulness of location-related services functionalities
MCPU	Perceived usefulness of mobile communication functionalities
MISPU	Perceived usefulness of mobile information searching functionalities
MJSPU	Perceived usefulness of mobile job scheduling and dispatching functionalities
MOPU	Perceived usefulness of mobile office functionalities
MTTPU	Perceived usefulness of mobile transaction processing functionalities
TC	Task complexity
*	95% significance level
**	99% significance level
***	99.9% significance level

Source: Developed for this research

As hypotheses H1a-f were not supported, it can be concluded that task complexity of mobile sales-force workers does not affect perceived usefulness of mobile work support functions. This finding differs from the results of a study by Zheng (2007, p. 167) who identified a significant influence of task complexity on mobile information searching and offline mobile transaction processing functionalities. Even though similar average values (3.73) for task complexity were identified in Zheng's study and this study (3.63), this deviation might be explained by the fact that this study examined a homogenous group of mobile sales-force workers, while Zheng's study examined a heterogeneous group of mobile workers. Yuan et al.'s study (2010) did not investigate the impact of task complexity on perceived usefulness of mobile work support functions such that their findings cannot be compared to the findings of this study. However, the results of this study clearly show that task complexity indirectly affects perceived usefulness of mobile work support functions, as task complexity significantly affects time criticality in a negative direction, which itself positively affects perceived usefulness of mobile work support functions (more results, cf. section 5.4).

6.3.1.2 Task interdependence

Hypotheses H2a-f investigated the impact of task interdependence on perceived usefulness of six mobile work support functions:

H2a-f: Task interdependence has a positive impact on perceived usefulness of mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office).

Table 6.5 summarises the results for the hypotheses testing of H2a-f.

Table 6.5 - Influence of task interdependence on perceived usefulness of mobile work support functions

Hypotheses	Relationship investigated	Original sample (208)	Sample mean (500)	T Statistics (|O/STERR|)	Supported?
H2a	TI -> MCPU	0.12	0.10	1.41	No
H2b	TI -> MISPU	0.26	0.24	3.11***	Yes
H2c	TI -> MTPPU	0.06	0.03	0.62	No
H2d	TI -> LRSPU	0.00	-0.02	0.05	No
H2e	TI -> MJSPU	0.01	-0.01	0.03	No
H2f	TI -> MOPU	0.19	0.19	2.53**	Yes

Legend:

LRSPU	Perceived usefulness of location-related services functionalities
MCPU	Perceived usefulness of mobile communication functionalities
MISPU	Perceived usefulness of mobile information searching functionalities
MJSPU	Perceived usefulness of mobile job scheduling and dispatching functionalities
MOPU	Perceived usefulness of mobile office functionalities
MTTPU	Perceived usefulness of mobile transaction processing functionalities
TI	Task interdependence
*	95% significance level
**	99% significance level
***	99.9% significance level

Source: Developed for this research

Based on the above results, two hypotheses (H2b, H2f) were supported, and a positive and significant relationship exists between task interdependence and both mobile information searching and mobile office functionalities.

As this study examines the impact of task interdependence for all mobile work support functions of the proposed structural model, not all research results can be compared to prior research in this area. Thereby, Zheng's (2007) study only investigated the relationship of mobile communication functionalities and task interdependence and did not examine all possible relationships between task interdependence and perceived usefulness of mobile work support functions. Similar to this research, Zheng (2007) did not find evidence for a significant influence of task interdependence on specific mobile communication sub-functionalities (i.e., voice communication and text messaging). As Yuan et al.'s study (2010) did not investigate the relationship between task interdependence and perceived usefulness of mobile work support functions, their findings cannot be compared to the results of the current study.

Similar to task complexity, task interdependence indirectly affects perceived usefulness of all mobile work support functions, as it positively affects time criticality for all six research models investigated (cf. section 5.4 for more information).

6.3.1.3 Time criticality

The relationship between perceived usefulness of six mobile work support functions and time criticality is examined by the following hypotheses:

H3a-f: Time criticality has a positive impact on perceived usefulness of mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office).

Table 6.6 summarises the results for the hypotheses testing of H3a-f.

Table 6.6 - Influence of time criticality on perceived usefulness of mobile work support functions

Hypotheses	Relationship investigated	Original sample (208)	Sample mean (500)	T Statistics (|O/STERR|)	Supported?
H3a	TCR -> MCPU	0.34	0.35	4.78***	Yes
H3b	TCR -> MISPU	0.23	0.24	2.85***	Yes
H3c	TCR -> MTPPU	0.30	0.30	4.18***	Yes
H3d	TCR -> LRSPU	0.28	0.27	3.65***	Yes
H3e	TCR -> MJSPU	0.27	0.28	3.93***	Yes
H3f	TCR -> MOPU	0.29	0.29	3.76***	Yes

Legend:
LRSPU Perceived usefulness of location-related services functionalities
MCPU Perceived usefulness of mobile communication functionalities
MISPU Perceived usefulness of mobile information searching functionalities
MJSPU Perceived usefulness of mobile job scheduling and dispatching functionalities
MOPU Perceived usefulness of mobile office functionalities
MTTPU Perceived usefulness of mobile transaction processing functionalities
TCR Time criticality

* 95% significance level
** 99% significance level
*** 99.9% significance level

Source: Developed for this research

The above results reveal that all time criticality-related hypotheses are supported, and there exists a significant positive relationship between time criticality and all mobile work support functions investigated in this study.

These findings partially confirm Zheng's (2007) and Yuan et al.'s (2010) research. Thereby, Zheng (2007, p. 167) identified a positive relationship between time criticality and mobile notification, location tracking and real-time job dispatching functionalities. However, Zheng (2007, p. 167) did not identify a significant relationship between time criticality and batch mode job dispatching functionalities. Similar to Zheng (2007), Yuan et al. (2010, p. 132) identified a significant relationship between time criticality and both mobile notification and location-tracking functionalities. Furthermore, Yuan et al. (2010, p. 132) did not identify a significant relationship between time criticality and real-time job dispatching functionalities.

Differences among the findings of this dissertation and Zheng's (2007) and Yuan et al.'s (2010) research can be explained by the different types of mobile workers investigated and their different needs for respective mobile work support. Thus, while this study examined the impact of time criticality on perceived usefulness of mobile work support functions for a homogenous group of sales-force workers, the other two studies mentioned above examined a broader set of mobile workers from different industries.

Last but not least, it is clear from the research results that time criticality is positively affected by both task complexity and task interdependence (cf. section 5.4 for more information).

6.3.1.4 Location sensitivity

In this research, location sensitivity is measured by two sub-constructs, namely, location dependence and location variance. The following hypotheses examine the relationship between perceived usefulness of mobile work support functions and both location sensitivity and location dependence.

H4a-f: Location variance has a positive impact on perceived usefulness of mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office).

H4g-l: Location dependence has a positive impact on perceived usefulness of mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office).

Table 6.7 summarises the results for the above mentioned hypotheses.

Table 6.7 - Influence of location sensitivity on perceived usefulness of mobile work support functions

Hypotheses	Relationship investigated	Original sample (208)	Sample mean (500)	T Statistics (|O/STERR|)	Supported?
H4a	LOCVAR -> MCPU	0.05	0.05	0.41	No
H4b	LOCVAR -> MISPU	0.30	0.31	0.12	No
H4c	LOCVAR -> MTPPU	0.11	0.12	0.99	No
H4d	LOCVAR -> LRSPU	0.02	0.03	0.28	No
H4e	LOCVAR -> MJSPU	0.20	0.01	0.21	No
H4f	LOCVAR -> MOPU	0.21	0.20	0.11	No
H4g	LOCDEP -> MCPU	0.28	0.28	4.06***	Yes
H4h	LOCDEP -> MISPU	0.22	0.22	2.91***	Yes
H4i	LOCDEP -> MTPPU	0.34	0.34	6.01***	Yes
H4j	LOCDEP -> LRSPU	0.31	0.31	4.86***	Yes
H4k	LOCDEP -> MJSPU	0.22	0.22	3.27***	Yes
H4l	LOCDEP -> MOPU	0.23	0.23	3.49***	Yes

Legend:
LOCVAR Location variance
LOCDEP Location dependence
LRSPU Perceived usefulness of location-related services functionalities
MCPU Perceived usefulness of mobile communication functionalities
MISPU Perceived usefulness of mobile information searching functionalities
MJSPU Perceived usefulness of mobile job scheduling and dispatching functionalities
MOPU Perceived usefulness of mobile office functionalities
MTTPU Perceived usefulness of mobile transaction processing functionalities

* 95% significance level
** 99% significance level
*** 99.9% significance level

Source: Developed for this research

Table 6.7 shows that there is a significant positive relationship between location dependence and perceived usefulness of all mobile work support functions investigated. However, no significant relationship between location variance and perceived usefulness of all mobile work support functions could be determined. Instead, the results indicate a significant indirect impact of location variance on perceived usefulness of mobile work support functions, as location variance strongly affects location dependence in a negative direction (-0.58***, cf. section 5.4). Similar findings were determined by Zheng (2007) and Yuan et al. (2010, p.

132). Zheng (2007, p. 167) identified a significant positive relationship of perceived usefulness of location-related services and both location variance and location dependence. Furthermore, Yuan et al. (2010, p. 132) identified a significant positive relationship between location dependence and perceived usefulness of location tracking, navigation and real-time job dispatching functionalities.

6.3.2 Influence of perceived usefulness of mobile work support functions on perceived impact on mobile work performance of mobile work support functions

The purpose of this subsection is to discuss research question RQ5, namely:

RQ5: To what extent does a perceived fit between mobile sales-force worker tasks and use of mobile work support functions influence perceived mobile work performance?

Hypotheses H5a-f were used to test the relevant relationships in the research model as depicted in figure 6.1.

H5a-f: Perceived usefulness of mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office) has a positive impact on perceived mobile work performance.

Table 6.8 summarises the results for the hypotheses testing of H5a-f.

Table 6.8 - Influence of perceived usefulness of mobile work support functions on perceived mobile work performance

Hypo-theses	Relationship investigated	Original sample (208)	Sample mean (500)	T Statistics (|O/STERR|)	Supported?
H5a	MCPU -> MCPI	0.10	0.10	2.84***	Yes
H5b	MISPU -> MISPI	0.79	0.79	14.97***	Yes
H5c	MTPPU -> MTPPI	0.86	0.86	21.61***	Yes
H5d	LRSPU -> LRSPI	0.60	0.60	10.15***	Yes
H5e	MJSPU -> MJSPI	0.72	0.73	13.12***	Yes
H5f	MOPU -> MOPI	0.83	0.84	17.76***	Yes

Legend:

LRSPI	Perceived impact on mobile work performance of location-related services functionalities
LRSPU	Perceived usefulness of location-related services functionalities
MCPI	Perceived impact on mobile work performance of mobile communication functionalities
MCPU	Perceived usefulness of mobile communication functionalities
MISPI	Perceived impact on mobile work performance of mobile information searching functionalities
MISPU	Perceived usefulness of mobile information searching functionalities
MJSPI	Perceived impact on mobile work performance of mobile job scheduling and dispatching functionalities
MJSPU	Perceived usefulness of mobile job scheduling and dispatching functionalities
MOPI	Perceived impact on mobile work performance of mobile office functionalities
MOPU	Perceived usefulness of mobile office functionalities
MTTPI	Perceived impact on mobile work performance of mobile transaction processing functionalities
MTTPU	Perceived usefulness of mobile transaction processing functionalities
*	95% significance level
**	99% significance level
***	99.9% significance level

Source: Developed for this research

As hypotheses H5a-f were supported, it is concluded that for all mobile work support functions investigated, perceived usefulness positively correlates with perceived impact on mobile work performance. Again, this finding confirms recent TTF-related research in this specific research domain (i.e., Gebauer et al. 2010; Gebauer & Tang 2008; Zheng 2007).

Especially regarding those mobile work support functions that were not perceived to be useful by the research participants, the above findings need to be interpreted carefully, as perceived usefulness of mobile work support is a necessary precondition towards increasing mobile work performance. Even though a significant positive relationship between perceived usefulness and perceived impact on mobile work performance of the location-related service functionalities was determined, this specific mobile work support function was not considered to be useful by the participants (i.e., 2.66 on average). Therefore, location-related service functionalities do not have the potential to positively affect work performance of mobile sales-force workers—despite the significant and positive relationship between perceived usefulness and perceived impact on mobile work performance.

6.3.3 Influence of perceived usefulness on intention to use mobile work support functions

This subsection examines the following research question:

RQ6: To what extent does a perceived fit between mobile sales-force worker tasks and use of mobile work support functions influence intention to use mobile work support functions?

The results of the testing for the following hypotheses provide the quantitative basis to answer research question RQ6:

H6a-f: Perceived usefulness of mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office) has a positive impact on intention to use.

Table 6.9 summarises the results for hypotheses H6a-f.

Table 6.9 - Influence of perceived usefulness on intention to use mobile work support functions

Hypo-theses	Relationship investigated	Original sample (208)	Sample mean (500)	T Statistics (|O/STERR|)	Supported?
H6a	MCPU -> MCITU	0.43	0.43	4.42***	Yes
H6b	MISPU -> MISITU	0.66	0.67	9.24***	Yes
H6c	MTPPU -> MTPITU	0.76	0.75	12.62***	Yes
H6d	LRSPU -> LRITU	0.75	0.75	15.39***	Yes
H6e	MJSPU -> MJSITU	0.68	0.68	11.31***	Yes
H6f	MOPU -> MOITU	0.66	0.65	7.27***	Yes

Legend:

LRSITU	Intention to use location-related services functionalities
LRSPU	Perceived usefulness of location-related services functionalities
MCITU	Intention to use mobile communication functionalities
MCPU	Perceived usefulness of mobile communication functionalities
MISITU	Intention to use mobile information searching functionalities
MISPU	Perceived usefulness of mobile information searching functionalities
MJSITU	Intention to use mobile job scheduling and dispatching functionalities
MJSPU	Perceived usefulness of mobile job scheduling and dispatching functionalities
MOITU	Intention to use mobile office functionalities
MOPU	Perceived usefulness of mobile office functionalities
MTTITU	Intention to use mobile transaction processing functionalities
MTTPU	Perceived usefulness of mobile transaction processing functionalities
*	95% significance level
**	99% significance level
***	99.9% significance level

Source: Developed for this research

As hypotheses H6a-f were supported, it can be concluded that there is a significant positive relationship between perceived usefulness and intention to use mobile work support functions. As the path coefficients are between 0.43 and 0.78, the relationship can be considered strongly positive. These findings are supported by similar studies in this research domain (i.e., Gebauer et al. 2010; Gebauer & Tang 2008; Zheng 2007).

6.3.4 Influence of intention to use mobile work support functions on perceived impact on mobile work performance

The purpose of this subsection is to discuss the results of the following research question:

RQ7: To what extent does the intention to use mobile work support functions by mobile sales-force workers influence perceived mobile work performance?

To answer research question RQ7, hypotheses H7a-f tested all relevant relationships, namely:

H7a-f: Intention to use mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office) has a positive impact on perceived mobile work performance.

Table 6.10 summarises all relevant results from the hypotheses testing.

Table 6.10 - Influence of intention to use mobile work support functions on perceived impact on mobile work performance

Hypo-theses	Relationship investigated	Original sample (208)	Sample mean (500)	T Statistics (|O/STERR|)	Supported?
H7a	MCITU -> MCPI	0.52	0.52	7.02***	Yes
H7b	MISITU -> MISPI	0.18	0.18	3.28***	Yes
H7c	MTPITU -> MTPPI	0.12	0.13	3.01***	Yes
H7d	LRSITU -> LRSPI	0.19	0.19	2.85***	Yes
H7e	MJSITU -> MJSPI	0.22	0.22	3.68***	Yes
H7f	MOITU -> MOPI	0.34	0.33	8.01***	Yes

Legend:

LRSITU	Intention to use location-related services functionalities
LRSPI	Perceived impact on mobile work performance of location-related services functionalities
MCITU	Intention to use mobile communication functionalities
MCPI	Perceived impact on mobile work performance of mobile communication functionalities
MISITU	Intention to use mobile information searching functionalities
MISPI	Perceived impact on mobile work performance of mobile information searching functionalities
MJSITU	Intention to use mobile job scheduling and dispatching functionalities
MJSPI	Perceived impact on mobile work performance of mobile job scheduling and dispatching functionalities
MOITU	Intention to use mobile office functionalities
MOPI	Perceived impact on mobile work performance of mobile office functionalities
MTTITU	Intention to use mobile transaction processing functionalities
MTTPI	Perceived impact on mobile work performance of mobile transaction processing functionalities
*	95% significance level
**	99% significance level
***	99.9% significance level

Source: Developed for this research

Again, support could be found for all hypotheses (H7a-f) investigated in this subsection and therefore, it is concluded that for all mobile work support functions investigated, the relationships between intention to use and perceived impact on mobile work performance were significant and positive. The finding that intention to use positively affects work performance confirms recent studies in the research domain of TTF and mobile technology (Deibert et al. 2008; Zheng 2007).

6.3.5 Moderating effect of perceived degree of innovativeness

In the following subsections, the results for research questions RQ7 and RQ8 are summarised and discussed:

- **RQ8: To what extent is the relationship between the perceived usefulness of mobile work support functions and perceived mobile work performance influenced by the perceived degree of innovativeness of mobile work support functions?**
- **RQ9: To what extent is the relationship between the perceived usefulness of mobile work support functions and intention to use mobile work support functions influenced by the perceived degree of innovativeness of mobile work support functions?**

As depicted in figure 6.1, hypotheses H8a-f and H9a-f investigate the relevant relationships to provide answers to the above research questions.

To answer research question RQ8, the following hypotheses were tested in this research:

H8a-f: The relationship between the perceived usefulness of mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office) and perceived mobile work performance is moderated by the perceived degree of innovativeness of mobile work support functions.

Table 6.11 summarises the results for the testing of hypotheses H8a-f.

Table 6.11 - Moderating effect of perceived degree of innovativeness on the relationship between perceived usefulness of mobile work support functions and perceived impact on mobile work performance

Hypo-theses	Relationship investigated	Original sample (208)	Sample mean (500)	T Statistics (|O/STERR|)	Supported?
H8a	MCPU * MCPIN -> MCPI	0.01	0.01	0.34	No
H8b	MISPU * MISPIN -> MISPI	0.04	0.04	1.62	No
H8c	MTPPU * MTPPIN -> MTPPI	-0.04	-0.04	2.94	No
H8d	MJSPU * MJSPIN -> MJSPI	0.03	0.03	0.98	No
H8e	LRSPU * LRSPIN -> LRSPI	-0.08	-0.08	3.06	No
H8f	MOPU * MOPIN -> MOPI	-0.02	-0.02	1.14	No

Legend:

LRSPI	Perceived impact on mobile work performance of location-related services functionalities
LRSPIN	Perceived degree of innovativeness of location-related services functionalities
LRSPU	Perceived usefulness of location-related services functionalities
MCPI	Perceived impact on mobile work performance of mobile communication functionalities
MCPU	Perceived usefulness of mobile communication functionalities
MCPIN	Perceived degree of innovativeness of mobile communication functionalities
MISPI	Perceived impact on mobile work performance of mobile information searching functionalities
MISPIN	Perceived degree of innovativeness of mobile information searching functionalities
MISPU	Perceived usefulness of mobile information searching functionalities
MJSPI	Perceived impact on mobile work performance of mobile job scheduling and dispatching functionalities
MJSPIN	Perceived degree of innovativeness of mobile job scheduling and dispatching functionalities
MJSPU	Perceived usefulness of mobile job scheduling and dispatching functionalities
MOPI	Perceived impact on mobile work performance of mobile office functionalities
MOPIN	Perceived degree of innovativeness of mobile office functionalities
MOPU	Perceived usefulness of mobile office functionalities
MTTPI	Perceived impact on mobile work performance of mobile transaction processing functionalities
MTTPIN	Perceived degree of innovativeness of mobile transaction processing functionalities
MTTPU	Perceived usefulness of mobile transaction processing functionalities
*	95% significance level
**	99% significance level
***	99.9% significance level

Source: Developed for this research

Thereby, no support could be found for hypotheses H8a-f and for the moderating effect of perceived degree of innovativeness on the influence of perceived usefulness on perceived impact on mobile work performance.

Hypotheses H9a-f provide the empirical basis to provide an answer to research question RQ9:

H9a-f: The relationship between the perceived usefulness of mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office) and intention to use mobile work support functions is

moderated by the perceived degree of innovativeness of mobile work support functions.

Table 6.12 summarises all relevant results for the hypotheses testing.

Table 6.12 - Moderating effect of perceived degree of innovativeness on the relationship between perceived usefulness and intention to use mobile work support functions

Hypo-theses	Relationship investigated	Original sample (208)	Sample mean (500)	T Statistics (|O/STERR|)	Supported?
H9a	MCPU*MCPIN -> MCITU	0.02	0.02	0.41	No
H9b	MISPU*MISPIN -> MISITU	0.04	0.04	1.73	No
H9c	MTPPU*MTPPIN -> MTPITU	0.06	0.06	2.35	No
H9d	LRSPU*LRSPIN -> LRSITU	0.01	0.01	0.41	No
H9e	MJSPU*MJSPIN -> MJSITU	-0.08	-0.08	2.43	No
H9f	MOPU*MOPIN -> MOITU	0.05	0.05	4.33	No

Legend:

LRSITU	Intention to use location-related services functionalities
LRSPIN	Perceived degree of innovativeness of location-related services functionalities
LRSPU	Perceived usefulness of location-related services functionalities
MCITU	Intention to use mobile communication functionalities
MCPIN	Perceived degree of innovativeness of mobile communication functionalities
MCPU	Perceived usefulness of mobile communication functionalities
MISITU	Intention to use mobile information searching functionalities
MISPIN	Perceived degree of innovativeness of mobile information searching functionalities
MISPU	Perceived usefulness of mobile information searching functionalities
MJSITU	Intention to use mobile job scheduling and dispatching functionalities
MJSPIN	Perceived degree of innovativeness of mobile job scheduling and dispatching functionalities
MJSPU	Perceived usefulness of mobile job scheduling and dispatching functionalities
MOITU	Intention to use mobile office functionalities
MOPIN	Perceived degree of innovativeness of mobile office functionalities
MOPU	Perceived usefulness of mobile office functionalities
MTTITU	Intention to use mobile transaction processing functionalities
MTTPIN	Perceived degree of innovativeness of mobile transaction processing functionalities
MTTPU	Perceived usefulness of mobile transaction processing functionalities
*	95% significance level
**	99% significance level
***	99.9% significance level

Source: Developed for this research

No support could be found for hypotheses H9a-f (as all path coefficients are < 0.10), therefore, this study did not determine any significant moderating effect of perceived degree of innovativeness on the relationship between the perceived usefulness of mobile work support functions and intention to use.

Instead, the data collected in the second research phase reveals that the perceived degree of innovativeness has a strong direct effect on intention to use for all mobile work support functions and a direct effect on perceived impact on mobile work performance for certain mobile work support functions investigated in this research (i.e., mobile communication, location-related services, and mobile office).

Table 6.13 summarises the relevant results for this finding.

Table 6.13 - Direct effect of perceived degree of innovativeness on intention to use and perceived impact on mobile work performance

Hypo-theses	Relationship investigated	Original sample (208)	Sample mean (500)	T Statistics (|O/STERR|)	Supported?
n/a	MCPIN -> MCITU	0.46	0.45	4.95***	n/a
n/a	MCPIN -> MCPI	0.32	0.32	4.10***	n/a
n/a	MISPIN -> MISITU	0.30	0.30	4.13***	n/a
n/a	MISPIN -> MISPI	0.02	0.02	0.42	n/a
n/a	MTPPIN -> MTPITU	0.20	0.20	3.16***	n/a
n/a	MTPPIN -> MTPPI	0.04	0.03	1.02	n/a
n/a	LRSPIN -> LRSITU	0.20	0.21	3.82***	n/a
n/a	LRSPIN -> LRSPI	0.18	0.18	3.86***	n/a
n/a	MJSPIN -> MJSITU	0.24	0.24	3.81***	n/a
n/a	MJSPIN -> MJSPI	0.08	0.07	1.40	n/a
n/a	MOPIN -> MOITU	0.26	0.27	2.86***	n/a
n/a	MOPIN -> MOPI	0.18	0.18	4.40***	n/a

Legend:

LRSITU	Intention to use location-related services functionalities
LRSPIN	Perceived degree of innovativeness of location-related services functionalities
LRSPI	Perceived impact on mobile work performance of location-related services functionalities
MCITU	Intention to use mobile communication functionalities
MCPI	Perceived impact on mobile work performance of mobile communication functionalities
MCPIN	Perceived degree of innovativeness of mobile communication functionalities
MISITU	Intention to use mobile information searching functionalities
MISPIN	Perceived degree of innovativeness of mobile information searching functionalities
MISPI	Perceived impact on mobile work performance of mobile information searching functionalities
MJSITU	Intention to use mobile job scheduling and dispatching functionalities
MJSPIN	Perceived degree of innovativeness of mobile job scheduling and dispatching functionalities
MJSPI	Perceived impact on mobile work performance of mobile job scheduling and dispatching functionalities
MOITU	Intention to use mobile office functionalities
MOPIN	Perceived degree of innovativeness of mobile office functionalities
MOPI	Perceived impact on mobile work performance of mobile office functionalities
MTTITU	Intention to use mobile transaction processing functionalities
MTTPIN	Perceived degree of innovativeness of mobile transaction processing functionalities
MTTPI	Perceived impact on mobile work performance of mobile transaction processing functionalities
*	95% significance level
**	99% significance level
***	99.9% significance level

Source: Developed for this research

This finding deviates from the original notion of this research that assumed a moderating effect of perceived degree of innovativeness on both the influence of perceived usefulness on intention to use and the influence of intention to use on perceived impact on mobile work performance. Thus, the results show that mobile sales-force workers tend to more often use those mobile work support functions that are considered to be more innovative. For specific mobile work support functions (mobile communication, location-related services and mobile office), the more innovative they are perceived to be, the higher the perceived impact on work performance is. Thereby, this research revealed that perceived degree of innovativeness can be considered a precursor/antecedent for intention to use and perceived impact on mobile work performance.

As this study uses a simplistic version of the personal innovativeness construct established by Midgley and Dowling (1978), the abovementioned findings extend existing TAM-related studies that investigate the impact of personal innovativeness on perceived usefulness and intention to use (e.g., Fang et al. 2009; Farzana & Ainin 2008; Lee et al. 2011; Lu et al. 2005; Schillewaert et al. 2005; Wu et al. 2011; Zarmpou et al. 2011). Future research could be based thereupon to verify or falsify the results of the present study by, for example, extending TTF research with the personal innovativeness construct.

6.3.6 Influence of individual characteristics on perceived usefulness of mobile work support functions

In this subsection, the following research question is discussed:

RQ10: Do individual characteristics of mobile sales-force workers influence the perceived fit between mobile sales-force worker tasks and use of mobile work support functions?

As outlined in figure 6.1, hypotheses H10a-f, H11a-f, H12a-f and H13a-f tested the impact of four individual characteristics (gender, job role, length of tenure, business unit) on perceived usefulness of mobile work support functions. The following subsections discuss the relevant hypotheses in more detail.

6.3.6.1 Gender

Hypotheses H10a-f examined the impact of differences across gender regarding perceived usefulness of mobile work support functions. The wording of these hypotheses is as follows:

H10a-f: There are differences in perceived usefulness of mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office) across gender.

Table 6.14 summarises the results of the hypotheses testing.

Table 6.14 - Influence of gender differences on perceived usefulness of mobile work support functions

Hypotheses	Relationship investigated	Original sample (208)	Sample mean (500)	T Statistics (|O/STERR|)	Supported?
H10a	Gender -> MCPU	0.04	0.06	0.57	No
H10b	Gender -> MISPU	0.13	0.13	1.36	No
H10c	Gender -> MTPPU	0.21	0.20	1.22	No
H10d	Gender -> LSRPU	0.08	0.06	0.46	No
H10e	Gender -> MJSPU	0.10	0.09	0.54	No
H10f	Gender -> MOPU	0.13	0.13	0.80	No

Legend:
LRSPU Perceived usefulness of location-related services functionalities
MCPU Perceived usefulness of mobile communication functionalities
MISPU Perceived usefulness of mobile information searching functionalities
MJSPU Perceived usefulness of mobile job scheduling and dispatching functionalities
MOPU Perceived usefulness of mobile office functionalities
MTTPU Perceived usefulness of mobile transaction processing functionalities

* 95% significance level
** 99% significance level
*** 99.9% significance level

Source: Developed for this research

As no support for hypotheses H10a-f could be determined, it is concluded that there are no significant differences regarding perceived usefulness of mobile work support functions across gender. Thereby, the research findings do not confirm prior results by Chesley (2005) or Middleton (2007) who identified differences in perceptions across gender in the context of technology usage. Rather, this research brought new light into this domain of research, as suggested by Gefen and Straub (1997), as according to the results of this study, gender differences do not need to be considered when designing and rolling out mobile applications for mobile sales-force workers.

6.3.6.2 Length of tenure

Potential differences across participants with regard to length of tenure were investigated by the following hypotheses:

H11a-f: There are differences in perceived usefulness of mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office) across length of tenure.

Table 6.15 summarises the results for the testing of hypotheses H11a-f.

Table 6.15 - Influence of length of tenure on perceived usefulness of mobile work support functions

Hypotheses	Relationship investigated	Original sample (208)	Sample mean (500)	T Statistics (|O/STERR|)	Supported?
H11a	Tenure -> MCPU	-0.07	-0.06	0.92	No
H11b	Tenure -> MISPU	-0.14	-0.14	2.14**	Yes
H11c	Tenure -> MTPPU	-0.10	-0.09	2.35**	Yes
H11d	Tenure -> LRSPU	-0.12	-0.12	1.66*	Yes
H11e	Tenure -> MJSPU	-0.08	-0.08	1.36	No
H11f	Tenure -> MOPU	-0.13	-0.12	1.89*	Yes

Legend:
LRSPU Perceived usefulness of location-related services functionalities
MCPU Perceived usefulness of mobile communication functionalities
MISPU Perceived usefulness of mobile information searching functionalities
MJSPU Perceived usefulness of mobile job scheduling and dispatching functionalities
MOPU Perceived usefulness of mobile office functionalities
MTTPU Perceived usefulness of mobile transaction processing functionalities
Tenure Length of tenure

* 95% significance level
** 99% significance level
*** 99.9% significance level

Source: Developed for this research

Even though this research did not directly examine differences in perception of usefulness between younger and older sales-force workers, the data reveals that there is support for hypotheses H11b-d and hypothesis H11f. The results show that sales-force workers with a greater length of tenure tend to be more sceptical towards MCT than workers with a shorter length of tenure. Thus, mobile work support functions are perceived to be less useful by mobile sales-force workers with a greater length of tenure. Concerning four of the six mobile work support functions investigated, the data from this study suggests that a greater length of tenure negatively affects perceived usefulness of mobile work support functions. Thus, these findings confirm research by Morris and Venkatesh (2000) and Meyer (2007), who established that a greater length of tenure is negatively related with perceived usefulness of information technologies in general.

6.3.6.3 Job role

Differences in perceived usefulness of mobile work support functions between supervisors and operational sales-force workers were investigated by the following six hypotheses:

H12a-f: There are differences in perceived usefulness of mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office) across job roles.

Table 6.16 summarises the results for the testing of hypotheses H12a-f.

Table 6.16 - Influence of job role differences on perceived usefulness of mobile work support functions

Hypotheses	Relationship investigated	Original sample (208)	Sample mean (500)	T Statistics (|O/STERR|)	Supported?
H12a	Job role -> MCPU	0.10	0.10	1.22	No
H12b	Job role -> MISPU	0.11	0.11	2.58***	Yes
H12c	Job role -> MTPPU	0.05	0.05	0.79	No
H12d	Job role -> LRSPU	0.11	0.10	1.89*	Yes
H12e	Job role -> MJSPU	0.11	0.11	1.84*	Yes
H12f	Job role -> MOPU	0.14	0.13	2.87***	Yes

Legend:
LRSPU Perceived usefulness of location-related services functionalities
MCPU Perceived usefulness of mobile communication functionalities
MISPU Perceived usefulness of mobile information searching functionalities
MJSPU Perceived usefulness of mobile job scheduling and dispatching functionalities
MOPU Perceived usefulness of mobile office functionalities
MTTPU Perceived usefulness of mobile transaction processing functionalities

* 95% significance level
** 99% significance level
*** 99.9% significance level

Source: Developed for this research

A binary variable was used to determine differences across job roles using operational sales-force workers as reference variable (cf. section 3.5.2.2 for more information) for the six mobile work support functions. The results for hypothesis H12b and hypotheses H12d-f indicate that except for mobile communication and mobile transaction processing functionalities, supervisors rated perceived usefulness of all other mobile work support functions 11-14% higher than operational sales-force workers. As supervisors have more contact with headquarter colleagues, make fewer sales calls and need to handle more administrative tasks, mobile office functionalities are especially useful for them—as opposed to mobile transaction processing functionalities. The fact that hypotheses H12b and H12d-f were supported in this research validates recent studies that identified differences in perceptions of usefulness and performance impact among different groups of workers (Deibert et al. 2009; Gebauer et al. 2010; Zheng 2007).

6.3.6.4 Business units

Differences across the four business units investigated are examined by the following hypotheses:

H13a-f: There are differences in perceived usefulness of mobile work support functions (mobile communication, mobile information searching, mobile transaction processing, location-related services, mobile job scheduling and dispatching, mobile office) across business units.

Table 6.17 summarises the results of the hypotheses testing.

Table 6.17 - Influence of differences across business units on perceived usefulness of mobile work support functions

Hypotheses	Relationship investigated	Original sample (208)	Sample mean (500)	T Statistics (|O/STERR|)	Supported?
H13a	BU3 -> MCPU	0.26	0.25	2.87***	Yes
H13b	BU3 -> MISPU	0.23	0.23	2.11**	Yes
H13c	BU3 -> MTPPU	0.26	0.26	2.49**	Yes
H13d	BU3 -> LRSPU	0.28	0.28	2.79***	Yes
H13e	BU3 -> MJSPU	0.29	0.29	3.27***	Yes
H13f	BU3 -> MOPU	0.24	0.23	2.26**	Yes

Legend:

BU3	Business unit 3
LRSPU	Perceived usefulness of location-related services functionalities
MCPU	Perceived usefulness of mobile communication functionalities
MISPU	Perceived usefulness of mobile information searching functionalities
MJSPU	Perceived usefulness of mobile job scheduling and dispatching functionalities
MOPU	Perceived usefulness of mobile office functionalities
MTTPU	Perceived usefulness of mobile transaction processing functionalities
*	95% significance level
**	99% significance level
***	99.9% significance level

Source: Developed for this research

Regarding the differences among the four business units investigated in this study, support could be found for the hypotheses related to business units 3 and 4. Therefore, it can be concluded that there are differences in perceived usefulness for all mobile work support functions between the participants of business units 3 and 4. A binary variable was used to determine differences across business units using business unit 4 as reference variable (cf. section 4.2.2.2 for more information). It can be concluded that participants from business unit 3 rated perceived usefulness of mobile work support functions 23-29% higher than their counterparts in business unit 4. Among all the other potential combinations of business units, no significant differences between groups could be determined (more results, cf. section 5.4). The differences between business units 3 and 4 might be explained by their different ways of working and the different types of customers they visit. Similar to the differences identified across job roles, the abovementioned findings confirm recent research conducted in this area (Deibert et al. 2009; Gebauer et al. 2010; Zheng 2007).

6.4 Chapter summary

This chapter discussed the results of the previous data analysis chapters in relation to the study's research questions, hypotheses and existing literature. The research findings indicate that certain mobile work support functions are perceived to be useful and innovative in supporting mobile sales-force workers' tasks. Thereby, mobile communication functionalities can improve customer service and communication with an organisation's office personnel. Mobile information searching functionalities enable mobile sales-force workers to prepare more effectively for ad-hoc sales calls. Mobile transaction processing functionalities reduce double-handling of data entries by entering sales-process related data on the spot. Mobile office functionalities facilitate the handling of administrative work by sales-force workers during dead times.

However, this research also found that other mobile work support functions are not a good fit with the way tasks are conducted in the field—and are likely to be strongly resisted by sales-force workers. Some sales-force workers interviewed showed a strong resistance to using these functionalities as they fear that their autonomous way of working could change (through mobile job scheduling and dispatching functionalities) and they feared that their employer might unnecessarily use the tool for controlling purposes (e.g., by using location-related services functionalities).

Moreover, the results show that there are differences in perceived usefulness of mobile work support functions across different job roles, across the four business units in the case organisation and across participants with different lengths of tenure—but not across gender.

Furthermore, research findings indicate that two specific task characteristics of pharmaceutical sales-force workers (i.e., location dependence and time criticality) positively correlate with perceived usefulness of all mobile work support functions investigated and that this perceived fit is also positively correlated with intention to use mobile work support functions and perceived impact on mobile work performance.

In addition, no support could be determined for the moderating effect of the perceived degree of innovativeness on both the influence of perceived usefulness on intention to use and the influence of intention to use on perceived impact on mobile work performance. However, the research findings indicate that perceived degree of innovativeness has a strong direct effect on intention to use for all mobile work support functions and a direct effect on perceived impact on mobile work performance for certain mobile work support functions investigated in this research (i.e., mobile communication, location-related services, and mobile office). It should also be acknowledged that the study uses a simplistic version of the personal innovativeness construct and these findings regarding the variable perceived degree of innovativeness should, therefore, be treated with caution.

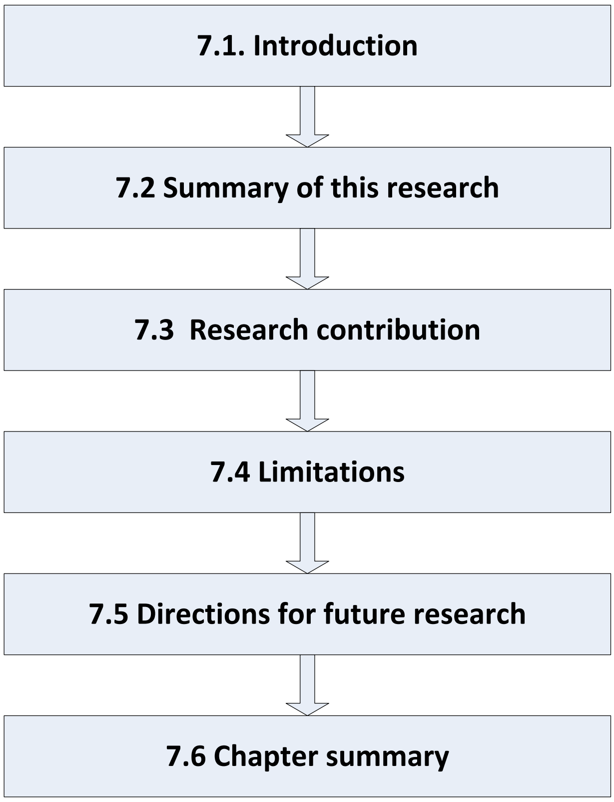
Appendix 2 provides a table summarising all hypotheses of this research and respective support.

7 Conclusions and implications

7.1 Introduction

The last chapter of this dissertation concludes this study. Figure 7.1 outlines the structure of this chapter.

Figure 7.1 - Structure of the conclusions and implications chapter



Source: Developed for this research

This chapter provides a high-level summary of this study in terms of the research questions and hypotheses investigated and tested in this research, the methodological approach used, and the key findings. Most importantly, this chapter discusses the key contributions this study has made to theory and practice and the implications of this research for current and future research and practice. The limitations of this study are acknowledged. Lastly, suggestions for future research in the area of this study are provided.

7.2 Summary of this research

The purpose of this section is to provide a summary of this research in terms of the research problem, general research questions and hypotheses which were investigated, the methodological approach used to conduct this study and the major findings and conclusions that can be drawn from this study.

7.2.1 Research problem

The main aims of this research were to investigate

1) how and to what extent are specific mobile work support functions enabled by MCT perceived to be useful in supporting mobile sales-force worker tasks;
2) the extent to which perceived usefulness is influenced by individual sales-force worker characteristics;
3) the extent to which perceived usefulness and intention to use mobile work support functions influence mobile sales-force worker performance; and
4) whether the perceived degree of innovativeness of mobile work support functions moderates the relationship between perceived usefulness and intention to use; and the relationship between perceived usefulness and perceived impact on mobile work performance of mobile work support functions.

To achieve these research objectives, a two-stage research design was selected, and 10 specific research questions and 13 specific hypotheses were formulated. Appendix 1 and appendix 2 provide a summary of all of research questions and hypotheses investigated in this study.

7.2.2 Research methodology

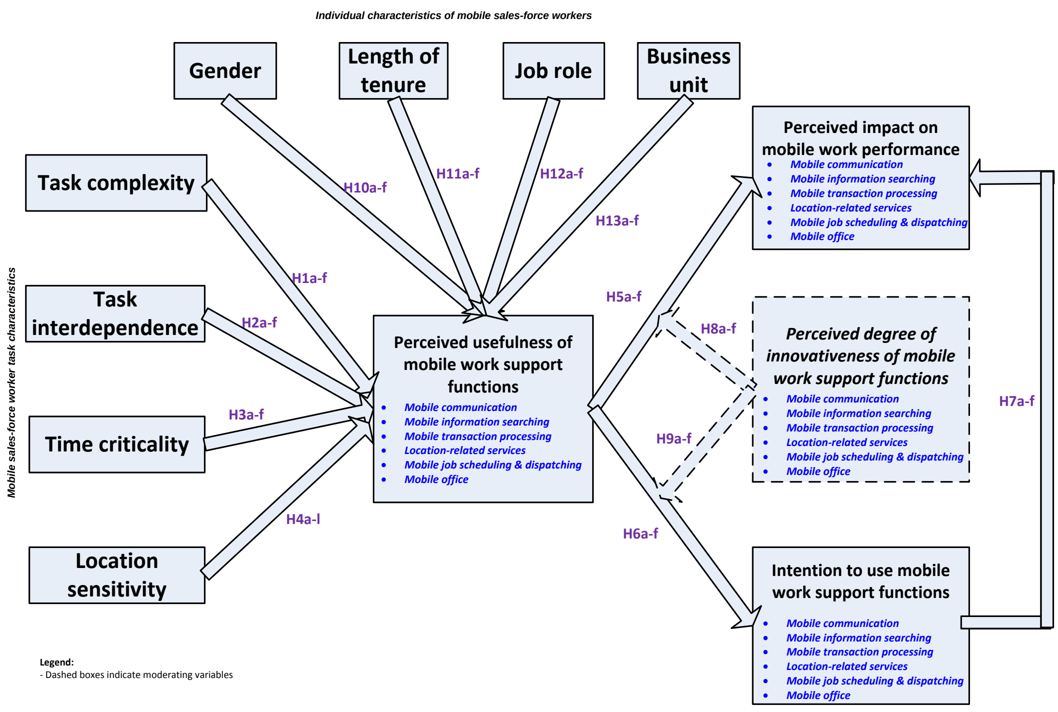
Drawing on task-technology fit (TTF) and technology acceptance model (TAM) theories, this study used two research phases and a mixed methodological approach to conduct an in-depth case study of the German division of a large pharmaceutical company. The first research phase collected primarily qualitative data using semi-structured interviews to determine how and why specific mobile work support functions are perceived to be useful in supporting pharmaceutical sales-force worker tasks. The first research phase informed the second research phase by providing support for the conceptual model proposed for this research and assisted in the refinement of the online survey instrument in the context of the case study organisation by developing real-life usage scenarios for each of the mobile work support functions investigated. The second research phase collected quantitative data to validate and test the research's conceptual model. Thereby, the second research phase determined to what extent is there a perceived fit between sales-force worker tasks and mobile work support functions and to what extent this fit and individual characteristics of sales-force workers influence sales-force worker performance and intention to use mobile work support functions.

7.2.3 Research hypotheses

Relevant parent and immediate literature in the context of the research questions provided the justification for the development of 13 hypotheses which were tested after having collected empirical data in the second research phase (online survey). The hypotheses tested the relationships in the proposed research mode—an adapted TTF model with two constructs from TAM (perceived usefulness, intention to use) that examined the perceived fit of mobile work support functions enabled by MCT and mobile sales-force worker tasks and the potential impact of this fit on the intention to use mobile work support functions and work performance of mobile sales-force workers.

Figure 7.1 provides an overview of the research model and the hypotheses formulated for this research.

Figure 7.2 - Research model of this study



Source: Developed for this research

Table 7.1 provides a summary of hypotheses which were supported or not supported in this study.

Table 7.1 - Supported and unsupported hypotheses of this study

Hypotheses	Relationship investigated	Supported?
H1a-f	Task complexity has a positive impact on perceived usefulness of mobile work support functions	None
H2a-f	Task interdependence has a positive impact on perceived usefulness of mobile work support functions	H2b, H2f
H3a-f	Time criticality has a positive impact on perceived usefulness of mobile work support functions	All
H4a-l	Location sensitivity has a positive impact on perceived usefulness of mobile work support functions	H4g-l
H5a-f	Perceived usefulness of mobile work support functions has a positive impact on perceived mobile work performance	All
H6a-f	Perceived usefulness of mobile work support functions has a positive impact on intention to use	All

Hypotheses	Relationship investigated	Supported?
H7a-f	Intention to use mobile work support functions has a positive impact on perceived mobile work performance	All
H8a-f	The relationship between the perceived usefulness of mobile work support functions and perceived mobile work performance is moderated by the perceived degree of innovativeness of mobile work support functions	None
H9a-f	The relationship between the perceived usefulness of mobile work support functions and intention to use mobile work support functions is moderated by the perceived degree of innovativeness of mobile work support functions	None
H10a-f	There are differences in perceived usefulness of mobile work support functions across gender	None
H11a-f	There are differences in perceived usefulness of mobile work support functions across length of tenure	H11b-d, H11f
H12a-f	There are differences in perceived usefulness of mobile work support functions across job roles	H12b, H12d-f
H13a-f	There are differences in perceived usefulness of mobile work support functions across business units	All

Source: Developed for this research

Appendix 2 provides a detailed table summarising all hypotheses and sub-hypotheses investigated in this study and the results of the hypotheses testing.

7.2.4 Major conclusions and findings

For both research phases, this study's major conclusions and findings are summarised in the following subsections.

Table 7.2 summarises this study's conclusions in relation to the research questions and hypotheses.

Table 7.2 - Conclusions in relation to the research questions and hypotheses

No.	Conclusion	Hypotheses	Research question
1	Except for mobile job scheduling and dispatching functionalities, all mobile work support functions investigated in this research were considered to be moderately useful and innovative	n/a	RQ1, RQ2
2	Mobile work support functions are perceived to accelerate communication, improve information delivery, reduce paper-based work, reduce double-handling of data entries, improve preparation for ad-hoc sales calls and facilitate a more efficient usage of dead times	n/a	RQ3
3	MCT might be misused as a control tool, might reduce work autonomy and might increase workload and stress	n/a	RQ3
4	Time criticality and location dependence of mobile sales-force workers positively affect perceived usefulness of mobile work support functions	H1a-f, H2a-f, H3a-f, H4a-l	RQ4
5	Perceived usefulness of mobile work support functions positively affects intention to use and perceived impact on mobile work performance of mobile work support functions	H5a-f, H6a-f, H7a-f	RQ5, RQ6, RQ7
6	No moderating effect of perceived degree of innovativeness could be determined for both the influence of perceived usefulness on intention to use and the influence of perceived usefulness on perceived impact on mobile work performance	H8a-f, H9a-f	RQ8, RQ9
7	Differences across job roles, across length of tenure and across business units affect perceived usefulness of mobile work support functions—but not across gender	H10a-f, H11a-f, H12a-f, H13a-f	RQ10

Source: Developed for this research

Conclusion 1 - Except for mobile job scheduling and dispatching functionalities, all mobile work support functions investigated in this research were considered to be moderately useful and innovative

Results from the first research phase indicate that the perceived usefulness and perceived degree of innovativeness of all mobile work support functions were considered to be of a medium level for supporting sales-force worker tasks in a mobile work setting—except for mobile job scheduling and dispatching functionalities where the degree of usefulness and innovativeness was considered to be low.

These results are similar to other studies in this area where comparable ratings for perceived usefulness of these mobile work support functions were determined (Yuan et al. 2010; Zheng 2007).

Conclusion 2 - Mobile work support functions are perceived to accelerate communication, improve information delivery, reduce paper-based work, reduce double-handling of data entries, improve preparation for ad-hoc sales calls and facilitate a more efficient usage of dead times

Results from the first research phase indicate why certain mobile work support functions are perceived to be useful and innovative. Thereby, mobile work support functions are perceived to:

- accelerate communication with customers, colleagues and office personnel (IBM Cooperation 2004; Yuan et al. 2010; Zheng 2007);
- improve information delivery to the customer (Accenture 2004; IBM Cooperation 2004; Koschembahr 2005);
- reduce paper-based work and thereby reduce double-handling of data entries by entering sales-process related data on the spot (Henri & Aurelie 2006; IBM Cooperation 2004; Perry et al. 2001; Pousttchi & Thurnher 2005; Schierholz et al. 2007; Sheng et al. 2005);

- improve preparation for ad-hoc sales calls and facilitate a more efficient usage of dead times resulting in a reduction of administrative work to be handled at home and an increase in work-life balance (Henri & Aurelie 2006; IBM Cooperation 2004; Liang & Wei 2004; Perry et al. 2001; Schierholz et al. 2007; Sheng et al. 2005).

Conclusion 3 - MCT might be misused as a control tool, might reduce work autonomy and might increase workload and stress

This research also established that other mobile work support functions are not a good fit with the way tasks are conducted in the field and are likely to be strongly resisted by sales-force workers. Some sales-force workers interviewed showed a strong resistance to using these functionalities as they feared their autonomous way of working could be changed (through mobile job scheduling and dispatching functionalities), their employer might unnecessarily misuse the tool for controlling purposes (e.g., by using location-related services functionalities) and workloads and stress may increase as a result of the invasive nature of MCT. Recent studies support these findings (Middleton 2007; Middleton & Cukier 2006; Shilton 2009).

Conclusion 4 - Time criticality and location dependence of mobile sales-force workers positively affect perceived usefulness of mobile work support functions

For all mobile work support functions investigated in this study, an analysis of survey data indicated that two specific task characteristics of mobile sales-force workers (i.e., location dependence and time criticality) are positively correlated with the perceived usefulness of all mobile work support functions investigated. Moreover, task complexity and task interdependence indirectly affect perceived usefulness of mobile work support functions for all six research models investigated in the second research phase of this study. In particular, task complexity negatively affects time criticality and task interdependence positively affects time criticality at a significant level. In addition, there exists a positive and significant relationship between task interdependence and both mobile information searching and mobile office functionalities. Location variety does not directly affect perceived usefulness of mobile work support functions, but does negatively affect location dependence.

This study's findings partially confirm the findings of Zheng’s (2007) and Yuan et al.'s (2010) research. Similar to this research, Zheng (2007, p. 167) identified a positive relationship between time criticality and mobile notification, location tracking and real-time job dispatching functionalities and a significant positive relationship of perceived usefulness of location-related services, and both location variance and location dependence. However, Zheng (2007, p. 167) identified a significant positive relationship between task complexity and certain mobile work support functions (information searching, offline transaction processing, batch mode job dispatching, real time job dispatching, mobile office)—but not between time criticality and batch mode job dispatching functionalities.

Similar to Zheng (2007) and this study’s findings, Yuan et al. (2010, p. 132) identified a significant relationship between time criticality and both mobile notification and location-tracking functionalities. In addition, Yuan et al. (2010, p. 132) identified a significant positive relationship between location dependence and perceived usefulness of location tracking, navigation and real-time job dispatching functionalities. However, Yuan et al. (2010, p. 132) did not identify a significant relationship between time criticality and real-time job dispatching functionalities; and did not investigate the impact of task complexity and task interdependence on perceived usefulness of mobile work support functions.

Differences between the findings of this dissertation and Zheng’s (2007) and Yuan et al.'s (2010) research can be explained by the different types of mobile workers investigated and their different needs for respective mobile work support. Thus, while this study examined the impact of task characteristics on perceived usefulness of mobile work support functions for a homogenous group of sales-force workers, the other two studies mentioned above examined a broader set of mobile workers from different industries.

Conclusion 5 - Perceived usefulness of mobile work support functions positively affects intention to use and perceived impact on mobile work performance of mobile work support functions

Support for hypotheses H5a-f and H6a-f indicates that for all mobile work support functions investigated in this study, perceived usefulness of mobile work support functions positively affects perceived impact on mobile work performance and intention to use mobile work support functions. In addition, intention to use mobile work support functions positively affects perceived impact on mobile performance. Thereby, this study confirms the interdependencies of the constructs established in the TTF model and recent studies in this specific research domain (Deibert et al. 2008; Gebauer et al. 2010; Gebauer & Tang 2008; Lee et al. 2005; Zheng 2007).

Conclusion 6 - No moderating effect of perceived degree of innovativeness could be determined for both the influence of perceived usefulness on intention to use and the influence of perceived usefulness on perceived impact on mobile work performance

In this study, no moderating effect on the perceived degree of innovativeness could be determined for both the influence of perceived usefulness on intention to use and the influence of perceived usefulness on perceived impact on mobile work performance. Instead, the results of the data analysis reveal that the perceived degree of innovativeness has a strong direct effect on intention to use for all mobile work support functions investigated and a direct effect on perceived impact on mobile work performance for some mobile work support functions investigated in this research (i.e., mobile communication, location-related services and mobile office). Even though there are studies that have identified a link between innovativeness and performance (e.g., Adegbesan & Ricart 2007; Rogers 1998), there is a lack of research that has empirically analysed perceived degree of innovativeness in relation to the six specific mobile work support functions investigated in this research such that this research finding cannot be compared to other studies.

Conclusion 7 - Differences across job roles, across length of tenure and across business units affect perceived usefulness of mobile work support functions—but not across gender

With regard to the analysis of the four individual characteristics (gender, length of tenure, job role, business unit) examined in this research, results indicate that no differences in perceived usefulness across gender could be determined. Except for mobile communication and mobile transaction processing functionalities, supervisors rated perceived usefulness of all other mobile work support functions 11-14% higher than operational sales-force workers. In addition, participants from business unit 3 perceived all mobile work support functions to be 23%-29% more useful than the participants from the reference business unit 4; while there were no differences between the other business units 1 and 2 and the reference business unit 4. Lastly, length of tenure and perceived usefulness of four mobile work support functions (i.e., mobile information searching, mobile transaction processing, location-related services and mobile office) are inversely related at a significant level. Thus, the research participants who were employed at the case organisation for longer periods of tenure perceived these four mobile work support functions to be less useful.

This study confirms the finding of recent empirical studies regarding the differences in technology perceptions across length of tenure (Meyer 2007; Morris & Venkatesh 2000), across business units and job roles (Deibert et al. 2009; Gebauer et al. 2010; Zheng 2007) and also contributes to research investigating differences across gender in the acceptance and use of technology (Gefen & Straub 1997; Terzis & Economides 2011).

7.3 Research contribution

The following subsections discuss this study's main contributions to theory and practice.

7.3.1 Contribution to theory

This study contributes to theory by:

- examining the impact of individual characteristics on perceived usefulness of mobile applications (Yuan et al. 2010);
- conducting a large-scale test of the TTF model for mobile technologies at the operational level (Gebauer et al. 2010);
- adding contextual extensions to the TTF model (Ahearne et al. 2008); and
- examining the link between sales technology and sales-force worker performance using TTF theory (e.g., Ahearne et al. 2008; Ahearne & Schillewaert 2001; BenMoussa 2006; Koschembahr 2005; Scornavacca & Sutherland 2008).

To achieve this, this study established and tested a generalisable framework to investigate to what extent a perceived good fit of mobile work support functions enabled by MCT and mobile sales-force worker tasks influences work performance of mobile sales-force workers and their intention to use mobile work support functions.

Thereby, the research results indicate that mobile work support functions have the potential to positively affect mobile work performance. In addition, the study provided new insights regarding the impact of individual characteristics on perceived usefulness of mobile work support functions and the impact of the perceived degree of innovativeness on intention to use mobile work support functions and perceived impact on mobile work performance. Based on empirical data collected in this research, differences in perceptions across job roles, length of tenure and business units could be determined for the perceived usefulness of all or some of the mobile work support functions—but not across gender. In addition, perceived degree of innovativeness did not moderate the relationship between perceived usefulness and intention to use mobile work support functions and the relationship between perceived usefulness of mobile work support functions and perceived impact on mobile work performance. Instead, this research identified that perceived degree of innovativeness can be a precursor of intention to use mobile work support functions and for perceived impact on mobile work performance.

7.3.2 Contribution to practice

This research contributes to practice in several ways. First, the study identified specific mobile work support functions that are perceived to fit with mobile sales-force worker tasks and thereby have the potential to increase work performance of mobile sales-force workers. For sales managers, increasing sales-force worker performance can be a means of gaining a competitive advantage over competitors in the market. In addition, the author of this study is convinced that by closely integrating two or more complementary mobile work support functions (e.g., first information gathering and then communicating new insights via email) into the sales process, the real potential for MCT to be useful and innovative in transforming sales-force work processes can be leveraged. Regarding the impact of task characteristics on perceived usefulness of mobile work support functions, this study determined that MCT can be especially useful in supporting location-dependent and time-critical tasks such as determining the closest customer in reach or looking up information that is relevant for the upcoming sales call.

Second, as certain individual characteristics of mobile sales-force workers significantly affect perceived usefulness of mobile work support functions, it can be concluded that there is no 'one size fits all' mobile application that affects mobile work performance of every type of sales-force worker in the same way. For organisations, this implies that the introduction of MCT needs to be supported with a strong business case. Thereby, it is crucial to determine the appropriate type of mobile device or mix of mobile devices (e.g., an iPad, smartphone) for the different types of sales-force workers and their specific mobile work tasks.

Third, as ubiquity can be seen as either a boon or a bane, the key findings of this study indicate that especially regarding the location-tracking functionality, adoption and acceptation issues in the work force need to be addressed such that the potential of MCT can be leveraged. On the one hand, MCT can be considered a tool that can contribute to a positive work-life balance. On the other hand, MCT can be considered a source of stress and additional work load such that the feeling of being a ‘Crackberry’ (Middleton & Cukier 2006) might emerge. Moreover, privacy of employees needs to be taken seriously—the recent finding by security researchers that iPhones keep track of where a user goes and stores this data in plaintext (*The Guardian* 2011) has not increased confidence of employees and the general public in location-tracking functions. If privacy issues are not addressed correctly, resistance to the introduction of MCT might arise in many organisations. Thus, this research strongly suggests involving all relevant panels and boards of a company when introducing MCT on a large-scale basis to provide appropriate oversight and governance. In the case organisation, workers’ councils are heavily involved in ensuring that no systems will be introduced that enable the identification of work performance-related data. The influence of such panels is underlined by the fact that the workers’ councils at Volkswagen—Europe’s largest automotive manufacturer—succeeded in having the email functionality of company mobile phones (i.e., BlackBerrys) disabled outside of regular working hours (*Spiegel Online* 2011).

Last but not least, based on the findings above, the following recommendations for both sales-force supervisors and operational sales-force workers can be made when implementing MCT in organisations or when trying to identify new business opportunities from an existing mobile computing platform.

This study suggests that sales-force supervisors should carefully consider both the strategic goals of the organisation they work in and the needs and concerns of their operational sales-force workers when implementing MCT in the workplace. Sales-force supervisors can benefit from the findings of this study by being aware that mobile work support functions are perceived to accelerate communication, improve information delivery, reduce paper-based work, reduce double-handling of data entries, improve preparation for ad-hoc sales calls and facilitate a more efficient usage of dead times. As both organisational business needs and task characteristics of mobile sales-force workers differ from industry to industry and from company to company, the fit of MCT with mobile sales-force worker tasks needs to be investigated thoroughly as there no 'one size fits all' application for all the different types of tasks that are undertaken by sales-force workers in the field. To achieve this, the six mobile work support functions investigated in this research can be reconsidered. Especially when analysing the benefits of location-related services and mobile job scheduling and dispatching functionalities, sales-force supervisors need to seriously consider the needs and concerns of their subordinates (e.g., privacy, work-life balance) to address resistance to change of mobile work tasks in advance. Even though it might be easier to leverage the benefits provided by mobile communication, mobile information searching, mobile transaction processing and mobile office functionalities, sales-force supervisors should also consult with the relevant boards and panels when implementing MCT in organisations (e.g., workers council, data protection officer etc.) as they can be important stakeholders that might positively or negatively affect the adoption and utilisation of MCT in an organisation. As this study identified differences across certain individual sales-force worker characteristics (i.e., length of tenure, job role and business unit), education and training on the use of MCT must be adjusted to respective needs of prospective sales-force workers to effectively use MCT in their mobile work tasks.

As the introduction of technologies like e.g., MCT is usually mandated in organisations, operational sales-force workers are advised to support the organisation they work in and to help identifying those areas where mobile work support functions fit with their daily tasks at hand. Again, the six mobile work support functions investigated in this research can help identifying the above mentioned fit. Furthermore, any concerns that operational sales-force workers have about using MCT need to be communicated proactively and timely such that these can be addressed early by their sales-force supervisors. Operational sales-force workers should view MCT as a tool that supports their daily work and should see the benefits provided by it. Operational sales-force workers must be self-disciplined and are also responsible for their own work-life balance. The mobile phone can be turned off after at the end of each working day. Based on the major findings of this dissertation, the researcher is convinced that a successful MCT implementation in an organisation needs to be aligned with its strategic goals and consider the needs and concerns of the people that have to use it.

7.4 Limitations

As with all studies, this research does have some limitations. Besides the research methodology-specific limitations of this study (cf. chapters 3), this subsection outlines limitations regarding the study's specific context, the specific type of innovation decision used to introduce MCT in the case organisation and the measurement of the perceived degree of innovativeness construct.

The scope of this research is limited to the extent that it was conducted in a single-case organisation and that the investigation concentrates on pharmaceutical sales-force work in Germany. Both limitations of this research also provided a unique opportunity often not available to researchers to conduct an in-depth test of the TTF model within a large organisation and a specific industry.

In addition, the research results are limited as the participants had to rate a technology whose use was mandated by the case organisation's management and was not yet in place at the time of the research. Thereby, ratings for perceived usefulness of mobile work support functions might be different in the case of an optional innovation-decision (Rogers 2003) as change management-related aspects (e.g., dealing with resistance against using new technologies) need to be handled differently (Cummings & Worley 2005; Graetz et al. 2006).

Lastly, the measurement of the perceived degree of innovativeness construct with a single item is simplistic; future research could use a more comprehensive set of measurement items (as, e.g., used by Fang et al. 2009; Farzana & Ainin 2008; Lee et al. 2011; Lu et al. 2005; Schillewaert et al. 2005; Wu et al. 2011; Zarmpou et al. 2011) for assessing perceived degree of innovativeness of an emerging technology such as MCT.

7.5 Directions for future research

Directions for future research are outlined in the following subsections.

Retest of the study's research model

Future research could retest this study's research model in several ways. First, the direct effect of the perceived degree of innovativeness on intention to use and perceived impact on mobile work performance could be investigated more thoroughly by using a more comprehensive measure such as the abovementioned personal innovativeness construct. Thereby, researchers need to ensure that the participants understand the difference between perceived usefulness and perceived degree of innovativeness. Second, the survey instrument's statistical power and generalisabilty could be increased by surveying a large and heterogeneous sample population. Thereby, it might be worth investigating why specific mobile work support functions are perceived to be not useful and why certain hypotheses were not supported in this study. Lastly, testing this research model in an organisation where MCT has been introduced and is in use could reveal new, additional findings.

Examination of the interrelatedness of mobile work support functions

The author is convinced that the real potential of MCT can be exploited when using Zheng's (2007) mobile work support functions in combination—not in isolation. For example, by combining two mobile work support functions, (e.g., looking information up and communicating it via email), perceived usefulness and perceived degree of innovativeness might be even higher. Thus, it is assumed that there are synergies among those functionalities, but this aspect was not considered in this research. Future research could cover this aspect in more detail. Thereby, one single performance figure indicating the aggregated perceived impact on mobile work performance within one organisation might be beneficial for senior managers when having to justify the budget for introducing MCT within organisations.

Testing the model with more advanced MCT and other variables

As mobile computing technologies are about to reach widespread acceptance and maturity (Ladd 2010; Lee & Lee 2009), it is suggested testing the proposed model with more advanced mobile technologies that have recently evolved or that are on the edge of entering the mass market. For example, the introduction of tablet PCs (e.g., iPads, android tablets) and the most recent versions of smartphones (e.g., the iPhone 5) could provide new functionalities that could substantially increase work performance. The integration of other variables in the proposed model is another option for future research. As more and more devices use a touch screen user interface, one could examine how usability factors of mobile devices in the context of mobile work tasks might affect perceived usefulness and intention to use. Furthermore, one could examine how a high bandwidth (e.g., as provided by WiMax, WLAN or 4G) might positively affect these constructs.

7.6 Chapter summary

This last chapter of the dissertation has summarised the study's key findings, and the main contributions of this study to theory and practice. As with most research, there are limitations which are acknowledged; and directions for future research have been suggested.

In brief, this study established and tested a generalisable framework to investigate the perceived fit of mobile work support functions enabled by MCT and mobile sales-force worker tasks and the potential impact of this fit on the intention to use mobile work support functions and work performance of mobile sales-force workers. A two-stage research design was chosen to conduct this study, and 10 research questions and 13 hypotheses were developed from an extensive review of the relevant literature, culminating in a comprehensive theoretical and conceptual model (cf. appendices 1 and 2 for all research questions and hypotheses of this study) which draws on TTF and TAM theories.

The following major conclusions were drawn from the research results:

- Except for mobile job scheduling and dispatching functionalities, all mobile work support functions investigated in this research were considered to be moderately useful and innovative

- Mobile work support functions are perceived to accelerate communication, improve information delivery, reduce paper-based work, reduce double-handling of data entries, improve preparation for ad-hoc sales calls and facilitate a more efficient usage of dead times
- MCT might be misused as a control tool, might reduce work autonomy and might increase workload and stress
- Time criticality and location dependence of mobile sales-force workers positively affect perceived usefulness of mobile work support functions
- Perceived usefulness of mobile work support functions positively affects intention to use and perceived impact on mobile work performance of mobile work support functions
- No moderating effect of perceived degree of innovativeness could be determined for both the influence of perceived usefulness on intention to use and the influence of perceived usefulness on perceived impact on mobile work performance
- Differences across job roles, across length of tenure and across business units affect perceived usefulness of mobile work support functions—but not across gender.

This study contributes to theory by examining the impact of individual characteristics on perceived usefulness of mobile applications, by conducting a large-scale test of the TTF model for mobile technologies at the operational level, by adding contextual extensions to the TTF model and by examining the link between sales technology and sales-force worker performance using TTF theory. The study contributed to practice by establishing a generalisable model that is not tied to pharmaceutical sales-force work and can be retested in a different industry setting. The scope of this research is limited with regard to the study's specific context, the specific type of innovation decision used to introduce MCT in the case organisation and the measurement of the perceived degree of innovativeness construct. This research provided a unique opportunity (not often available to researchers) to conduct an in-depth test of the proposed research model within a large organisation. Future research could retest the research model empirically validated and tested in this study in other contexts and industries and analyse the impact of perceived innovativeness on intention to use and perceived performance impact. In addition, the research model could be retested with more recent and advanced MCT to particularly investigate the use of ‘mobile apps’ and tablet PCs (e.g., iPads/Android tablets) and their potential impact on work performance.

This dissertation concludes with a quote from one of the interviewees:

‘The world will become wireless – and if a company misses the opportunities provided, it will lose its competitiveness.’ (P17)

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Appendix 1—Research questions

Table A1.1 - Research questions

	Research question
Research phase 1 - Semi-structured interviews	
RQ1	How useful is each of the mobile work support functions in supporting mobile sales-force worker tasks?
RQ2	To what degree is each of the mobile work support functions innovative in supporting mobile sales-force worker tasks?
RQ3	Why is each of the mobile work support functions useful or not useful in supporting mobile sales-force worker tasks?
Research phase 2 - Online survey	
RQ4	To what degree do task characteristics of mobile sales-force workers influence perceived usefulness of mobile work support functions?
RQ5	To what extent does a perceived fit between mobile sales-force worker tasks and use of mobile work support functions influence perceived mobile work performance?
RQ6	To what extent does a perceived fit between mobile sales-force worker tasks and use of mobile work support functions influence intention to use mobile work support functions?
RQ7	To what extent does the intention to use mobile work support functions by mobile sales-force workers influence perceived mobile work performance?
RQ8	To what extent is the relationship between the perceived usefulness of mobile work support functions and perceived mobile work performance influenced by the perceived degree of innovativeness of mobile work support functions?
RQ9	To what extent is the relationship between the perceived usefulness of mobile work support functions and intention to use mobile work support functions influenced by the perceived degree of innovativeness of mobile work support functions?
RQ10	Do individual characteristics of mobile sales-force workers influence the perceived fit between mobile sales-force worker tasks and use of mobile work support functions?

Source: Developed for this research

Appendix 2—Hypotheses and support

Table A2.1 - Supported and unsupported hypotheses of this research

ID	**Hypothesis**	**Supported**?
H1a	Task complexity has a positive impact on perceived usefulness of mobile communication functionalities	No
H1b	Task complexity has a positive impact on perceived usefulness of mobile information searching functionalities	No
H1c	Task complexity has a positive impact on perceived usefulness of mobile transaction processing functionalities	No
H1d	Task complexity has a positive impact on perceived usefulness of mobile job scheduling and dispatching functionalities	No
H1e	Task complexity has a positive impact on perceived usefulness of location-related services functionalities	No
H1f	Task complexity has a positive impact on perceived usefulness of mobile office functionalities	No
H2a	Task interdependence has a positive impact on perceived usefulness of mobile communication functionalities	No
H2b	Task interdependence has a positive impact on perceived usefulness of mobile information searching functionalities	Yes
H2c	Task interdependence has a positive impact on perceived usefulness of mobile transaction processing functionalities	No
H2d	Task interdependence has a positive impact on perceived usefulness of mobile job scheduling and dispatching functionalities	No
H2e	Task interdependence has a positive impact on perceived usefulness of location-related services functionalities	No
H2f	Task interdependence has a positive impact on perceived usefulness of mobile office functionalities	Yes
H3a	Time criticality has a positive impact on perceived usefulness of mobile communication functionalities	Yes
H3b	Time criticality has a positive impact on perceived usefulness of mobile information searching functionalities	Yes
H3c	Time criticality has a positive impact on perceived usefulness of mobile transaction processing functionalities	Yes
H3d	Time criticality has a positive impact on perceived usefulness of mobile job scheduling and dispatching functionalities	Yes

ID	Hypothesis	Supported?
H3e	Time criticality has a positive impact on perceived usefulness of location-related services functionalities	Yes
H3f	Time criticality has a positive impact on perceived usefulness of mobile office functionalities	Yes
H4a	Location variance has a positive impact on perceived usefulness of mobile communication functionalities	No
H4b	Location variance has a positive impact on perceived usefulness of mobile information searching functionalities	No
H4c	Location variance has a positive impact on perceived usefulness of mobile transaction processing functionalities	No
H4d	Location variance has a positive impact on perceived usefulness of mobile job scheduling and dispatching functionalities	No
H4e	Location variance has a positive impact on perceived usefulness of location-related services functionalities	No
H4f	Location variance has a positive impact on perceived usefulness of mobile office functionalities	No
H4g	Location dependence has a positive impact on perceived usefulness of mobile communication functionalities	Yes
H4h	Location dependence has a positive impact on perceived usefulness of mobile information searching functionalities	Yes
H4i	Location dependence has a positive impact on perceived usefulness of mobile transaction processing functionalities	Yes
H4j	Location dependence has a positive impact on perceived usefulness of mobile job scheduling and dispatching functionalities	Yes
H4k	Location dependence has a positive impact on perceived usefulness of location-related services functionalities	Yes
H4l	Location dependence has a positive impact on perceived usefulness of mobile office functionalities	Yes
H5a	Perceived usefulness of mobile communications functionalities has a positive impact on perceived mobile work performance	Yes
H5b	Perceived usefulness of mobile information searching functionalities has a positive impact on perceived mobile work performance	Yes
H5c	Perceived usefulness of mobile transaction processing functionalities has a positive impact on perceived mobile work performance	Yes
H5d	Perceived usefulness of location-related services functionalities has a positive impact on perceived mobile work performance	Yes

ID	Hypothesis	Supported?
H5e	Perceived usefulness of mobile job scheduling and dispatching functionalities has a positive impact on perceived mobile work performance	Yes
H5f	Perceived usefulness of mobile office functionalities has a positive impact on perceived mobile work performance	Yes
H6a	Perceived usefulness of mobile communications functionalities has a positive impact on intention to use	Yes
H6b	Perceived usefulness of mobile information searching functionalities has a positive impact on intention to use	Yes
H6c	Perceived usefulness of mobile transaction processing functionalities has a positive impact on intention to use	Yes
H6d	Perceived usefulness of location-related services functionalities has a positive impact on intention to use	Yes
H6e	Perceived usefulness of mobile job scheduling and dispatching functionalities has a positive impact on intention to use	Yes
H6f	Perceived usefulness of mobile work office functionalities has a positive impact on intention to use	Yes
H7a	Intention to use mobile communications functionalities has a positive impact on perceived mobile work performance	Yes
H7b	Intention to use mobile information searching functionalities has a positive impact on perceived mobile work performance	Yes
H7c	Intention to use mobile transaction processing functionalities has a positive impact on perceived mobile work performance	Yes
H7d	Intention to use location-related services functionalities has a positive impact on perceived mobile work performance	Yes
H7e	Intention to use mobile job scheduling and dispatching functionalities has a positive impact on perceived mobile work performance	Yes
H7f	Intention to use mobile office functionalities has a positive impact on perceived mobile work performance.	Yes
H8a	The relationship between the perceived usefulness of mobile communication functionalities and perceived mobile work performance is moderated by the perceived degree of innovativeness of mobile communication functionalities	No
H8b	The relationship between the perceived usefulness of mobile information searching functionalities and perceived mobile work performance is moderated by the perceived degree of innovativeness of mobile information searching functionalities	No

ID	Hypothesis	Supported?
H8c	The relationship between the perceived usefulness of mobile transaction processing functionalities and perceived mobile work performance is moderated by the perceived degree of innovativeness of mobile transaction processing functionalities	No
H8d	The relationship between the perceived usefulness of location-related services functionalities and perceived mobile work performance is moderated by the perceived degree of innovativeness of location-related services functionalities	No
H8e	The relationship between the perceived usefulness of mobile job scheduling and dispatching functionalities and perceived mobile work performance is moderated by the perceived degree of innovativeness of	No
H8f	The relationship between the perceived usefulness of mobile office functionalities and perceived mobile work performance is moderated by the perceived degree of innovativeness of mobile office functionalities	No
H9a	The relationship between the perceived usefulness of mobile communication functionalities and intention to use mobile communications is moderated by the perceived degree of innovativeness of mobile communication functionalities	No
H9b	The relationship between the perceived usefulness of mobile information searching functionalities and intention to use mobile information searching functionalities is moderated by the perceived degree of innovativeness of mobile information searching functionalities	No
H9c	The relationship between the perceived usefulness of mobile transaction processing functionalities and intention to use mobile transaction processing functionalities is moderated by the perceived degree of innovativeness of mobile transaction processing functionalities	No
H9c	The relationship between the perceived usefulness of mobile transaction processing functionalities and intention to use mobile transaction processing functionalities is moderated by the perceived degree of innovativeness of mobile transaction processing functionalities	No
H9d	The relationship between the perceived usefulness of location-related services functionalities and intention to use location-related services functionalities is moderated by the perceived degree of innovativeness of location-related services functionalities	No
H9e	The relationship between the perceived usefulness of mobile job scheduling and dispatching functionalities and intention to use mobile job scheduling and dispatching functionalities is moderated by the perceived degree of innovativeness of mobile job scheduling and dispatching functionalities	No
H9f	The relationship between the perceived usefulness of mobile office functionalities and intention to use mobile office functionalities is moderated by the perceived degree of innovativeness of mobile office functionalities	No

ID	Hypothesis	Supported?
H10a	There are differences in perceived usefulness of mobile communication functionalities across gender	No
H10b	There are differences in perceived usefulness of mobile information searching functionalities across gender	No
H10c	There are differences in perceived usefulness of mobile transaction processing functionalities across gender	No
H10d	There are differences in perceived usefulness of location-related services functionalities across gender	No
H10e	There are differences in perceived usefulness of mobile job scheduling and dispatching functionalities across gender	No
H10f	There are differences in perceived usefulness of mobile office functionalities across gender	No
H11a	There are differences in perceived usefulness of mobile communications functionalities across length of tenure	No
H11b	There are differences in perceived usefulness of mobile information searching functionalities across length of tenure	Yes
H11c	There are differences in perceived usefulness of mobile transaction processing across length of tenure	Yes
H11d	There are differences in perceived usefulness of location-related services functionalities across length of tenure	Yes
H11e	There are differences in perceived usefulness of mobile job scheduling and dispatching across length of tenure	No
H11f	There are differences in perceived usefulness of mobile office functionalities across length of tenure	Yes
H12a	There are differences in perceived usefulness of mobile communications functionalities across job roles	No
H12b	There are differences in perceived usefulness of mobile information searching functionalities across job roles	Yes
H12c	There are differences in perceived usefulness of mobile transaction processing functionalities across job roles	No
H12d	There are differences in perceived usefulness of location-related services functionalities across job roles	Yes
H12e	There are differences in perceived usefulness of mobile job scheduling and dispatching functionalities across job roles	Yes
H12f	There are differences in perceived usefulness of mobile office functionalities across job roles	Yes

ID	Hypothesis	Supported?
H13a	There are differences in perceived usefulness of mobile communication functionalities across business units	Yes
H13b	There are differences in perceived usefulness of mobile information searching functionalities across business units	Yes
H13c	There are differences in perceived usefulness of mobile transaction processing functionalities across business units	Yes
H13d	There are differences in perceived usefulness of location-related services functionalities across business units	Yes
H13e	There are differences in perceived usefulness of mobile job scheduling and dispatching functionalities across business units	Yes
H13f	There are differences in perceived usefulness of mobile office functionalities across business units	Yes

Source: Developed for this research

Appendix 3—Data screening results

Table A3.1 - Results for mean, median, standard deviation, variance, skewness and kurtosis of all online survey questionnaire items

Item	Mean	Median	Std. Deviation	Variance	Skewness	Std. Error of Skewness	Kurtosis	Std. Error of Kurtosis
TC1	5.21	5.00	1.23	1.51	-0.51	0.17	-0.24	0.34
TC2	5.79	6.00	1.26	1.60	-1.41	0.17	2.24	0.34
TC3	5.47	6.00	1.10	1.22	-0.93	0.17	1.16	0.34
TC4	4.63	5.00	1.54	2.38	-0.62	0.17	-0.38	0.34
TC5	4.71	5.00	1.50	2.25	-0.67	0.17	-0.35	0.34
TC6	4.00	4.00	1.54	2.36	-0.15	0.17	-0.57	0.34
TI1	4.75	5.00	1.71	2.93	-0.56	0.17	-0.76	0.34
TI2	4.61	5.00	1.57	2.47	-0.31	0.17	-0.76	0.34
TI3	4.39	5.00	1.67	2.80	-0.45	0.17	-0.65	0.34
TI4	4.44	4.00	1.59	2.54	-0.10	0.17	-0.94	0.34
TI5	4.23	4.50	1.70	2.88	-0.37	0.17	-0.83	0.34
TCR1	5.40	6.00	1.44	2.08	-1.08	0.17	0.79	0.34
TCR2	5.49	6.00	1.40	1.97	-1.18	0.17	1.20	0.34
TCR3	4.64	5.00	1.64	2.69	-0.46	0.17	-0.54	0.34
TCR4	4.76	5.00	1.69	2.87	-0.59	0.17	-0.58	0.34
TCR5	3.52	4.00	1.28	1.63	-0.40	0.17	0.58	0.34
TCR6	4.22	5.00	1.20	1.44	-1.17	0.17	0.96	0.34
Percentage of spont. sales calls	1.57	1.00	1.69	2.86	0.79	0.17	-0.62	0.34
Amount of dead time available	1.86	2.00	1.40	1.96	0.66	0.17	-0.28	0.34
LOCVAR1	5.82	7.00	1.44	2.08	-0.83	0.17	-0.47	0.34

Item	Mean	Median	Std. Deviation	Variance	Skewness	Std. Error of Skewness	Kurtosis	Std. Error of Kurtosis
LOCVAR2	5.38	6.00	1.99	3.97	-1.03	0.17	-0.10	0.34
LOCVAR3	3.35	4.00	2.00	4.01	0.41	0.17	-0.86	0.34
LOCDEP1	3.53	4.00	2.02	4.09	0.10	0.17	-1.29	0.34
LOCDEP2	3.75	4.00	2.12	4.49	0.05	0.17	-1.35	0.34
LOCDEP3	2.64	2.00	1.62	2.64	0.82	0.17	-0.05	0.34
LOCDEP4	3.37	4.00	1.83	3.35	-0.03	0.17	-1.39	0.34
LOCDEP5	3.08	3.00	2.04	4.17	0.44	0.17	-1.13	0.34
MCPU1	4.33	5.00	1.80	3.25	-0.56	0.17	-0.76	0.34
MCPU2	4.25	5.00	1.72	2.95	-0.59	0.17	-0.65	0.34
MCPU3	4.56	5.00	1.67	2.80	-0.60	0.17	-0.41	0.34
MCPIN	4.42	5.00	1.72	2.95	-0.58	0.17	-0.57	0.34
MCITU1	4.50	5.00	2.00	4.00	-0.41	0.17	-1.07	0.34
MCITU2	4.75	5.00	1.96	3.86	-0.63	0.17	-0.81	0.34
MCITU3	4.43	4.50	2.11	4.43	-0.36	0.17	-1.19	0.34
MCPI1	4.27	5.00	1.83	3.36	-0.49	0.17	-0.91	0.34
MCPI2	4.36	5.00	1.80	3.23	-0.62	0.17	-0.73	0.34
MCPI3	4.36	5.00	1.76	3.09	-0.58	0.17	-0.61	0.34
MISPU1	4.55	5.00	1.81	3.29	-0.70	0.17	-0.55	0.34
MISPU2	4.50	5.00	1.72	2.97	-0.68	0.17	-0.37	0.34
MISPU3	4.56	5.00	1.81	3.28	-0.82	0.17	-0.40	0.34
MISPIN	4.55	5.00	1.77	3.15	-0.43	0.17	-0.70	0.34
MISITU1	4.53	5.00	1.92	3.70	-0.47	0.17	-0.85	0.34
MISITU2	4.75	5.00	1.87	3.51	-0.61	0.17	-0.66	0.34
MISITU3	4.54	4.00	1.93	3.71	-0.43	0.17	-0.87	0.34
MISPI1	4.37	5.00	1.87	3.48	-0.52	0.17	-0.79	0.34
MISPI2	4.44	5.00	1.79	3.18	-0.63	0.17	-0.66	0.34

Item	Mean	Median	Std. Deviation	Variance	Skewness	Std. Error of Skewness	Kurtosis	Std. Error of Kurtosis
MISPI3	4.46	5.00	1.79	3.21	-0.62	0.17	-0.65	0.34
MTPPU1	4.23	5.00	1.89	3.56	-0.40	0.17	-0.95	0.34
MTPPU2	4.13	4.00	1.86	3.45	-0.36	0.17	-0.96	0.34
MTPPU3	4.36	5.00	1.85	3.44	-0.49	0.17	-0.84	0.34
MTPPIN	4.47	5.00	1.82	3.32	-0.38	0.17	-1.00	0.34
MTPITU1	4.28	4.00	1.94	3.77	-0.29	0.17	-1.04	0.34
MTPITU2	4.51	5.00	1.92	3.68	-0.45	0.17	-0.89	0.34
MTPITU3	4.25	4.00	2.00	3.98	-0.22	0.17	-1.10	0.34
MTPPI1	4.27	5.00	1.85	3.43	-0.41	0.17	-0.84	0.34
MTPPI2	4.26	5.00	1.88	3.52	-0.51	0.17	-0.84	0.34
MTPPI3	4.25	5.00	1.90	3.61	-0.48	0.17	-0.87	0.34
LRSPU1	3.39	4.00	1.75	3.05	0.06	0.17	-1.13	0.34
LRSPU2	3.37	3.00	1.81	3.26	0.03	0.17	-1.34	0.34
LRSPU3	3.39	4.00	1.72	2.95	0.03	0.17	-1.08	0.34
LRSPIN	3.51	4.00	1.82	3.32	0.02	0.17	-1.33	0.34
LRSITU1	3.35	3.00	1.88	3.54	0.11	0.17	-1.40	0.34
LRSITU2	3.62	4.00	1.88	3.54	-0.01	0.17	-1.19	0.34
LRSITU3	3.36	3.00	1.90	3.62	0.23	0.17	-1.21	0.34
LRSPI1	3.42	4.00	1.72	2.96	0.09	0.17	-1.05	0.34
LRSPI2	3.44	4.00	1.63	2.65	-0.12	0.17	-1.03	0.34
LRSPI3	3.48	4.00	1.75	3.07	-0.02	0.17	-1.23	0.34
MJSPU1	2.75	3.00	1.57	2.47	0.46	0.17	-0.63	0.34
MJSPU2	2.73	3.00	1.57	2.46	0.44	0.17	-0.75	0.34
MJSPU3	2.75	3.00	1.51	2.29	0.38	0.17	-0.64	0.34
MJSPIN	2.87	3.00	1.67	2.80	0.43	0.17	-0.86	0.34
MJSITU1	2.82	3.00	1.70	2.88	0.49	0.17	-0.93	0.34

Item	Mean	Median	Std. Deviation	Variance	Skewness	Std. Error of Skewness	Kurtosis	Std. Error of Kurtosis
MJSITU2	2.97	3.00	1.58	2.50	0.27	0.17	-0.97	0.34
MJSITU3	2.83	3.00	1.70	2.89	0.60	0.17	-0.50	0.34
MJSPI1	2.80	3.00	1.50	2.26	0.49	0.17	-0.65	0.34
MJSPI2	2.89	3.00	1.55	2.40	0.45	0.17	-0.77	0.34
MJSPI3	2.10	2.00	1.32	1.73	1.25	0.17	1.42	0.34
MOPU1	4.47	5.00	1.90	3.59	-0.54	0.17	-0.87	0.34
MOPU2	4.38	5.00	1.85	3.42	-0.54	0.17	-0.76	0.34
MOPU3	4.59	5.00	1.83	3.34	-0.69	0.17	-0.52	0.34
MOPIN	4.54	5.00	1.89	3.56	-0.44	0.17	-0.80	0.34
MOITU1	4.35	4.00	2.14	4.58	-0.30	0.17	-1.21	0.34
MOITU2	4.59	5.00	2.13	4.52	-0.47	0.17	-1.10	0.34
MOITU3	4.38	4.50	2.17	4.73	-0.30	0.17	-1.24	0.34
MOPI1	4.32	5.00	1.97	3.89	-0.46	0.17	-1.00	0.34
MOPI2	4.40	5.00	1.86	3.46	-0.50	0.17	-0.83	0.34
MOPI3	4.40	5.00	1.87	3.49	-0.53	0.17	-0.80	0.34

Legend:

LOCDEP	Location dependence
LOCVAR	Location variety
LRSITU	Intention to use location-related services functionalities
LRSPI	Perceived impact on mobile work performance of location-related services functionalities
LRSPIN	Perceived degree of innovativeness of location-related services functionalities
LRSPU	Perceived usefulness of location-related services functionalities
MCITU	Intention to use mobile communication functionalities
MCPI	Perceived impact on mobile work performance of mobile communication functionalities
MCPIN	Perceived degree of innovativeness of mobile communication functionalities
MCPU	Perceived usefulness of mobile communication functionalities
MISITU	Intention to use mobile information searching functionalities
MISPI	Perceived impact on mobile work performance of mobile information searching functionalities
MISPIN	Perceived degree of innovativeness of mobile information searching functionalities
MISPU	Perceived usefulness of mobile information searching functionalities
MJSITU	Intention to use mobile job scheduling and dispatching functionalities
MJSPI	Perceived impact on mobile work performance of mobile job scheduling and dispatching functionalities
MJSPIN	Perceived degree of innovativeness of mobile job scheduling and dispatching functionalities
MJSPU	Perceived usefulness of mobile job scheduling and dispatching functionalities
MOITU	Intention to use mobile office functionalities
MOPI	Perceived impact on mobile work performance of mobile office functionalities
MOPIN	Perceived degree of innovativeness of mobile office functionalities
MOPU	Perceived usefulness of mobile office functionalities
MTPITU	Intention to use mobile transaction processing functionalities
MTPPI	Perceived impact on mobile work performance of mobile transaction processing functionalities
MTPPIN	Perceived degree of innovativeness of mobile transaction processing functionalities
MTPPU	Perceived usefulness of mobile transaction processing functionalities
TC	Task complexity
TCR	Time criticality
TI	Task interdependence

Source: Developed for this research

Table A3.2 - Variance inflation factor (VIF) for all dependent variables

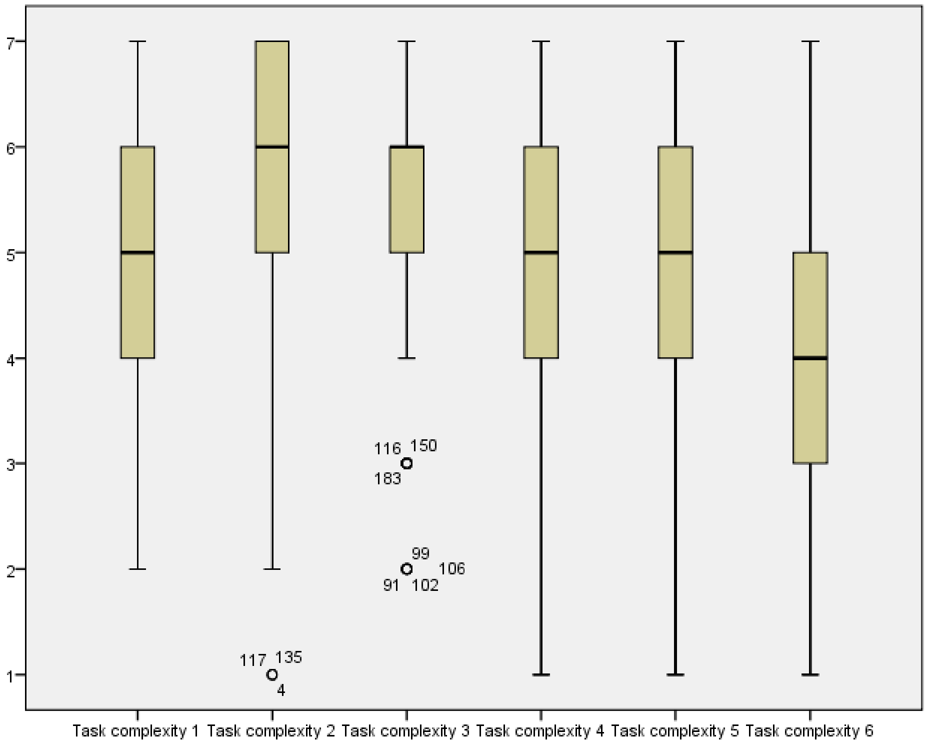
Dependent variable	Variance inflation factor
LOCDEP	1.52
LRSITU	7.23
LRSPI	8.68
LRSPU	1.43
MCITU	3.33
MCPI	4.17
MCPU	1.45
MISITU	9.44
MISPI	13.18
MISPU	1.84
MJSITU	4.53
MJSPI	6.41
MJSPU	1.34
MOITU	5.83
MOPI	27.70
MOPU	1.67
MTPITU	9.04
MTPPI	24.33
MTPPU	1.47
TCR	1.37

Legend:

LOCDEP	Location dependence
LRSITU	Intention to use location-related services functionalities
LRSPI	Perceived impact on mobile work performance of location-related services functionalities
LRSPU	Perceived usefulness of location-related services functionalities
MCITU	Intention to use mobile communication functionalities
MCPI	Perceived impact on mobile work performance of mobile communication functionalities
MCPU	Perceived usefulness of mobile communication functionalities
MISITU	Intention to use mobile information searching functionalities
MISPI	Perceived impact on mobile work performance of mobile information searching functionalities
MISPU	Perceived usefulness of mobile information searching functionalities
MJSITU	Intention to use mobile job scheduling and dispatching functionalities
MJSPI	Perceived impact on mobile work performance of mobile job scheduling and dispatching functionalities
MJSPU	Perceived usefulness of mobile job scheduling and dispatching functionalities
MOITU	Intention to use mobile office functionalities
MOPI	Perceived impact on mobile work performance of mobile office functionalities
MOPU	Perceived usefulness of mobile office functionalities
MTPITU	Intention to use mobile transaction processing functionalities
MTPPI	Perceived impact on mobile work performance of mobile transaction processing functionalities
MTPPU	Perceived usefulness of mobile transaction processing functionalities

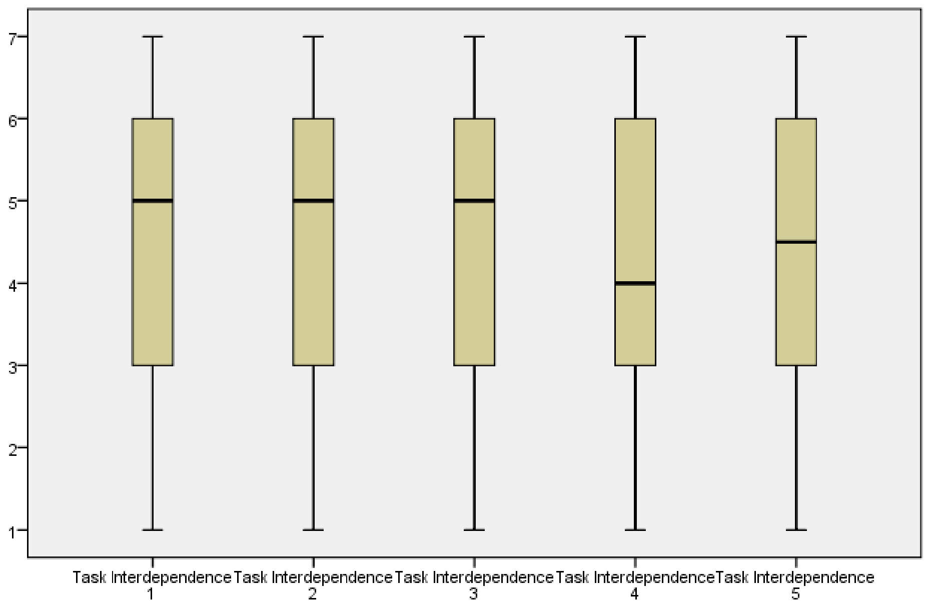
Source: Developed for this research

Figure A3.1 - Results for outlier analysis of task complexity



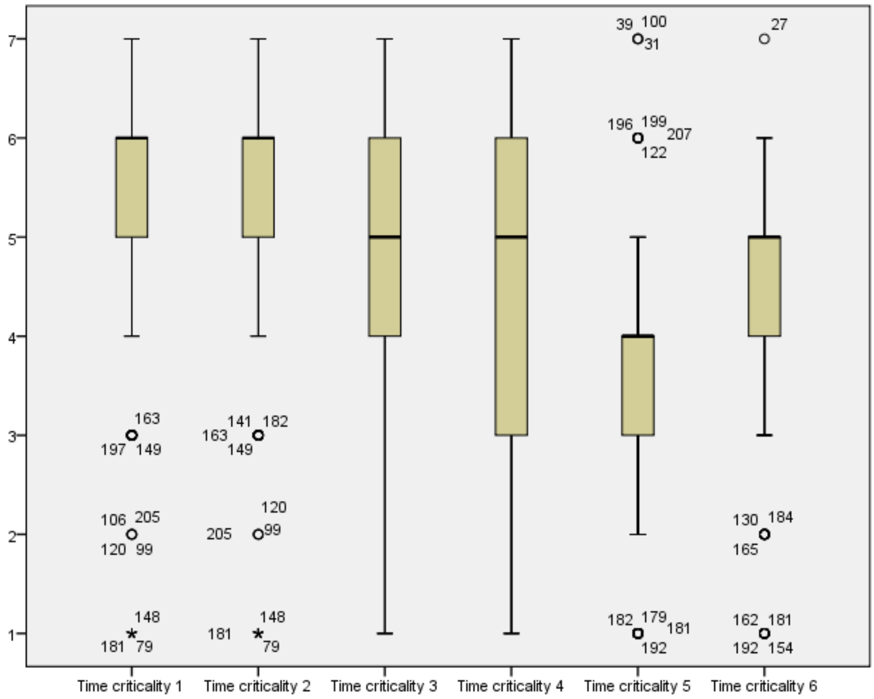
Source: Developed for this research

Figure A3.2 - Results for outlier analysis of task interdependence



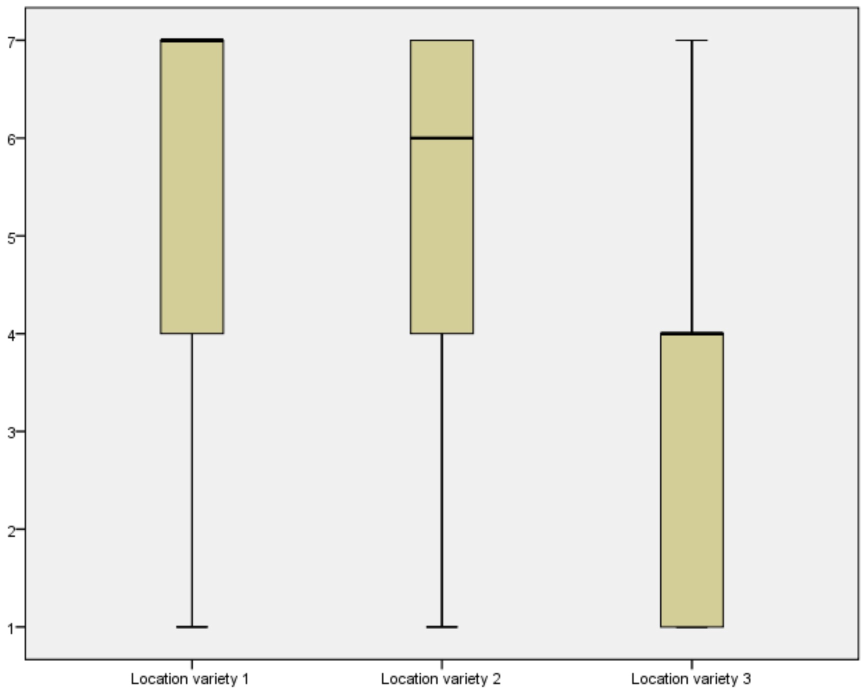
Source: Developed for this research

Figure A3.3 - Results for outlier analysis of time criticality



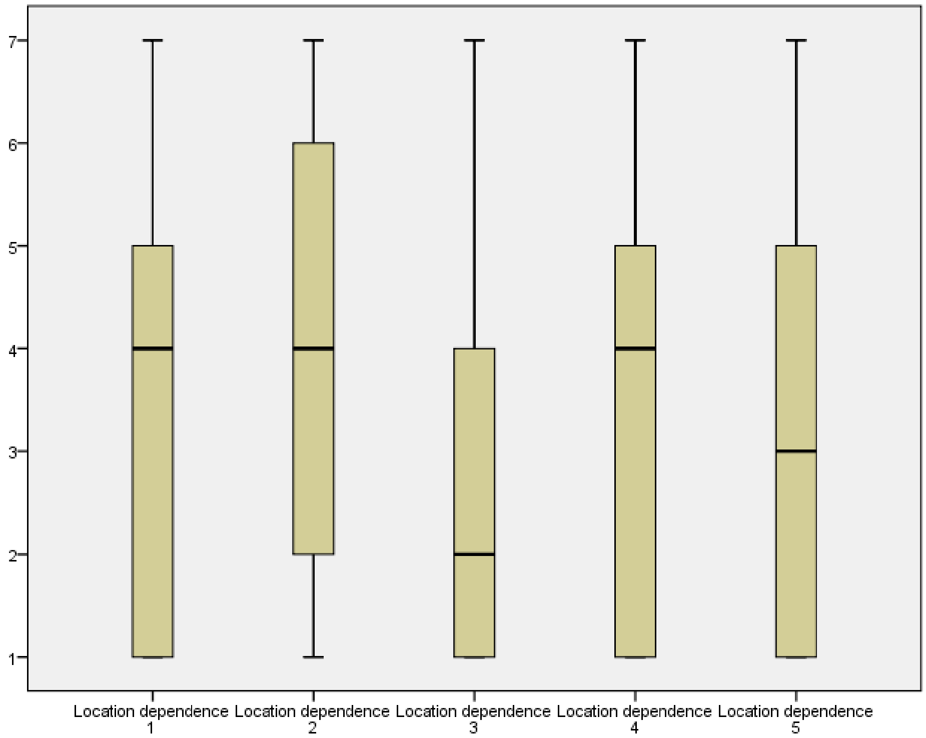
Source: Developed for this research

Figure A3.4 - Results for outlier analysis of location variance



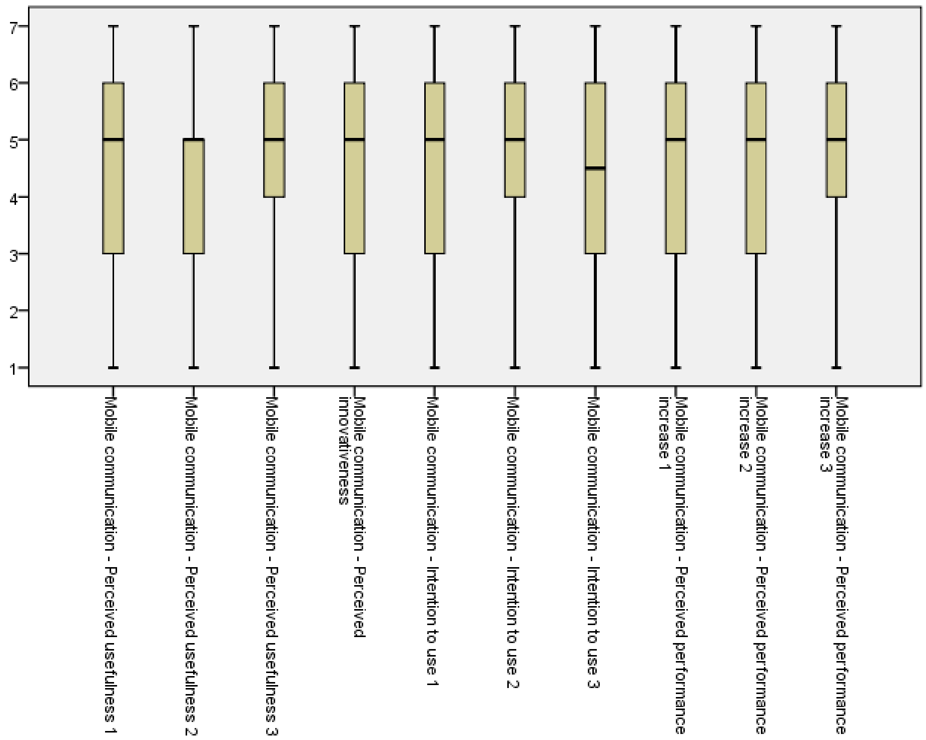
Source: Developed for this research

Figure A3.5 - Results for outlier analysis of location dependence



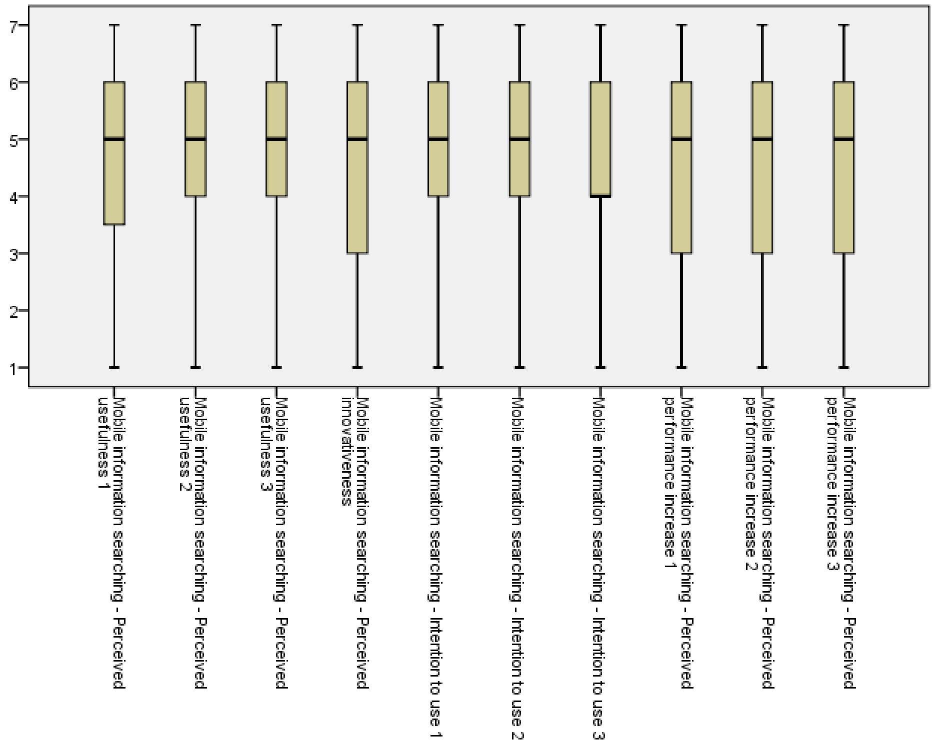
Source: Developed for this research

Figure A3.6 - Results for outlier analysis of mobile communication



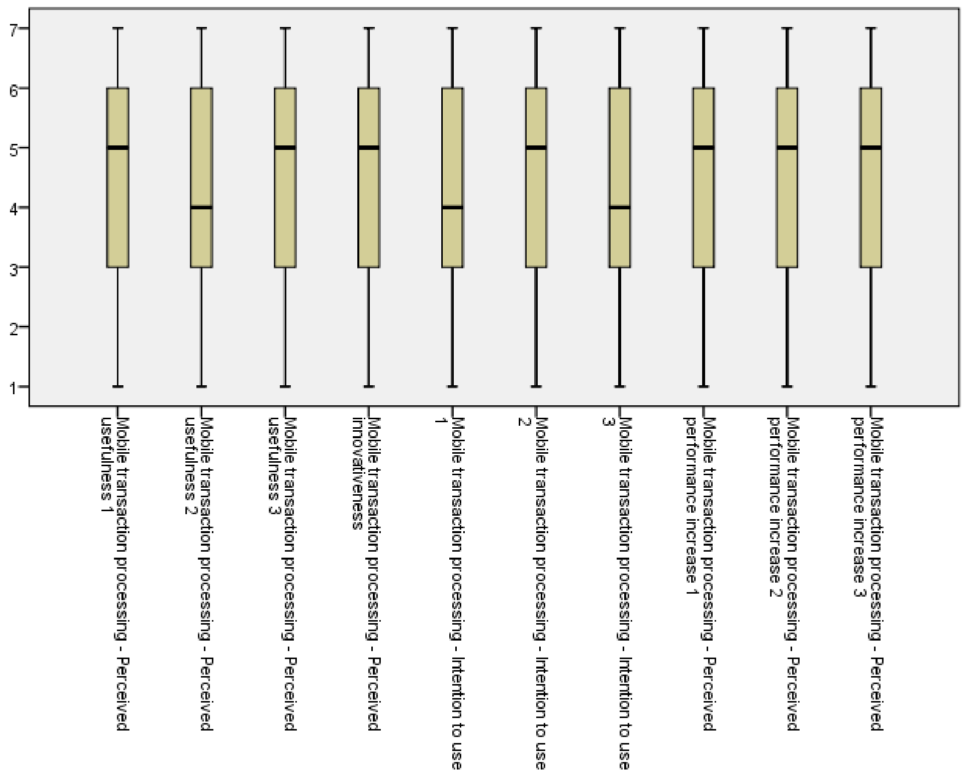
Source: Developed for this research

Figure A3.7 - Results for outlier analysis of mobile information searching



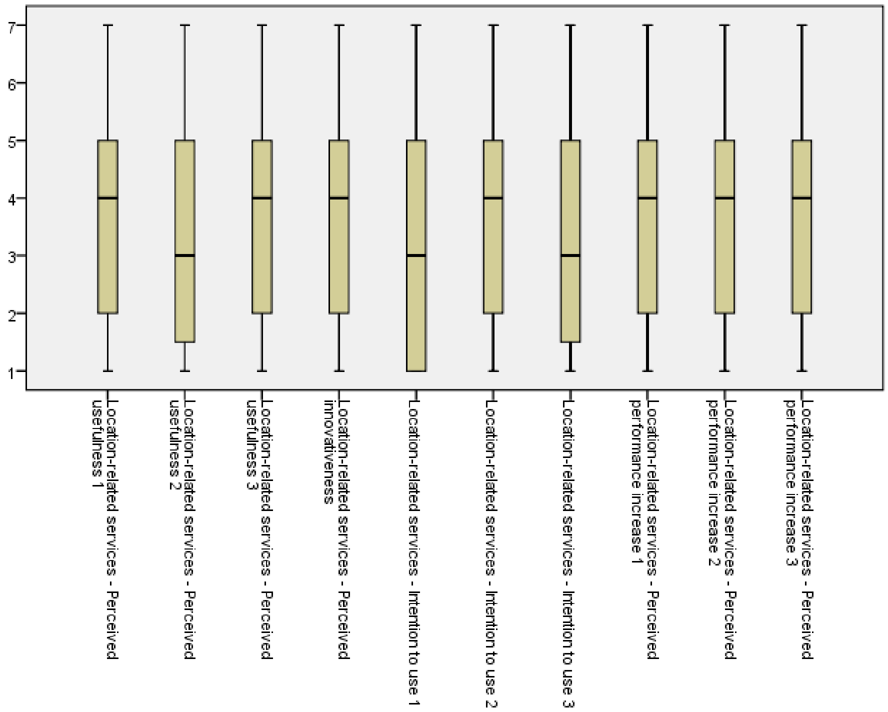
Source: Developed for this research

Figure A3.8 - Results for outlier analysis of mobile transaction processing



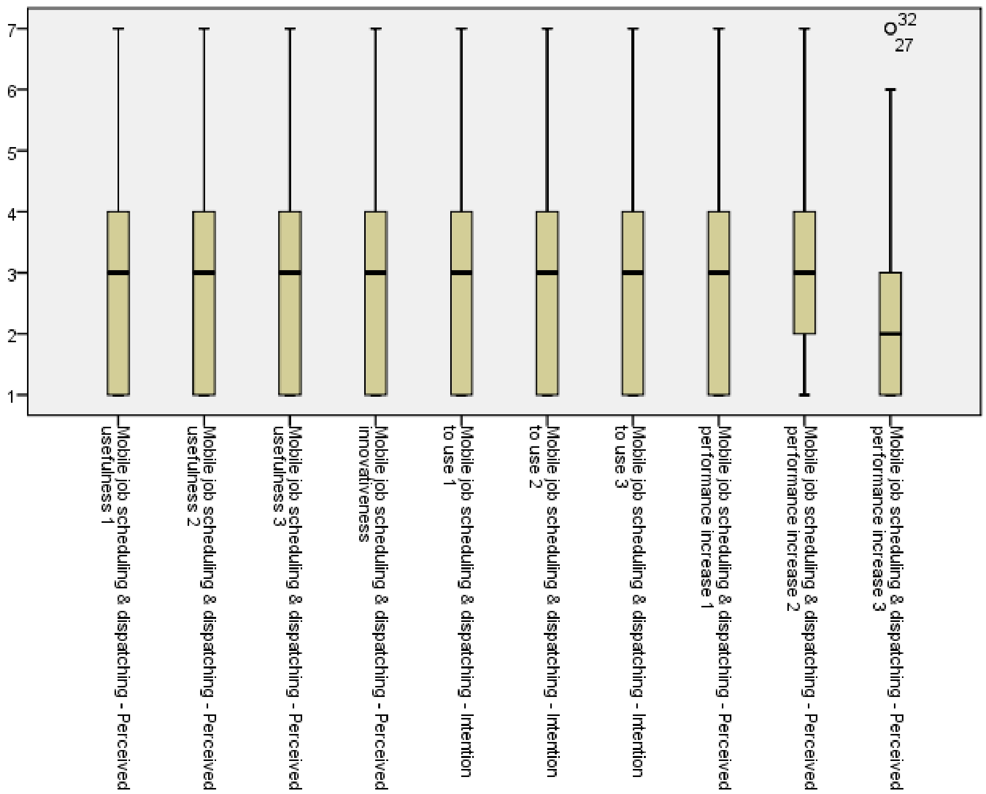
Source: Developed for this research

Figure A3.9 - Results for outlier analysis of location-related services



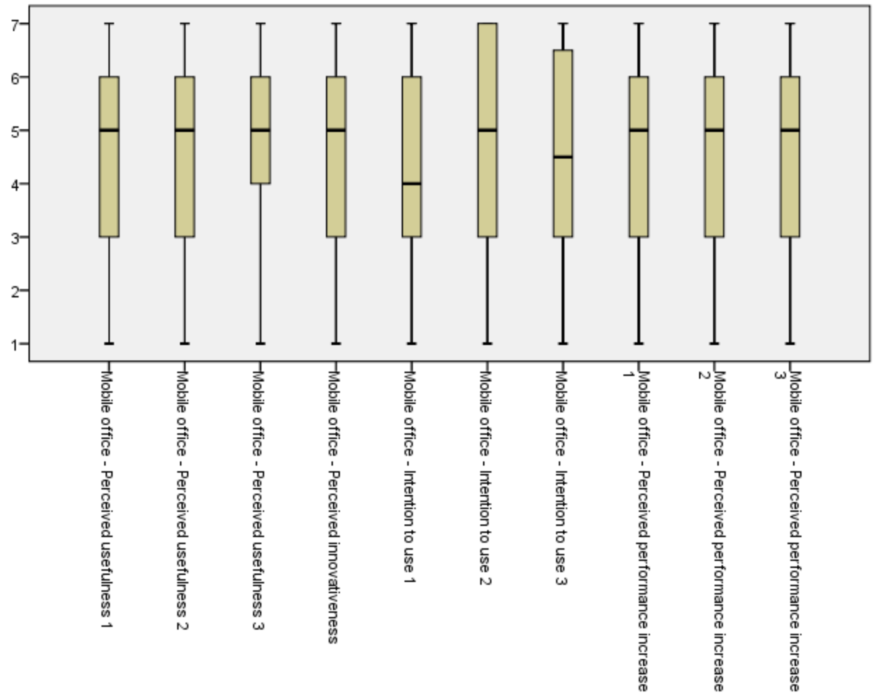
Source: Developed for this research

Figure A3.10 - Results for outlier analysis of mobile job scheduling and dispatching



Source: Developed for this research

Figure A3.11 - Results for outlier analysis of mobile office



Source: Developed for this research

Appendix 4—Path coefficients of research models investigated

Table A4.1 - Path coefficients of the structural model for the mobile communication functionality

Relationship investigated	Original sample (208)	Sample mean (500)	T Statistics (|O/STERR|)
BU1 -> MCPU	0.07	0.07	0.57
BU2 -> MCPU	0.09	0.09	0.93
BU3 -> MCPU	0.26	0.25	2.87***
Gender -> MCPU	0.04	0.06	0.57
Job role -> MCPU	0.10	0.10	1.22
LOCDEP -> MCPU	0.28	0.28	4.06***
LOCVAR -> LOCDEP	-0.59	-0.60	13.13***
MCITU -> MCPI	0.52	0.52	7.02***
MCPU*MCPIN -> MCITU	0.02	0.02	0.41
MCPU*MCPIN -> MCPI	0.01	0.01	0.34
MCPIN -> MCITU	0.46	0.45	4.95***
MCPIN -> MCPI	0.32	0.32	4.10***
MCPU -> MCITU	0.43	0.43	4.42***
MCPU -> MCPI	0.10	0.10	2.84***
TC -> TCR	-0.22	-0.23	3.13***
TCR -> MCPU	0.34	0.35	4.78***
Tenure -> MCPU	-0.07	-0.06	0.92
TI -> MCPU	0.12	0.10	1.41
TI -> TCR	0.45	0.45	6.98***

Legend:

LOCDEP	Location dependence
LOCVAR	Location variety
MCITU	Intention to use mobile communication functionalities
MCPI	Perceived impact on mobile work performance of mobile communication functionalities
MCPIN	Perceived degree of innovativeness of mobile communication functionalities
MCPU	Perceived usefulness of mobile communication functionalities
TC	Task complexity
TCR	Time criticality
TI	Task interdependence
*	95% significance level
**	99% significance level
***	99.9% significance level

Source: Developed for this research

Table A4.2 - Path coefficients of the structural model for the mobile information searching functionality

Relationship investigated	Original sample (208)	Sample mean (500)	T Statistics (|O/STERR|)
BU1 -> MISPU	0.11	0.11	0.95
BU2 -> MISPU	0.05	0.05	0.51
BU3 -> MISPU	0.23	0.23	2.11**
Gender -> MISPU	0.13	0.13	1.36
Job role -> MISPU	0.11	0.11	2.58***
LOCDEP -> MISPU	0.22	0.22	2.91***
LOCVAR -> LOCDEP	-0.58	-0.58	11.53***
MISITU -> MISPI	0.18	0.18	3.28***
MISPIN -> MISITU	0.30	0.30	4.13***
MISPIN -> MISPI	0.02	0.02	0.42
MISPU -> MISITU	0.66	0.67	9.24***
MISPU -> MISPI	0.79	0.79	14.97***
MISPU*MISPIN -> MISITU	0.04	0.04	1.73
MISPU*MISPIN -> MISPI	0.04	0.04	1.62
TC -> TCR	-0.24	-0.25	3.74***
TCR -> MISPU	0.23	0.24	2.85***
Tenure -> MISPU	-0.14	-0.14	2.14**
TI -> MISPU	0.26	0.26	3.02***
TI -> TCR	0.44	0.44	6.81***

Legend:

LOCDEP	Location dependence
LOCVAR	Location variety
MISITU	Intention to use mobile information searching functionalities
MISPI	Perceived impact on mobile work performance of mobile information searching functionalities
MISPIN	Perceived degree of innovativeness of mobile information searching functionalities
MISPU	Perceived usefulness of mobile information searching functionalities
TC	Task complexity
TCR	Time criticality
TI	Task interdependence
*	95% significance level
**	99% significance level
***	99.9% significance level

Source: Developed for this research

Table A4.3 - Path coefficients of the structural model for the mobile transaction processing functionality

Relationship investigated	Original sample (208)	Sample mean (500)	T Statistics (|O/STERR|)
BU1 -> MTPPU	0.06	0.05	0.45
BU2 -> MTPPU	0.02	0.01	0.15
BU3 -> MTPPU	0.26	0.26	2.49**
Gender -> MTPPU	0.21	0.20	1.22
Job role -> MTPPU	0.05	0.05	0.79
LOCDEP -> MTPPU	0.34	0.34	6.01***
LOCVAR -> LOCDEP	-0.58	-0.59	11.74***
MTPITU -> MTPPI	0.12	0.13	3.01***
MTPPIN -> MTPITU	0.20	0.20	3.16***
MTPPU -> MTPITU	0.76	0.75	12.62***
MTPPU -> MTPPI	0.86	0.86	21.61***
MTPPU*MTPPIN -> MTPITU	0.06	0.06	2.35
MTPPU*MTPPIN -> MTPPI	-0.04	-0.04	2.94
TC -> TCR	-0.22	-0.23	3.27***
TCR -> MTPPU	0.30	0.30	4.18***
Tenure -> MTPPU	-0.10	-0.09	2.35**
TI -> MTPPU	0.06	0.03	0.62
TI -> TCR	0.45	0.45	7.49***

Legend:

LOCDEP	Location dependence
LOCVAR	Location variety
MTPITU	Intention to use mobile transaction processing functionalities
MTPPI	Perceived impact on mobile work performance of mobile transaction processing functionalities
MTPPIN	Perceived degree of innovativeness of mobile transaction processing functionalities
MTPPU	Perceived usefulness of mobile transaction processing functionalities
TC	Task complexity
TCR	Time criticality
TI	Task interdependence
*	95% significance level
**	99% significance level
***	99.9% significance level

Source: Developed for this research

Table A4.4 - Path coefficients of the structural model for the mobile job scheduling and dispatching functionality

Relationship investigated	Original sample (208)	Sample mean (500)	T Statistics (|O/STERR|)
BU1 -> MJSPU	0.10	0.10	1.03
BU2 -> MJSPU	0.06	0.06	0.83
BU3 -> MJSPU	0.29	0.29	3.27***
Gender -> MJSPU	0.10	0.09	0.54
Job role -> MJSPU	0.11	0.11	1.84*
LOCDEP -> MJSPU	0.22	0.22	3.27***
LOCVAR -> LOCDEP	-0.58	-0.59	11.73***
MJSITU -> MJSPI	0.22	0.22	3.68***
MJSPIN -> MJSITU	0.24	0.24	3.81***
MJSPIN -> MJSPI	0.08	0.07	1.40
MJSPU -> MJSITU	0.68	0.68	11.31***
MJSPU -> MJSPI	0.72	0.73	13.12***
MJSPU*MJSPIN -> MJSITU	-0.08	-0.08	2.43
MJSPU*MJSPIN -> MJSPI	0.03	0.03	0.98
TC -> TCR	-0.23	-0.24	3.62***
TCR -> MJSPU	0.27	0.28	3.93***
Tenure -> MJSPU	-0.08	-0.08	1.36
TI -> MJSPU	0.01	-0.01	0.03
TI -> TCR	0.44	0.45	7.15***

Legend:

LOCDEP	Location dependence
LOCVAR	Location variety
MJSITU	Intention to use mobile job scheduling and dispatching functionalities
MJSPI	Perceived impact on mobile work performance of mobile job scheduling and dispatching functionalities
MJSPIN	Perceived degree of innovativeness of mobile job scheduling and dispatching functionalities
MJSPU	Perceived usefulness of mobile job scheduling and dispatching functionalities
TC	Task complexity
TCR	Time criticality
TI	Task interdependence
*	95% significance level
**	99% significance level
***	99.9% significance level

Source: Developed for this research

Table A4.5 - Path coefficients of the structural model for the location-related services functionality

Relationship investigated	Original sample (208)	Sample mean (500)	T Statistics (|O/STERR|)
BU1 -> LRSPU	0.10	0.10	0.86
BU2 -> LRSPU	0.09	0.09	0.97
BU3 -> LRSPU	0.28	0.28	2.79***
Gender -> LRSPU	0.08	0.06	0.46
Job role -> LRSPU	0.11	0.10	1.89*
LOCDEP -> LRSPU	0.31	0.31	4.86***
LOCVAR -> LOCDEP	-0.58	-0.59	11.48***
LRSITU -> LRSPI	0.19	0.19	2.85***
LRSPIN -> LRSITU	0.20	0.21	3.82***
LRSPIN -> LRSPI	0.18	0.18	3.86***
LRSPU -> LRSITU	0.75	0.75	15.39***
LRSPU -> LRSPI	0.60	0.60	10.15***
LRSPU*LRSPIN -> LRSITU	0.01	0.01	0.41
LRSPU*LRSPIN -> LRSPI	-0.08	-0.08	3.06
TC -> TCR	-0.24	-0.24	3.51***
TC -> TCR	-0.23	-0.24	3.60***
TCR -> LRSPU	0.28	0.27	3.65***
Tenure -> LRSPU	-0.12	-0.12	1.66*
TI -> LRSPU	0.00	-0.02	0.05
TI -> TCR	0.44	0.44	7.16***

Legend:

LOCDEP	Location dependence
LOCVAR	Location variety
LRSITU	Intention to use location-related services functionalities
LRSPI	Perceived impact on mobile work performance of location-related services functionalities
LRSPIN	Perceived degree of innovativeness of location-related services functionalities
LRSPU	Perceived usefulness of location-related services functionalities
TC	Task complexity
TCR	Time criticality
TI	Task interdependence
*	95% significance level
**	99% significance level
***	99.9% significance level

Source: Developed for this research

Table A4.6 - Path coefficients of the structural model for the mobile office functionality

Relationship investigated	Original sample (208)	Sample mean (500)	T Statistics (|O/STERR|)
BU1 -> MOPU	0.14	0.13	1.11
BU2 -> MOPU	0.08	0.07	0.80
BU3 -> MOPU	0.24	0.23	2.26**
Gender -> MOPU	0.13	0.13	0.80
Job role -> MOPU	0.14	0.13	2.87***
LOCDEP -> MOPU	0.23	0.23	3.49***
LOCVAR -> LOCDEP	-0.59	-0.59	12.77***
MOITU -> MOPI	0.34	0.33	8.01***
MOPIN -> MOITU	0.26	0.27	2.86***
MOPIN -> MOPI	0.18	-0.18	4.40***
MOPU -> MOITU	0.66	0.65	7.27***
MOPU -> MOPI	0.83	0.84	17.76***
MOPU*MOPIN -> MOITU	0.05	0.13	4.33
MOPU*MOPIN -> MOPI	-0.02	-0.02	1.14
TC -> TCR	-0.22	-0.24	3.41***
TCR -> MOPU	0.29	0.29	3.76***
Tenure -> MOPU	-0.13	-0.12	1.89*
TI -> MOPU	0.19	0.19	2.38**
TI -> TCR	0.45	0.45	7.48***

Legend:

LOCDEP	Location dependence
LOCVAR	Location variety
MOITU	Intention to use mobile office functionalities
MOPI	Perceived impact on mobile work performance of mobile office functionalities
MOPIN	Perceived degree of innovativeness of mobile office functionalities
MOPU	Perceived usefulness of mobile office functionalities
TC	Task complexity
TCR	Time criticality
TI	Task interdependence
*	95% significance level
**	99% significance level
***	99.9% significance level

Source: Developed for this research

Appendix 5—Semi-structured interview questionnaire (Research phase 1)

Interview Protocol

Date:………………………….

Interviewee's name: …………………………………………………………………….

Job function: ……………………………………………………………………….

Start Time of Interview: ………………. Finish Time of Interview: ………………….

Introduction

Thank you for your time and willingness to take part in this interview. This research would not be possible without your participation.

Purpose of this research

The purpose of this research project is to investigate to what extent a perceived good fit between tasks of pharmaceutical sales-force workers and the use of Mobile Computing Technologies (MCT) influence the intention to use MCT and the performance of mobile sales-force workers.

The interview will take about 45-60 minutes. Your participation is highly appreciated.

Status of this research

This research is conducted in cooperation with Faculty of Business and Law, University of Southern Queensland, Australia.

Ethical concerns regarding this research

- This interview is confidential. Your anonymity is assured as you will not be identified in reports.
- Incidental identification will not be possible as steps will be taken to disguise all participants.
- Undisguised information about participants in this research will not be made public or given to a third party.

Note:

- It's your decision to participate in this study, we can stop at any time without any consequence for you.
- I would like your permission to tape this interview. If you agree, you are welcome at any time during the interview to ask me to cease taping the interview.
- Are there any further questions either about the interview procedure or the purpose of the research?
- If you wish I would be happy to provide you with a summary of the results from this research.

Definitions

For this interview to be successful, it's important to have a common understanding on the following key terminologies, namely:

Mobile workers

- are working away from their office desk for more than 20% of their working day. Pharmaceutical sales-force workers are considered to be mobile workers.

Mobile work setting

- In this research, the mobile work setting is the work environment that you face while you are on the move (like e.g. before, during, and after a sales call; while driving; etc.). Thus, the time window when you leave the house in the morning and when you return in the evening.
- This is not the work environment that you encounter while working from home ('home office'), while being in the German headquarter or while being on a sales congress for your organisation.

Mobile tasks

- Mobile tasks are all work-relevant tasks that need to be completed in the mobile work setting.
- These are **not** the work-relevant tasks that you are conducting in your home office.

Dead times

- This research considers dead times those waiting times when a mobile worker is 'trapped' in the work process and has to wait for the next step of the work process.

Mobile Computing Technology (MCT)

- **MCT** are defined as computing hardware and systems that can easily be moved and used while on the move, have wireless access to the Internet and a company's intranet, are based on most current hardware and use wireless broadband bandwidth (at least 3G),
- In this research, MCT is considered a **technological innovation** that has the potential to **increase work performance**.
- Following are some examples for the use of MCT, namely by e.g.
    - Integrating voice and video communications by accessing podcast or web conferences while engaged in mobile work.
    - Enhanced computational capabilities of mobile phones: i.e. editing documents, agendas, personal and professional files while engaged in mobile work.
    - Being able to access to web applications and information resources via web browsing while engaged in mobile work.
    - Ability to send and receive email while engaged in mobile work
    - Using location-based applications: maps, routes, directions, localization of commercial services.
    - Enhancing networking applications (peer to peer communication) by using instant messaging tools while engaged in mobile work.

If we have common understanding on these terms and the general conditions of this research, we can now start with the actual interview.

Question section:

1. Demographic information

Gender

Identifier	Question	Male	Female
GEN1	1a. What is your gender?	☐	☐

Job role

Identifier	Question	Yes	No
SUP1	1b. Are you a supervisor/manager?	☐	☐

Length of tenure

Identifier	Question	< 5 years	5-10 years	10-20 years	> 20 years
TEN1	1c. How long do you work for this company?	☐	☐	☐	☐

Business Unit

Identifier	Question	BU1	BU2	BU3	BU4
BU1	1d. For which business unit do you work for?	☐	☐	☐	☐

Analysis of mobile work support functions

In the following, I will introduce six mobile work support functions that are based on current research in this area and that are supposed to add value for sales-force workers in their mobile work setting.

When analysing each of the six functionalities, please consider you current experience with MCT but also try to think of new examples/scenarios where the respective mobile work support functions can support your mobile tasks.

2.1 Mobile communication

Mobile workers can use mobile communication functionalities in order to (synchronously and asynchronously) interact with their colleagues and their clients through voice and text messages.

Besides traditional voice communication, mobile communication functionalities enable online access to emails or chatting with colleagues via instant messaging functionalities. Attachments (i.e. electronic documents attached to email messages) can be sent and read in the mobile work setting.

Please consider the following examples of the use of mobile communication functionalities and how these might support your mobile tasks:

Functionality description	**Already used?**	**Considered useful?**	**Considered innovative?**	**Justification/ Comment**
		1 = not useful at all 4 = neutral 7 = very useful	1 = not innovative at all 4 = neutral 7 = very innovative	
Reading/ Writing emails via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	
Opening email attachments via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	
Unified messaging: Putting voice messages into emails etc. via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	
Reading/ writing SMS via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	
Instant messaging/ Chatting via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	
Video telephony via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	
Participating in web conferences/ web casts via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	

2.2 Mobile information searching

Mobile information searching helps mobile workers to receive time-critical information in **real-time** while working in their mobile work setting.

Thereby, the company's information systems (i.e. intranet, CRM, ERP, e-learning, knowledge management systems, medical databases, e-learning) or job-relevant Internet web sites can be accessed.

Please consider the following examples of the use of mobile information searching functionalities and how these might support your mobile tasks:

Functionality description	**Already used?**	**Considered useful?**	**Considered innovative?**	**Justification/ Comment**
		1 = not useful at all 4 = neutral 7 = very useful	1 = not innovative at all 4 = neutral 7 = very innovative	
Online access to intranet via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	
Online access to corporate databases via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	
Online access to CRM system via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	
Online access to ERP system via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	
M-learning: accessing learning modules via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	
Internet search via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	
Accessing e-books with medical/ product information via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	
Accessing video and audio content (e.g., IPTV broadcast, online videos, podcasts etc.) via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	

2.3 Mobile transaction processing

Mobile transaction processing facilitates routine organisational and business transactions as they are performed on the spot and thereby can be conducted in a more efficient and cost effective way.

Thereby, information that is collected (e.g., on a sheet of paper) and later on entered into an IT system are supposed to be entered on the spot. As transactions can be handled directly in the mobile work setting (and a user does not have to wait, until he's back online in his home office) processes can be speeded up and added value to the customer can be provided.

Please consider the following examples of the use of mobile transaction processing functionalities and how these might support your mobile tasks:

Functionality description	**Already used?**	**Considered useful?**	**Considered innovative?**	**Justification/ Comment**
		1 = not useful at all 4 = neutral 7 = very useful	1 = not innovative at all 4 = neutral 7 = very innovative	
Entering data in online-systems instead of making paper-based notes (and thereby reducing paper-based work, double entry of data etc.) via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	
Supporting specific business processes (e.g., sales process) via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	

2.4 Mobile job scheduling and dispatching

Mobile job scheduling and dispatching includes both scheduling shared resources (like e.g. equipment) and scheduling appointments (like e.g. tasks, time and location).

This functionality enables the rescheduling of tasks and appointments in the mobile work setting through a central operator.

Please consider the following examples of the use of mobile job scheduling and dispatching functionalities and how these might support your mobile tasks:

Functionality description	**Already used?**	**Considered useful?**	**Considered innovative?**	**Justification/ Comment**
		1 = not useful at all 4 = neutral 7 = very useful	1 = not innovative at all 4 = neutral 7 = very innovative	
Receiving sales call appointments (daily basis & ad hoc) arranged by a centrally coordinated unit via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	
Assigning new mobile work tasks to colleagues via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	
Receiving new mobile work tasks from colleagues/ head quarter via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	

2.5 Location-related services

Location-related services support mobile workers by providing job-related location information like e.g. showing the availability of certain resources or colleagues that are within reach.

Please consider the following examples of the use of location-related service functionalities and how these might support your mobile tasks:

Functionality description	**Already used?**	**Considered useful?**	**Considered innovative?**	**Justification/ Comment**
		1 = not useful at all 4 = neutral 7 = very useful	1 = not innovative at all 4 = neutral 7 = very innovative	
Receiving information about the location of colleagues or customers via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	
Receiving information from navigation system regarding the current position and the distance to a specific location via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	
Receiving additional information about the current location like hotels, gas stations, restaurants etc. that are within reach via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	

2.6 Mobile office

Mobile office is the mobile version of the traditional office. The functions of mobile office include word processing, spreadsheet, presentation software and personal information management functionalities (calendar, address book, calculator).

Please consider the following examples of the use of mobile office functionalities and how these might support your mobile tasks:

Functionality description	**Already used?**	**Considered useful?**	**Considered innovative?**	**Justification/ Comment**
		1 = not useful at all 4 = neutral 7 = very useful	1 = not innovative at all 4 = neutral 7 = very innovative	
Outlook: Accessing online calendar, arranging appointments via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	
Excel: Using calculating software while on the move via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	
PowerPoint: Reading, editing and creating presentations via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	
Holding presentations in front of the customer via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	
Accessing and editing online task lists via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	
Using mobile device as dictation machine (Voice recognition software converts voice into text) via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	
Accessing and manipulating documents which are stored online via a mobile device	Yes ☐ No ☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐	

Appendix 6—Online-survey questionnaire (Research phase 2)

Information sheet:

Purpose of this research

The purpose of this research project is to investigate to what extent a perceived good fit between tasks of pharmaceutical sales-force workers and use of Mobile Computing Technologies (MCT) influence the intention to use MCT and the performance of mobile sales-force workers.

The online survey will take about 30-45 minutes. Your participation is highly appreciated.

Status of this research

This research is conducted in cooperation with Faculty of Business & Law, University of Southern Queensland, Australia.

Ethical concerns regarding this research

- All information collected in this survey will be kept strictly confidential.
- Incidental identification of study participants will not be possible as steps will be taken to disguise all participants.
- Undisguised information about participants in this research will not be made public or given to a third party.
- Your participation is completely voluntary and you can stop at any time without any consequence for you and all the data you provided for this study will be destroyed.
- If you have any ethical concerns regarding this research, you can contact Human Research Ethics Committee (HREC) at the University of Southern Queensland (email: ethics@usq.edu.au, telephone +61 74631 2690).

Note:

- If you wish I would be happy to provide you with a summary of the results from this research.

☐ I have fully read the above information, and understand the nature and purpose of this research. I understand that my participation is completely voluntary and that I may withdraw at any time. In this case, all the data you provided for this study will be destroyed. I understand that the results of this study will be treated with confidentiality. The results will be reported only in their aggregate form and I will not be identified individually. *[Checkbox must be checked in order to proceed]*

Continue

Definitions:

For this survey to be successfully completed, it's important to have a common understanding of the following key terminologies, namely:

Mobile workers

- are working away from their office desk for more than 20% of their working day. Pharmaceutical sales-force workers are considered to be mobile workers.

Mobile work setting

- In this research, the mobile work setting is the work environment that you face while you are on the move (like e.g. before, during, and after a sales call; while driving; etc.). Thus, the time window when you leave the house in the morning and when you return in the evening.
- This is not the work environment that you encounter while working from home ('home office'), while being in the headquarter or while being on a sales congress for your organisation.

Mobile tasks

- Mobile tasks are all work-relevant tasks that need to be completed in the mobile work setting.
- These are **not** the work-relevant tasks that you are conducting in your home office.

Dead times

- This research considers dead times those waiting times when a mobile worker is 'trapped' in the work process and has to wait for the next step of the work process.

Mobile Computing Technology (MCT)

- **MCT** are defined as computing hardware and systems that can easily be moved and used while on the move, have wireless access to the Internet and a company's intranet, are based on most current hardware and use wireless broadband bandwidth (at least 3G),
- In this research, MCT is considered a **technological innovation** that has the potential to **increase work performance**.
- Following are some examples for the use of MCT, namely by e.g.
  - Integrating voice and video communications by accessing podcast or web conferences while engaged in mobile work.
  - Enhanced computational capabilities of mobile phones: i.e. editing documents, agendas, personal and professional files while engaged in mobile work.
  - Being able to access to web applications and information resources via web browsing while engaged in mobile work.
  - Ability to send and receive email while engaged in mobile work
  - Using location-based applications: maps, routes, directions, localization of commercial services.
  - Enhancing networking applications (peer to peer communication) by using instant messaging tools while engaged in mobile work.

If we have common understanding on these terms and the general conditions of this research, we can now start with the actual survey. The upcoming question section is divided in three parts. At first, demographic questions will be asked. Second, the characteristics of your mobile tasks will be analysed. Third, we want to know your opinion on six mobile work support technologies that are considered beneficial for mobile workers. For each of the mobile work support functions, (a) specific scenario(s) will be outlined that are considered to be specifically beneficial and innovative.

1. Demographic information

Gender

Identifier	Question	Male	Female
GEN1	1a: What is your gender?	☐	☐

Job role

Identifier	Question	Yes	No
SUP1	1b: Are you are a supervisor/manager?	☐	☐

Length of tenure

Identifier	Question	< 5 years	5-10 years	10-20 years	> 20 years
TEN1	1c: How long have you been working for this company?	☐	☐	☐	☐

Business Unit

Identifier	Question	BU1	BU2	BU3	BU4
BU1	1d: For which business unit do you work for?	☐	☐	☐	☐

2. Task characteristics

Task complexity

Task complexity is the function of all possible task characteristics, such as inherent uncertainties in the nature of the task, tradeoffs that must be made between different goal criteria, and the degree to which steps taken in performing the task are irreversible.

2a: To what extent do you agree with the following statements regarding the **degree of complexity of your mobile tasks**?

Identifier	Questions	Strongly agree (7)	Agree	Somewhat agree	Neutral (4)	Somewhat disagree	Disagree	Strongly disagree (1)
TC1	My work is of repetitive nature	☐	☐	☐	☐	☐	☐	☐
TC2	I need to handle unexpected events	☐	☐	☐	☐	☐	☐	☐
TC3	There is a clearly known way to do the major types of my work	☐	☐	☐	☐	☐	☐	☐
TC4	I can rely on established procedures	☐	☐	☐	☐	☐	☐	☐
TC5	There is an understandable sequence of steps that can be followed during my work	☐	☐	☐	☐	☐	☐	☐
TC6	My work is routine	☐	☐	☐	☐	☐	☐	☐

Task interdependence

Task interdependence is defined as the degree to which a goal accomplishment requires related or dependent tasks. It requires coordination with others to accomplish a collective set of tasks.

2b: To what extent do you agree with the following statements regarding the **degree of interdependence of your mobile tasks**?

Identifier	Questions	Strongly agree (7)	Agree	Somewhat agree	Neutral (4)	Somewhat disagree	Disagree	Strongly disagree (1)
TI1	My work can be done independently from others	☐	☐	☐	☐	☐	☐	☐
TI2	My work can be planned with little need to coordinate with others	☐	☐	☐	☐	☐	☐	☐
TI3	My work requires frequent coordination with customers and colleagues	☐	☐	☐	☐	☐	☐	☐
TI4	My work rarely requires obtaining information from others to complete a task	☐	☐	☐	☐	☐	☐	☐
TI5	My work is relatively unaffected by the performance of others	☐	☐	☐	☐	☐	☐	☐
TI6	My work depends on receiving information from others	☐	☐	☐	☐	☐	☐	☐

Time criticality

Time criticality is defined as the importance with which a task needs to be performed promptly. Time urgency is a personality characteristic that relates to one's perspective about time.

2c: To what extent do you agree with the following statements on the **time criticality of your mobile tasks**?

Identifier	Questions	Strongly agree (7)	Agree	Somewhat agree	Neutral (4)	Somewhat disagree	Disagree	Strongly disagree (1)
TCR1	It's important for me to **start my tasks on time**	☐	☐	☐	☐	☐	☐	☐
TCR2	It's important for me to **complete my tasks on time**	☐	☐	☐	☐	☐	☐	☐
TCR3	It's important for me to **start my tasks as soon as possible**	☐	☐	☐	☐	☐	☐	☐
TCR4	It's important for me to **complete my tasks as soon as possible**	☐	☐	☐	☐	☐	☐	☐

2d: Usually, what is the average time window (from start to finish) for you to complete a typical mobile task?

Identifier	No restriction (1)	Within a week (2)	Within a few days (3)	Within a day (4)	Within a few hours (5)	Within an hour (6)	Within 10 minutes (7)
TCR5	☐	☐	☐	☐	☐	☐	☐

2e: What is the time urgency for you to start or finish a typical mobile task?

Identifier	Take it easy (1)	Allow delays (2)	Allow a little delay (3)	At normal speed(4)	Better done sooner (5)	Immediate (6)	In a hurry (7)
TU2	☐	☐	☐	☐	☐	☐	☐

Additional questions on the nature of your mobile work

Identifier	Questions	0–10 %	11–20 %	21–30 %	31–40%	41-50 %	> 50 %
SPO1	2f: In a usual working week: How many per cent of your sales calls can be considered to be spontaneous (and have not been planned in advanced)?	☐	☐	☐	☐	☐	☐

Identifier	Questions	0 (no time available)	1 – 30 min.	31-60 min.	61- 90 min.	91 – 120 min.	> 120 min.
MCT1	2g: On a usual working day: How many minutes of dead time could be spent more effectively through using MCT (e.g., for handling administrative work, email communication etc.)?	☐	☐	☐	☐	☐	☐

Location variety

Location variety is dealing with the extent to which mobile workers work at various locations. Low location variety means the task must be performed at a specific location, and workers have less freedom in choosing the working location.

2h: To what extent do you agree with the following statements on the **location variety of your mobile tasks**?

Identifier	Questions	Always at the same locations (1)			Some at the same location, but some at different locations (4)			Always at different locations (7)
LOCVAR1	To what extent do you work at various locations?	☐	☐	☐	☐	☐	☐	☐

Identifier	Questions	At one specific location (1)			At several alternative locations (4)			Any Place (7)
LOCVAR2	To what extent is your work limited to a specific location?	☐	☐	☐	☐	☐	☐	☐

Identifier	Questions	To a great extent (7)			Moderately (4)			Not at all (1)
LOCVAR3	To what extent do you have the freedom of choosing a place to perform your work?	☐	☐	☐	☐	☐	☐	☐

Location dependence

Location dependence is dealing with the extent to which dynamic location-related information is required to perform the task.

2i: To what extent do you agree with the following statements on the **location dependence of your mobile tasks**?

Identifier	Questions	To a great extent (7)			Moderately (4)			Not at all (1)
LOCDEP1	My Work is dependent on the information about my current location	☐	☐	☐	☐	☐	☐	☐
LOCDEP2	My work is dependent on information about the location of my customers	☐	☐	☐	☐	☐	☐	☐
LOCDEP3	My work is dependent on information about the location of my colleagues	☐	☐	☐	☐	☐	☐	☐
LOCDEP4	My work is dependent on information about the location of equipment that is related to my work	☐	☐	☐	☐	☐	☐	☐
LOCDEP5	My work is dependent on the information about travel or navigation guides to the destination	☐	☐	☐	☐	☐	☐	☐

3. Analysis of mobile work support functions

In the following, we would like to measure perceived usefulness, perceived degree of innovativeness, perceived impact on work mobile performance and the intention to use of six mobile work support functions.

Please answer the following questions by taking under consideration the scenarios provided and other suitable scenarios that you could think of yourself that are not listed here.

3.1 Mobile communication functionalities: Perceived usefulness, perceived degree of innovativeness, perceived impact on mobile work performance and intention to use

In general, mobile workers can use mobile communication functionalities in order to interact with their colleagues and their customers through voice and text messages.

In dead times of your mobile work setting, imagine that you could access your emails (and email attachments) online and communicate via email with your customers, sales-force colleagues and headquarter staff. Customer satisfaction could be increased by responding more quickly to customer inquiries. The exchange of information within your company could be enhanced as you can communicate more rapidly with colleagues and headquarter staff. In addition, administrative tasks can be handled via email in dead times of your mobile work setting and not in your home office when you come home after work.

Based on the above definition and scenario description, please answer the following questions:

3.1a: To what extent do you agree with the following statements on the **perceived usefulness of mobile communication functionalities?**

Identifier	Questions	To a great extent (7)			Moderately (4)			Not at all (1)
MCPU1	To what extent do you perceive it would increase the productivity of your work?	☐	☐	☐	☐	☐	☐	☐
MCPU2	To what extent do you perceive it would improve the performance of your work?	☐	☐	☐	☐	☐	☐	☐
MCPU3	To what extent do you perceive it would be useful for your work?	☐	☐	☐	☐	☐	☐	☐

3.1b: To what extent do you agree with the following statement on the **perceived degree of innovativeness of mobile communication functionalities?**

Identifier	Question	To a great extent (7)			Moderately (4)			Not at all (1)
MCPIN1	To what extent do you perceive its use to be innovative?	☐	☐	☐	☐	☐	☐	☐

3.1c: To what extent do you agree with the following statements on the **intention to use mobile communication functionalities?**

Identifier	Questions	Strongly agree (7)	Agree	Somewhat agree	Neutral (4)	Somewhat disagree	Disagree	Strongly disagree (1)
MCITU1	I intend to use mobile communication.	☐	☐	☐	☐	☐	☐	☐
MCITU1	I would like to use mobile communication.	☐	☐	☐	☐	☐	☐	☐
MCITU3	I think that mobile communication should be used.	☐	☐	☐	☐	☐	☐	☐

3.1d: To what extent do you agree with the following statements on the **performance impact on mobile work performance of mobile communication functionalities**?

Identifier	Questions	To a great extent (7)			Moderately (4)			Not at all (1)
MCPI1	To what extent do you think that it could have a strong and positive influence on your work process?	☐	☐	☐	☐	☐	☐	☐
MCPI2	To what extent do you think that it could positively influence your work effectiveness?	☐	☐	☐	☐	☐	☐	☐
MCPI3	To what extent do you think that it could positively influence your work efficiency?	☐	☐	☐	☐	☐	☐	☐

3.2 Mobile information searching: Perceived usefulness, perceived degree of innovativeness, perceived impact on mobile work performance and intention to use

In general, mobile information searching functionalities support mobile workers to receive time-critical information in real-time while working in their mobile work setting.

Imagine you could access all relevant information sources (Intranet, Internet, ERP, CRM etc.) in real time whenever needed in your mobile work setting. You could thereby provide additional value for your customers by providing better information in the sales call. In addition, you could prepare more effectively for ad-hoc sales calls as you can look up online customer data and targeting information in the CRM system.

Based on the above definition and scenario description, please answer the following questions:

3.2a: To what extent do you agree with the following statements on the **perceived usefulness of mobile information searching functionalities?**

Identifier	Questions	To a great extent (7)			Moderately (4)			Not at all (1)
MISPU1	To what extent do you perceive it would increase the productivity of your work?	☐	☐	☐	☐	☐	☐	☐
MISPU2	To what extent do you perceive it would improve the performance of your work?	☐	☐	☐	☐	☐	☐	☐
MISPU3	To what extent do you perceive it would be useful for your work?	☐	☐	☐	☐	☐	☐	☐

3.2b: To what extent do you agree with the following statements on the **perceived degree of innovativeness of mobile information searching functionalities?**

Identifier	Question	To a great extent (7)			Moderately (4)			Not at all (1)
MISPIN1	To what extent do you perceive its use to be innovative?	☐	☐	☐	☐	☐	☐	☐

3.2c: To what extent do you agree with the following statements on the **intention to use mobile information searching functionalities?**

Identifier	Questions	Strongly agree (7)	Agree	Somewhat agree	Neutral (4)	Somewhat disagree	Disagree	Strongly disagree (1)
MISITU1	I intend to use mobile information searching.	☐	☐	☐	☐	☐	☐	☐
MISITU1	I would like to use mobile information searching.	☐	☐	☐	☐	☐	☐	☐
MISITU3	I think that mobile information searching should be used.	☐	☐	☐	☐	☐	☐	☐

3.2d: To what extent do you agree with the following statements on the **perceived impact on mobile work performance mobile information searching functionalities?**

Identifier	Questions	To a great extent (7)			Moderately (4)			Not at all (1)
MISPI1	To what extent do you think that it could have a strong and positive influence on your work process?	☐	☐	☐	☐	☐	☐	☐
MISPI2	To what extent do you think that it could positively influence your work effectiveness?	☐	☐	☐	☐	☐	☐	☐
MISPI3	To what extent do you think that it could positively influence your work efficiency?	☐	☐	☐	☐	☐	☐	☐

3.3 Mobile transaction processing: Perceived usefulness, perceived degree of innovativeness, perceived impact on mobile work performance and intention to use

In general, mobile transaction processing facilitates routine organisational and business transactions as they are performed on the spot and thereby can be conducted in a more efficient and cost effective way.

Imagine you could enter all sales-/CRM-relevant data online (e.g., call feedback, customer response, plans for next calls etc.) directly after a sales call has taken place. Double work would be reduced as you would not have to make paper-based notes and enter this information in an online system after you come home in the evening. Medical inquiries from a customer could be typed in an online system in front of the customer (or directly after a sales call) and sample management would be facilitated as the system could check whether the respective customer is allowed to receive a specific medical sample.

Based on the above definition and scenario description, please answer the following questions:

3.3a: To what extent do you agree with the following statements on the **perceived usefulness of mobile transaction processing functionalities?**

Identifier	Questions	To a great extent (7)			Moderately (4)			Not at all (1)
MTPPU1	To what extent do you perceive it would increase the productivity of your work?	☐	☐	☐	☐	☐	☐	☐
MTPPU2	To what extent do you perceive it would improve the performance of your work?	☐	☐	☐	☐	☐	☐	☐
MTPPU3	To what extent do you perceive it would be useful for your work?	☐	☐	☐	☐	☐	☐	☐

3.3b: To what extent do you agree with the following statements on the **perceived degree of innovativeness of mobile transaction processing functionalities?**

Identifier	Question	To a great extent (7)			Moderately (4)			Not at all (1)
MTPPIN1	To what extent do you perceive its use to be innovative?	☐	☐	☐	☐	☐	☐	☐

3.3c: To what extent do you agree with the following statements on the **intention to use mobile transaction processing functionalities?**

Identifier	Questions	Strongly agree (7)	Agree	Somewhat agree	Neutral (4)	Somewhat disagree	Disagree	Strongly disagree (1)
MTPITU1	I intend to use mobile transaction processing.	☐	☐	☐	☐	☐	☐	☐
MTPITU1	I would like to use mobile transaction processing.	☐	☐	☐	☐	☐	☐	☐
MTPITU3	I think that mobile transaction processing should be used.	☐	☐	☐	☐	☐	☐	☐

3.3d: To what extent do you agree with the following statements on the **perceived impact on mobile work performance of mobile transaction processing functionalities?**

Identifier	Questions	To a great extent (7)			Moderately (4)			Not at all (1)
MTPPI1	To what extent do you think that it could have a strong and positive influence on your work process?	☐	☐	☐	☐	☐	☐	☐
MTPPI2	To what extent do you think that it could positively influence your work effectiveness?	☐	☐	☐	☐	☐	☐	☐
MTPPI3	To what extent do you think that it could positively influence your work efficiency?	☐	☐	☐	☐	☐	☐	☐

3.4. Location-related services: Perceived usefulness, perceived degree of innovativeness, perceived impact on mobile work performance and intention to use

In general, location-related services support mobile workers by providing job-related location information like e.g. showing the availability of certain resources, customers or colleagues that are within reach.

Imagine that your current navigation system is enhanced by value-adding information regarding the status and current position of your colleagues and customers. In order to facilitate the decision which customer should be visited next/spontaneously, the map of the navigation system would be enriched with internal targeting information (customer value; customer turnover, last visit, etc.), your distance to the customer (based on your location) and information regarding the customer's availability (by considering the customer's business hours, holiday from the CRM system). In addition, you would see the location and the status of your sales-force colleagues (available, within a call etc.) and you can decide whether you want to contact/meet a colleague. The information display would be updated in real time and would adapt to current position you have.

Based on the above definition and scenario description, please answer the following questions:

3.4a: To what extent do you agree with the following statements on the **perceived usefulness of location-related services functionalities?**

Identifier	Questions	To a great extent (7)			Moderately (4)			Not at all (1)
LRSPU1	To what extent do you perceive it would increase the productivity of your work?	☐	☐	☐	☐	☐	☐	☐
LRSPU2	To what extent do you perceive it would improve the performance of your work?	☐	☐	☐	☐	☐	☐	☐
LRSPU3	To what extent do you perceive it would be useful for your work?	☐	☐	☐	☐	☐	☐	☐

3.4b: To what extent do you agree with the following statements on the **perceived degree of innovativeness of location-related services functionalities?**

Identifier	Question	To a great extent (7)			Moderately (4)			Not at all (1)
LRSPIN1	To what extent do you perceive its use to be innovative?	☐	☐	☐	☐	☐	☐	☐

3.4c: To what extent do you agree with the following statements on the **intention to use location-related services functionalities?**

Identifier	Questions	Strongly agree (7)	Agree	Somewhat agree	Neutral (4)	Somewhat disagree	Disagree	Strongly disagree (1)
LRSITU1	I intend to use location-related services.	☐	☐	☐	☐	☐	☐	☐
LRSITU1	I would like to use location-related services.	☐	☐	☐	☐	☐	☐	☐
LRSITU3	I think that location-related services should be used.	☐	☐	☐	☐	☐	☐	☐

3.4d: To what extent do you agree with the following statements on the **perceived impact on mobile work performance of location-related services functionalities?**

Identifier	Questions	To a great extent (7)			Moderately (4)			Not at all (1)
LRSPI1	To what extent do you think that it could have a strong and positive influence on your work process?	☐	☐	☐	☐	☐	☐	☐
LRSPI2	To what extent do you think that it could positively influence your work effectiveness?	☐	☐	☐	☐	☐	☐	☐
LRSPI3	To what extent do you think that it could positively influence your work efficiency?	☐	☐	☐	☐	☐	☐	☐

3.5 Mobile job scheduling & dispatching: Perceived usefulness, perceived degree of innovativeness, perceived impact on mobile work performance and intention to use

In general, mobile job dispatching and scheduling includes both scheduling of shared resources (like e.g. equipment) and scheduling of appointments (like e.g. tasks, time and location).

Imagine a system that supports you in planning your sales calls. This system would make suggestions how your daily sales call plan could look like. You will also receive recommendations which customer to visit next and whether an ad-hoc sales call would fit into your current route.

Based on the above definition and scenario description, please answer the following questions:

3.5a: To what extent do you agree with the following statements on the **perceived usefulness of mobile job scheduling and dispatching functionalities?**

Identifier	Questions	To a great extent (7)			Moderately (4)			Not at all (1)
MJSPU1	To what extent do you perceive it would increase the productivity of your work?	☐	☐	☐	☐	☐	☐	☐
MJSPU2	To what extent do you perceive it would improve the performance of your work?	☐	☐	☐	☐	☐	☐	☐
MJSPU3	To what extent do you perceive it would be useful for your work?	☐	☐	☐	☐	☐	☐	☐

3.5b: To what extent do you agree with the following statements on the **perceived degree of innovativeness of mobile job scheduling and dispatching functionalities?**

Identifier	Question	To a great extent (7)			Moderately (4)			Not at all (1)
MJSPIN1	To what extent do you perceive its use to be innovative?	☐	☐	☐	☐	☐	☐	☐

3.5c: To what extent do you agree with the following statements on the **intention to use mobile job scheduling and dispatching functionalities?**

Identifier	Questions	Strongly agree (7)	Agree	Somewhat agree	Neutral (4)	Somewhat disagree	Disagree	Strongly disagree (1)
MJSITU1	I intend to use mobile job scheduling and dispatching.	☐	☐	☐	☐	☐	☐	☐
MJSITU2	I would like to use mobile job scheduling and dispatching.	☐	☐	☐	☐	☐	☐	☐
MJSITU3	I think that mobile job scheduling and dispatching should be used.	☐	☐	☐	☐	☐	☐	☐

3.5d: To what extent do you agree with the following statements on the **perceived impact on mobile work performance of mobile job scheduling and dispatching functionalities?**

Identifier	Questions	To a great extent (7)			Moderately (4)			Not at all (1)
MJSPI1	To what extent do you think that it could have a strong and positive influence on your work process?	☐	☐	☐	☐	☐	☐	☐
MJSPI2	To what extent do you think that it could positively influence your work effectiveness?	☐	☐	☐	☐	☐	☐	☐
MJSPI3	To what extent do you think that it could positively influence your work efficiency?	☐	☐	☐	☐	☐	☐	☐

3.6 Mobile office: Perceived usefulness, perceived degree of innovativeness, perceived impact on mobile work performance and intention to use

In general, mobile office functionalities enable mobile workers to use word processing, spreadsheet, presentation software and personal information software while being on the move.

In the dead times of your mobile work setting, imagine you could do (parts of your) administrative work that you would have to do otherwise in your home office at the end of your working day. You would be able to use mobile office software in your mobile work setting. You could access calendar information or edit task tasks lists online. Exchanging documents and collaboration with others would thereby be made more effectively. You could prepare presentations in lunch breaks and can make calculations in excel sheets while waiting for the next call.

Based on the above definition and scenario description, please answer the following questions:

3.6a: To what extent do you agree with the following statements on the **perceived usefulness of mobile office functionalities?**

Identifier	Questions	To a great extent (7)			Moderately (4)			Not at all (1)
MOPU1	To what extent do you perceive it would increase the productivity of your work?	☐	☐	☐	☐	☐	☐	☐
MOPU2	To what extent do you perceive it would improve the performance of your work?	☐	☐	☐	☐	☐	☐	☐
MOPU3	To what extent do you perceive it would be useful for your work?	☐	☐	☐	☐	☐	☐	☐

3.6b: To what extent do you agree with the following statements on the **perceived degree of innovativeness of mobile office functionalities?**

Identifier	Question	To a great extent (7)			Moderately (4)			Not at all (1)
MOPIN1	To what extent do you perceive its use to be innovative?	☐	☐	☐	☐	☐	☐	☐

3.6c: To what extent do you agree with the following statements on the **intention to use mobile office functionalities?**

Identifier	Questions	Strongly agree (7)	Agree	Somewhat agree	Neutral (4)	Somewhat disagree	Disagree	Strongly disagree (1)
MOITU1	I intend to use mobile office.	☐	☐	☐	☐	☐	☐	☐
MOITU1	I would like to use mobile office.	☐	☐	☐	☐	☐	☐	☐
MOITU3	I think that mobile office should be used.	☐	☐	☐	☐	☐	☐	☐

3.6d: To what extent do you agree with the following statements on the **perceived impact on mobile work performance of mobile office functionalities?**

Identifier	Questions	To a great extent (7)			Moderately (4)			Not at all (1)
MOPI1	To what extent do you think that it could have a strong and positive influence on your work process?	☐	☐	☐	☐	☐	☐	☐
MOPI2	To what extent do you think that it could positively influence your work effectiveness?	☐	☐	☐	☐	☐	☐	☐
MOPI3	To what extent do you think that it could positively influence your work efficiency?	☐	☐	☐	☐	☐	☐	☐