Determinants of IS continuance: The use of mobile computing services by field service staff in a South African mandatory setting

By Shamil Talip

Student Number: 696327

Supervisor:

Jean-Marie Bancilhon

M.Com (Information Systems) by Research

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SCHOOL OF ECONOMIC
& BUSINESS SCIENCES

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Declaration

I declare that this dissertation is my own unassisted work, except only where acknowledgements and references have been made in the text. I have read and fully understood the school Senate Policy on Plagiarism. I am well aware that plagiarism constitutes presentation of others as one's own, and failure to give credit where it is due.

This dissertation has not been submitted before, to any other institution, for an award of any degree or examination.

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Shamil Talip

Date:

ABSTRACT

Rugged mobile computing devices have enhanced durability and protection, thus allowing these devices to be used in the field as opposed to the office. These rugged mobile computing devices provide organisations with the ability to extend their information system services to their field staff, such as delivery persons, transport drivers and field technicians. Bhattacherjee's (2001) IS continuance model appears to fall short in explaining IS continuance in the context of field service staff who often perform repetitive tasks as part of their job as opposed to doing more complex tasks as performed by office bound knowledge workers. An IS continuance-based study in a South African organisation, where field service staff use rugged mobile devices, will improve our understanding of user behaviour towards technology within the body of IS knowledge.

This study makes a contribution to theory by demonstrating that the core IS Continuance model by Bhattacherjee (2001), can be extended to include additional constructs to better predict IS continuance. This study proposes and tests an extension of Bhattacherjee's (2001) IS continuance model, which explains the determinants of IS continuance intention in terms of affective and cognitive factors. The cognitive factors are task technology fit, perceived service availability, result demonstrability and the affective factor is the construct of familiarity.

The study is carried out in a mandatory setting within the context of field technicians (working for a South African utility organisation) using application services on rugged mobile devices. To date, most IS continuance studies appear to have been carried out in a voluntary setting or an academic institution setting and very few of them have been conducted in organisations (mandatory settings).

A structured questionnaire with closed questions was developed to capture field data from 144 participants on each of the study's variables

The hypotheses were tested using both parametric and non-parametric correlation and

regression statistical analyses. The independent variables of perceived post-usage usefulness, familiarity and satisfaction explain approximately 51% of the variance in IS continuance intention. One of the key findings of the research is that perceived post usage usefulness loses its significance in the presence of Familiarity in predicting IS continuance intention. Thus, familiarity (affective factor) is the stronger predictor of IS continuance intention as opposed to the cognitive factors.

In summary, this study showed that the affective factor is a stronger predictor of IS continuance intention than the cognitive factors, thus providing a richer understanding of IS continuance and a foundation for future research. Thus, in addition to methodological and contextual contributions, this study also contributes to theory.

Keywords: *IS Continuance; Mobile Computing; Field Workers; Field Service Staff Perceived Post-Usage Usefulness; Familiarity; Satisfaction; Perceived Service Availability; Task-Technology Fit; South African Organisation; Utility*

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1 INTRODUCTION

There are various theory-based research papers that have linked information systems (IS) to firm performance (Bharadwaj, 2000; Rivard, Raymond and Verreault, 2006) and IS to individual performance (Goodhue and Thompson, 1995). The measure of performance can only be achieved by the continued use of the IS to achieve this success Bhattacherjee (2001). Petter, DeLone and McLean (2013) have argued that usage is the antecedent to any individual or organisational impact and hence there has been a major focus on IS usage studies. Bhattacherjee (2001) argues however, that these IS usage studies have mainly focused on technology adoption. By definition, "adoption" is a construct that explains the initial acceptance of technology (Bhattacherjee, 2001). Although adoption is very important, the "continued" use of technology is of greater importance than just the initial adoption (Bhattacherjee, 2001). Bhattacherjee, Perols and Sanford (2008) justify the criticality of IS continued use in a business by arguing that employees who continue to use the IS for business tasks often contribute to an organisation's performance. The current study proposes and tests an extended IS continuance model which is underpinned by the IS continuance model by Bhattacherjee (2001). Although this current study is within an organisation based in South Africa (mandatory setting), where field service staff are using mobile computing services on rugged devices –a context that has been underexplored in IS continuance research to date – the unit of analysis is at the individual level.

1.1 Context of the study

1.1.1 Mobile computing within industry

Schadler and McCarthy (2012) cite in an IT trade journal that 350 million employees worldwide will use smartphones by 2016. Schadler and McCarthy (2012) also predict that business spending on mobile projects will grow by 100% by 2015, and more than

half of business decision-makers will increase their mobile technology budget in 2015 as they look for better ways to improve their business.

These decisions have been helped by the introduction of rugged mobile handheld computers (as seen in figure 1). Rugged mobile handheld computer devices have different standards and different operational characteristics than consumer-grade devices. Fully rugged units have enhanced durability and protection, thus allowing these mobile computing devices to be used in the field as opposed to the office. The features of these rugged mobile computing devices include shock and water resistance and the device can be dropped to a certain height without breakage. These characteristics allow enterprises in the transportation, utilities, construction and any other related field service industries to extend their information systems (IS) services to workers who are not office bound. In the past this was not possible as normal computers were not durable enough to withstand the tough conditions that field workers work in. Professions such as delivery persons, transport drivers and field technicians are provided with information services using these rugged mobile computing devices. Thus, technology that was only reserved for the "office worker" (often referred to as the knowledge worker) has now moved into the realms of the so-called "blue-collar[1]" field staff (Wickman, 2012).

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[1] Manual labourers are often called blue collar workers

Figure 1 - Illustration of a rugged handheld mobile computing device

Source: http://www.elsi.es/pda-industrial-terminal-movil/motorola-mc75a-ref364.html

1.2 Problem statement

1.2.1 Research Problem

A systematic search across 6 databases to target the top 25 IS journals(namely Ebsco Business Source Premier, ISI Web of Science, Proquest, Science Direct, JSTOR and ACM guide) resulted in eight quantitative empirical research papers for post adoption usage in a mandatory setting (please refer to Annexure A and B). Following the results of the systematic review, there appears to be no known studies to date that focus on specific determinants for continued use of mobile computing services on rugged devices by field service staff of an organisation within a mandatory context.

Such a study is important because there cannot be a single conceptual snapshot of IT that will capture all usage contexts (Orlikowski and Iacono, 2001). This means that there cannot be a "one size fits all" model to predict all usage. Therefore the characteristics of the IT artefact being studied should be considered as an important

role in explaining user behaviour (Orlikowski and Iacono, 2001). According to Venkatesh and Bala (2008), there have been researchers who have developed context-specific determinants for usage behaviour type studies albeit focusing only on the adoption context — for instance, Karahanna and Straub (1999) for electronic communication systems (i.e., e-mail systems), Koufaris (2002) for e-commerce and Hong and Tam (2006) for multipurpose information appliances.

Given the above, it appears that Bhattacherjee's (2001) model falls short in providing a richer understanding of IS continuance taking into consideration the IT artefact and the specific context (mandatory setting) of this present study. This study proposes to use additional constructs borrowed from other theories and models were needed with a focus on specific determinants to make it more useful for practitioners within a particular context. Thus taking these considerations into account, there is a need for an extended IS continuance model to be formulated and tested to advance the body of IS knowledge.

1.2.2   Background and Industry Problem

In South Africa there are various organisations such as the many city municipalities, Eskom or Rand Water that provide utilities (e.g. electricity or water) to numerous areas in the country. One of these organisations (Company A – an electricity utility) employs about 4 400 field service staff based across 240 technical service centres across South Africa (Anon, 2012a; Anon, 2012b). The field service officers are responsible for servicing its customer base to ensure minimum disruption to the supply of either electricity or water. Utility companies generally base their model on a dispatching system. If a customer is experiencing a supply problem, the customer will call a contact centre. A work order is generated and transferred to a provincial dispatching centre based on the customer's address. The dispatching centre with the help of a work management system will narrow down the location of the fault and who is the closest field service technician based at one of the 220 technical service centres. The work order will be dispatched to the field technician who is required to restore the supply

issues. In the past, this work order was communicated via voice, using a two-way commercial radio or a more advanced text based radio unit, and limited feedback could be sent to the dispatching centre.

Company A has recently introduced rugged mobile computing devices using Windows Mobile as their operating system. This gives senior staff at the utility organisation the ability to load various applications on the devices including a work order dispatching application with richer functionality. The work orders are now dispatched over the air to these applications residing on the devices, instead of being dispatched via voice, using a two-way commercial radio. The content that is dispatched is much richer by providing information such as the customer's location and details of the fault. The field technician can provide regular milestone feedback at various stages on the status of the repair time of the fault. The device has a Global Positioning System (GPS) application enabling the technician to find the location of the fault quicker as opposed to using a conventional map book. The introduction of these mobile computing services on the rugged devices should ensure that the specific utility organisation increases its performance by reducing the average restoration time it takes to fix customer faults. This impacts the key performance indicators of customer service.

Since the initial adoption of these devices (with applications), there is a large percentage of users continuing to use the services offered on the mobile computing device. There are also departments that mobile devices will be rolled out to in the future and there are a few users not using it as well. Therefore there is a need to determine the reasons why some field service staff are continuing to use the services on the rugged devices and the lessons learnt can be applied to those who are not using it and to those planned future users.

These observations by managers at the utility organisation are in line with the 2012 Neochange Adoption Insight report (Anon, 2012d). According to the report, effective usage of IT is only at 54% within organisations.

1.2.3 Characteristics of the population that is sampled

The United Nations Human Development Indicators (2011)[2] for South Africa, state that the mean years of schooling of adults older than 25 is 8.5 years as opposed to the expected 12 years of schooling as in most developed countries. This indicates that workers in large South African organisations could have various levels of education ranging from not completing secondary school to those with tertiary qualifications. This provides a unique context for studying continued IS use as the spectrum of education levels is broad.

Of the eight studies that resulted from the systematic search of the 6 databases, three surveyed university students. In these three studies, most students were studying for a bachelor's degree and spent at least 17 hours on the Internet per week. Only one of the eight studies detailed that 24.1% of their sample had a junior or senior high school qualification (Hsieh and Wang, 2007). The other 75.9% had a bachelor's degree or higher. Given that the majority of the studies were done in a university setting, an inference can be drawn that most of the users who were studied in the past were studying towards or have a university degree (please refer to Annexure C for details).

These studies did not cover workers who had not completed secondary school, or those with a diploma qualification from a technical college or a University of Technology (previously known as a Technikon).

As company A provided an environment with workers with varying levels of formal education, this provided a context for this study.

1.3 Importance and contributions of this study

As mentioned above, it was argued that adapting a model for a specific context is

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[2] Human Development Indicators for South Africa Report 2011
http://hdrstats.undp.org/en/countries/profiles/ZAF.html last accessed 22 June 2013

beneficial as there cannot be a single model in IT that will capture all usage contexts (Orlikowski and Iacono, 2001). Thus proposing and testing an extended model contributes to IS continuance theory as it provides a greater understanding of the subject area taking into consideration the context in which the study was conducted.

To carry out an IS continuance based study in a South African organisation, with its proportion of education levels and workers, will add to the understanding of user behaviour towards technology (within the body of IS knowledge) through the formulation of an extended IS continuance model.

The findings have important practical implications, as the utility organisation could use it to determine the factors why certain field service technicians continue to use the services offered on the rugged mobile computing device. The lessons learnt could be shared with the management team so that they can apply it to the areas where the continued usage rate of the rugged mobile computing device by field staff is low. For example, the managers of Company A could choose to sign up with a cell phone network provider with better coverage in certain areas to improve the usage of the device, if the findings indicate that there is a strong relationship between perceived service availability and perceived post-usage usefulness.

1.3.1   Research Question

The main focus of this research project is in the area of IS continuance.
The study question is:

- To what extent will the determinants IS continuance intention in terms of affective and cognitive factors better explain the continued use of mobile computing services on rugged devices by field service staff of a South African utility organisation than Bhattacherjee's(2001) IS continuance model?

1.3.2 Objectives

In order to achieve the aim of this research, the following objectives have been addressed:

- A literature review on the subject of IS continuance was completed.
- The development of an extended IS continuance model to improve on IS continuance theory, with a focus on the determinants for perceived post-usage usefulness and IS continuance intention. The core model is based on the IS continuance model by Bhattacherjee (2001). Additional constructs have been imported and adapted from adoption-focused studies that best suit this research problem and added as determinants to perceived post-usage usefulness and IS continuance intention. All the constructs have been operationalised, using measures as described in previous literature.
- A survey questionnaire has been drafted for the data collection.
- The data collected has been statistically analysed to test the impact of the determinants of perceived post-usage usefulness and IS continuance intention of Bhattacherjee's (2001) IS continuance model.
- A discussion and explanation of the findings from the data analysis is presented.

1.4 Theories underpinning the proposed model

This section gives an overview of the theory and models that underpin the current research. Such an overview is elaborated upon in chapter 2.

The core of this study's proposed model is based on Bhattacherjee's (2001) IS Continuance Model which itself is underpinned by the expectation-confirmation theory by Oliver (1980). The expectation-confirmation theory originates in the consumer space

and states that consumers will intend to repurchase the same products primarily due to their satisfaction from previous use of it. Thus from their prior use the consumers' expectations are either positively or negatively disconfirmed. Bhattacherjee's (2001) adapts the expectation-confirmation theory to say that IS users will continue to use an information system (IS) based on their satisfaction obtained from prior use and their expectations of the IS.

This study's model extends Bhattacherjee's (2001) IS continuance model to provide a better understanding of IS continuance and thus incorporates various other relevant models and theory to enhance it.

Thus, reference is made to other theories such as: the job characteristic model by Hackman and Oldham (1976) to explain result demonstrability; Goodhue and Thompson's (1995) task technology-fit model; image theory by Beach and Mitchell (1987) to explain perceived service availability and the theory of reasoned action (Fishbein and Azjen, 1975) to explain the dependent variable which is IS continuance intention.

1.5 Organisation of the research report

Chapter 2: Literature Review

This chapter is divided into two key parts.

The first part introduces a discussion on the concept of a mobile field worker as well the concept of workforce management within the utility industry. This part ends with the explanation of what is a rugged mobile device is and why firms are opting to use it for field staff as opposed to conventional mobile computing devices.

The second part of the chapter will provide a background to IS continuance studies and the concept of mobile computing. Thereafter this part of the chapter will present a

discussion on prior findings on IS continuance studies with particular emphasis on the IS continuance model by Bhattacherjee (2001). In addition, determinants to the model are proposed via hypotheses, which were tested in this study.

Chapter 3: Research Methodology

The research methodology, research design, data collection techniques, instrument and operational measures are discussed. In addition, reliability, validity as well as data analysis techniques that were used for the analysis, is discussed.

Chapter 4: Data Analysis

The findings from this research are analysed using inferential statistical tools such regression analysis. The results from inferential statistical analyses conducted on the research data are presented in this chapter.

Chapter 5: Discussion

The results from the data analysis are discussed and interpreted.

Chapter 6: Conclusion

This chapter presents a review of the entire study, discusses limitations and future recommendations are made.

1.6 Chapter Summary

This introduction chapter has presented a brief overview of IS continuance studies and provided an overview of the context of an organisation based in South Africa (mandatory setting) where the use of mobile computing services on rugged devices by

field service staff are used. In addition, the aim of this research, the research problem, research question and objectives of the study has been introduced. The following section discusses what is mobile computing and workforce management within the field.

2 LITERATURE REVIEW

2.1 Introduction

This chapter is presented in two parts. The first part of the chapter introduces the concept of mobile field staff (also referred to as mobile field workers) as well as the concept of workforce management within the utility industry. This part ends with the explanation of what is a rugged mobile device and why firms are opting to use it for field staff as opposed to "consumer type" devices.

The second part of the chapter will provide a background to IS continuance studies and a discussion of the appropriate theory underpinning this study.   Thereafter the proposed model is presented via hypotheses which then provides a richer understanding of IS continuance.

2.2 Part 1: The Mobile Worker and Work Force Management

2.2.1 Difference between a mobile knowledge worker and a mobile field worker

Mobile field service staff are workers who generally spend more than 20% of their time away from their office locations where they are based (BenMoussa, 2003; Lu, Bao and Wang, 2012). This definition of a mobile worker can be categorised into two groups, namely mobile knowledge workers and mobile field workers (Yuan & Zheng, 2009). Mobile knowledge workers may include managers, professionals, journalists, real estate agents, tourist guides, to name a few; and mobile field workers may include delivery persons, transport drivers, emergency personnel (e.g. ambulance and firefighting staff) and field technicians.

2.2.1.1   Complexity of tasks

The task complexity for mobile knowledge workers is higher than that for field workers, as field workers tend to carry out more repetitive tasks in their work (Yuan & Zheng 2009). To further elaborate, field workers usually follow a repetitive standard process whereas mobile knowledge workers are less inclined to do repetitive tasks. The field workers of Company A follow the workforce management process (see figure 2) which is discussed further in the next section.

2.2.1.2   Importance of time and location

Field workers use more real time functions such as job dispatching, location tracking, navigation, and mobile notification, than mobile knowledge workers who use mobile office functions instead (Yuan & Zheng, 2009; Yuan et al, 2010).

The importance of time and location for field workers is higher than that for mobile knowledge workers (Yuan, Archer, Connelly & Zheng, 2010). For example as with company A, the maintenance workers need to attend to faults within a certain time and at a particular location. This is in contrast to mobile knowledge workers, for whom time and location is usually more flexible.

Field workers use more real time functions such as job dispatching, location tracking, navigation, and mobile notification, than mobile knowledge workers who use mobile office functions instead (Yuan & Zheng, 2009; Yuan et al, 2010).

2.2.2   Workforce management within the electricity industry

A stable and an uninterrupted electricity power supply contributes to the growth of a nation as it is a contributing factor to the economy (Salleh, Cob, Shanmugam, Shariff, 2009). The technical complexity and the large geographic spread of an electricity

distribution network makes maintenance and fault repairs cumbersome and costly (Salleh et al. 2009). Therefore a highly-productive mobile workforce is important to carry out maintenance and fault repair activities to ensure that the utility company provides uninterrupted supply of electricity. Thousands of field service technicians may perform hundreds of thousands of maintenance and repair activities during a year to ensure continuous electricity supply (Anon, 2012b).

In order for a utility company's mobile field workforce to be highly productive, one of the most important performance measures used is the downtime (often referred to as restoration time within industry) (Agnihothri, Sivasubramaniam & Simmons, 2002; Salleh et al. 2009; Bernardon, Pfitscher, Sperandio, Garcia and Reck, 2012). Downtime is defined as the time that has elapsed between the request for service or fault being reported, up until the time the service is completed or the fault is repaired (Agnihothri et al; 2002). Downtime can be divided further into various milestones such as response time, travel time and on-site or fault repair time. Response time is the time taken for the field technician to respond to a new request; for example the field technician could still be finishing another task at another location before embarking on to the next task. The travel time is the time taken to arrive at the site and the on-site time is the time taken to complete the service or repair the fault.

Burden (1995) argues that the two way communication radio has been essential to the utility industry to efficiently control a mobile field workforce in order to reduce downtime or restoration time, by playing a crucial role in dispatching a field technician to carry out a task. The electricity industry was among the first organisations to adopt the two way radio communication for work management and the first reported utility to use it was in the UK in 1947 (Burden,1995).

However, despite the two way communication radio being used for decades within the industry, it could not handle all the associated data that was needed by the field technician in order to perform their tasks as efficiently as required to meet customer demands (Salleh et al. 2009). Mobile workforce management solutions combined with

GPS mapping capabilities over and above the conventional 2 way radio communication, have proven successful for organisations to realise these shorter times (Salleh et al. 2009). For a typical utility company, two-thirds of total employees are field-based and therefore the automation of dispatching field technicians to the correct site and granting them sufficient information increases productivity and reduces cost of the organisation (Dobbs, 2014). In order to achieve this, organisations have implemented mobile computing workforce management solutions.

Brodt and Verburg's (2007) study focused on European organizations and they found that the adoption of mobile solutions as part of the work force management solutions were more prevalent among the electricity utility industries than any other.

Company A has deployed a mobile work force management system to achieve four objectives which are: (1) able to dispatch work order requests to a mobile computing device; (2) able to dispatch the correct field service technicians factoring in constraints such as their skill level and the available tools in their vehicle; (3) complete mobilization of the technician to perform end-to-end service tasks, including the ability to look up inventory status or download instructions in real time or cached on a mobile computing device; (4) Integrate geographic information system (GIS) capabilities with the mobile computing device to enable the technician to travel to the correct destination. These objectives are in line with industry standards according to the Gartner field service management report (Anon, 2012e). Figure 2 is an illustration of an example of a work management process implemented by Company A.
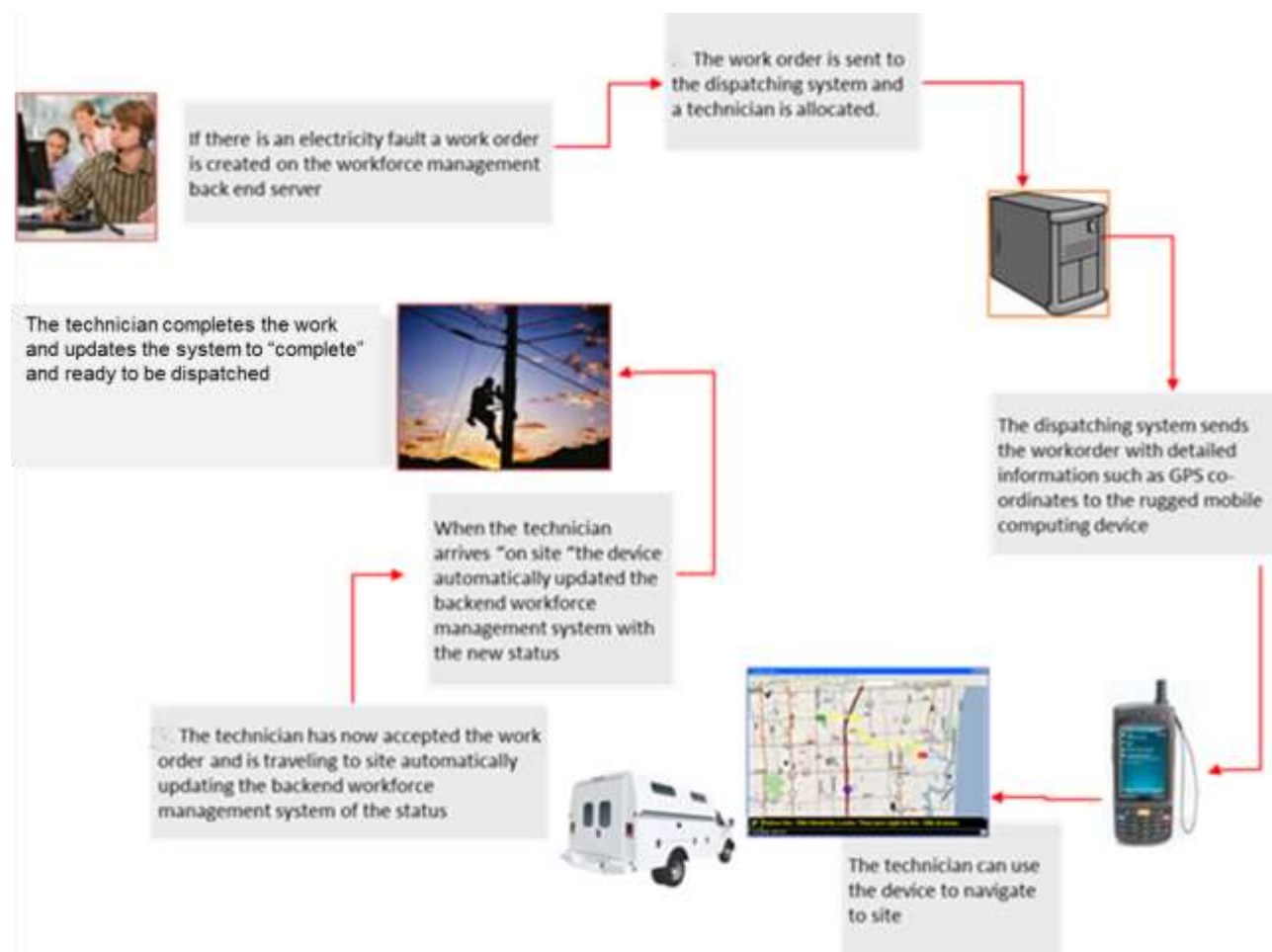
Figure 2 - Work Force Management Process (Anon, 2012b)

2.2.3 Rugged Mobile Computing Devices

Brodt and Verburg's (2007) study found that in most European electricity utility organisations, adoption of mobile computing services on rugged devices for their field workers was part of the implementation of their mobile workforce solution. Most of the mobile devices that were purchased by these European utility companies for their field staff were rugged, as previous case studies indicated that "normal consumer" mobile devices resulted in frequent failure due the harshness of the environment (Cronin, 2013). Figure 3 illustrates the leading causes of mobile computing device failure in the field (Cronin, 2013). The most common reason is the dropping of the device by the individual. In the current context within South Africa, this is quite prevalent as well, as field technicians often have to climb or access electricity poles in rural areas without the

help of mechanical hoists. Often during these physical activities the devices are dropped.

Leading Causes of Device Failure

Cause	Percentage
Dropping device	77%
Software related issues	42%
Water/liquid exposure	38%
Unauthorized changes to device configuration/ settings by end user	14%
Excessive heat/cold temperature exposure	11%
Dust particulates exposure	9%
Excessive vibration exposure	8%
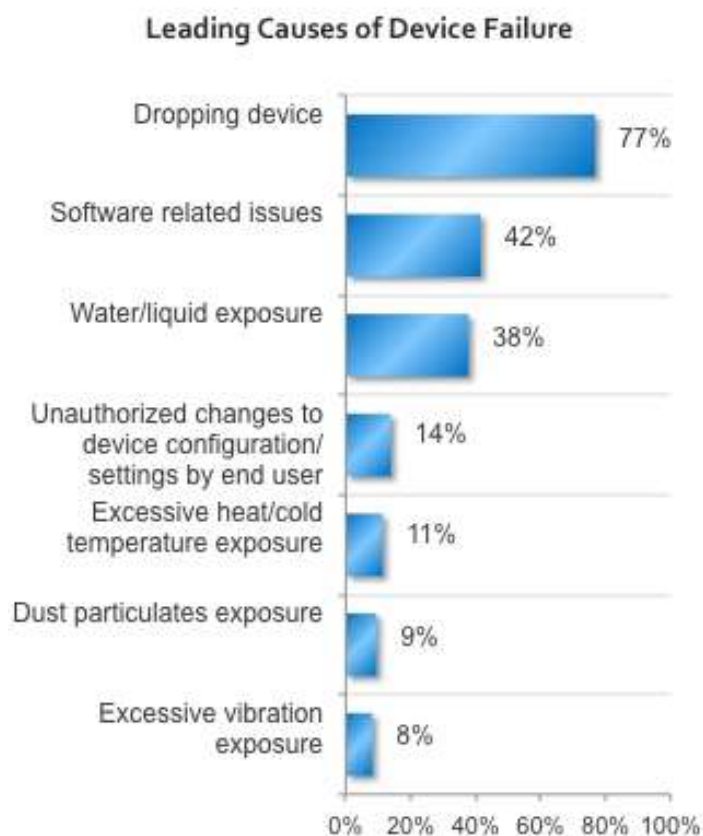
Figure 3 - Leading Causes of Device Failure (Cronin, 2013)

In addition, the survey indicated that the most important factor for a device to be used in the field is the ability to use the device in direct sunlight and still be able to see the content displayed on the screen of the device (Cronin, 2013). Other factors such as the ability to use the device with gloves on, and in wet conditions and the ability to withstand extreme vibrations were also raised.

In a country like South Africa all these above mentioned factors was considered when the rugged mobile device solution was implemented. The reason is that South Africa averages 8.5 sunshine hours per day according the South African Weather Service

(2014)[3], therefore it is paramount that field workers are able to read the content on the screen of the device in any weather condition. According to the South African National Roads Agency (2011)[4] about three hundred thousand kilometers of South Africa's roads are untarred (gravel roads). Company A has to service communities in rural areas and thus the field technicians have to use these gravel roads often to get to their destinations. During these driving conditions on rural roads the mobile device thus has to be able to withstand vibrations and this feature is therefore important to company A.

As a result of the increased failure rates of "normal" consumer devices used in the field environment, their total cost of ownership is considered much higher than rugged mobile computing devices (Cronin, 2013). Despite consumer devices having a lower upfront adoption cost, the operating cost is significantly higher in the long term due to increase in repair costs.

Taking into consideration the various case studies, Company A has opted to rollout the rugged mobile computing device that has rugged capabilities as described above.

2.3 Part 2 – IS continuance

2.3.1 Definition of IS Continuance

User involvement is at the heart of most research in information systems and by implication it is a key variable in IS success (Petter, DeLone and McLean, 2013). Burton-Jones and Straub (2006) argue that there is no widely accepted definition of IS usage and that researchers have operationalised it in various ways. After surveying 48 empirical studies of individual system use they claimed that there were 14 different types of measures. For example, they found the following type of usage measures such

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[3] http://www.weathersa.co.za/ accessed 13 Jan 2015
[4] http://roadsafety.co.za/2011-06/how-many-kilometres-of-rsa-roads-are-tarred-vs-un-tarred/ accessed 13 Jan 2015

as "extent of use", "appropriateness of use", duration of use", "decision to use or not" and "frequency of use".

While his research's central theme is not to argue about the detail of a common definition of usage or usage intention, it does take the recommendation of Burton-Jones and Straub (2006), that researchers should be upfront about their definition and its assumptions. Therefore taking this recommendation on board this present research has used the synonyms of "IS continuance intention" or "continued IS intention". Limayem, Hirt and Cheung (2007) have described that IS continuance usage is just one of the definitions that forms part of the post-adoption basket of definitions. They mention that it could be referred to other synonyms such as, routinisation, infusion, committed use, continued use and consistent use. However, the synonyms of "IS continuance intention" or "continued IS intention" are in line with the terminology used by Bhattacherjee (2001). Therefore IS continuance intention is thus defined as the mental state of a user that represents a commitment to carrying on using the target IS following an initial acceptance (adoption) and the experience gained from initial use (Bhattacherjee, 2001; Bhattacherjee et al., 2008).

2.3.2   IS Continuance Use in a Mandatory Setting

This section will discuss IS continuance use in a mandatory setting as well as the motive for the use of Bhattacherjee's (2001) IS continuance model (ISCM) as the core model underpinning this study.

According to Sørebø and Eikebrokk (2008) and Venkatesh and Bala (2008), adoption in both mandated and voluntary environments have been studied in depth but post-adoption studies appear to have primarily focused on voluntary settings. Sørebø and Eikebrokk's (2008) definition of mandatory is absolute: a user does not have the freedom to choose, as they are required to utilise the system i.e. forced upon them by a senior figure. However, Hartwick and Barki (1994) and Venkatesh and Davis (2000) have argued that a mandatory environment is not absolute and that it is about users'

perception towards a particular authority whom they perceive to have an influence on their behaviour, which results in some users using the mandated technology and other users not using it. Thus, the extent to which users consider an environment to be mandatory varies. In addition, Hartwick and Barki (1994) and Venkatesh and Davis (2000) also argue that although certain technology is mandated by an organisation, usage intentions vary because there will always be some users who are not willing to abide by the rules.

Taking this study's specific context into consideration, each of the 220 service centres across the country has a field service manager supervising the field workers assigned to them. Therefore the field workers' perception toward their own particular manager whom they perceive to have an influence on their behaviour will vary between them. In some instances there could be field workers perceiving that the technology is forced upon them whereas the field staff at another service centre will perceive the opposite. Hence it can be deduced that there continues to be a need for IS continuance studies in a mandatory context, as the context of this specific study and findings from previous studies indicate that 'mandatory' is not absolute.

Studies for continued use in mandatory settings appear not to have been covered as extensively as pure adoption studies, and thus there are fewer publications on this subject that is known of to date. However, Bhattacherjee's (2001) IS continuance model seems to be the most widely used model used in IS Continuance studies with over 2600 citations to date. Of the nine papers reviewed, five papers have proposed models based on the core Bhattacherjee's (2001) IS continuance model which is based on the expectation-confirmation theory by Oliver (1980).

Karahanna, Straub and Chervany (1999) have used IT adoption models to predict continuance behaviour but have showed that adopters differ to continued users in the set of behavioural beliefs underlying their attitude. They argue that post-adoption users' attitude is primarily based on an accumulation of past experience whereas pre-

adopters behaviour is based on uncertainty due to possible lack of information about the IS before first use. For example, variables such as perceived ease of use are important to pre-adopters but it is less important to continuance users. Moreover Bhattacherjee's (2001) ISCM could be the better model to use as opposed to using adoption models to predict continuance, as adoption models fail to explain why users discontinue to use an IS after initially adopting it.

Even fewer studies appear to have focused on the determinants of the variables commonly used in the IS continuance models such as the variables called perceived post-usage usefulness and continuance intention. Venkatesh and Bala (2008) and Rosemann and Vessey (2008) argue that research should not just be about validating and testing a model that makes little sense to someone in industry, but these studies should be beneficial to the practitioners as well. Venkatesh and Bala (2008) emphasise this point by quoting a phrase by a leading IS scholar, Alan Dennis,

> "*imagine talking to a manager and saying that to be adopted it must be useful and easy to use. I imagine the reaction would be Duh! The more important question is what makes technology useful (sic)*"

There have been researchers who have presented studies about various determinants for key constructs of the adoption models that address Venkatesh and Bala's (2008) plea for more relevant studies for practitioners. Venkatesh and Davis (2000) have extended TAM (Davis, 1989) to TAM2 (The Technology Acceptance Model version 2).and Venkatesh and Bala (2008) included additional determinants and proposed TAM3 (The Technology Acceptance Model version 3). These studies have focused on determinants of the key variables of TAM, i.e. perceived usefulness (PU) and perceived ease of use (PEOU). There appears to be very few studies that have studied the determinants of the key variables (i.e. perceived post-usage usefulness and continuance intention) of the IS continuance model as proposed by Bhattacherjee (2001).

Larsen , Sørebø and Sørebø (2009) believe that studies in IS continuance can be categorised into three groups. The first group are studies that are using existing IS adoption variables to try and explain IS continuance. The second group are in-depth studies of the established Bhattacherjee's (2001) IS continuance model (referred to as ISCM from now onwards). Lastly, the third group integrates the ISCM with complementary theoretical constructs to improve on what best predicates continuance intention. This research belongs to the third group as it intends to enrich on IS continuance theory by studying the impacts that determinants (as seen in Figure 4) have on key variables of Bhattacherjee's(2001) ISCM.

2.3.3   Theoretical Background

This section discusses the detail of the theories and models that underpin the present study's extended IS continuance model. The core of this study's proposed model is based on Bhattacherjee's (2001) IS Continuance Model which itself is underpinned by the expectation-confirmation theory by Oliver (1980). Reference is made to other theories such as: the job characteristic model by Hackman and Oldham (1976) to explain result demonstrability; Goodhue and Thompson's (1995) task technology-fit model; image theory by Beach and Mitchell (1987) to explain perceived service availability and the theory of reasoned action (Fishbein and Azjen, 1975) to explain the dependent variable which is IS continuance intention.

2.3.3.1 Expectation-Confirmation Theory (ECT)

The expectation-confirmation theory is used in consumer behaviour and marketing studies. This theory is to study consumer behaviour as it explains the reason why consumers want to repurchase a specific product again (Oliver, 1980). The expectation-confirmation theory (ECT) suggests that there are two key constructs namely disconfirmation which in turn has a major effect on satisfaction.

To understand this theory, the two above mentioned constructs are discussed separately starting with the construct of disconfirmation below.

Oliver's (1980) starting point in developing the consumer ECT was using the adaptation-level theory. Adaptation-level theory in its simplest form states that all judgments are made with respect to a frame of reference (Helson, 1948). This study was one of the first studies that provided a quantitative analysis and adapted the theory from the field of psychophysics to the field of social behaviour. Using Helson's (1948) adaptation level theory, Oliver (1980) expanded it by stating that consumers' cognition of a product before use is considered their "adaptation level" (frame of reference). This level of adaptation is often set by a third party such as advertisements or promotions. After the product has been used, a cognitive comparison between the actual product experience and their "adaptation level" is made and this determines subsequent evaluations and the amount of deviation from the initial adaptation level. These evaluations result in consumers changing their adaptation level. Oliver (1980) argues that if the consumer product exceeds, meets, or does not come close to one's expectations (adaptation level) then this results in a positive, zero, or negative disconfirmation respectively.

These disconfirmations will result in satisfaction. Satisfaction can thus be seen as a function of the expectation (adaptation) level and perceptions of disconfirmation (Oliver, 1980). Bhattacherjee (2001) summarises satisfaction as a psychological emotional state resulting from a cognitive evaluation by users of their expectancy versus actuality experience. Thus ECT theorises that expectation (disconfirmation) relative to a frame of reference (adaptation level) is a determinant to satisfaction. The reverse causes dissatisfaction.

Most consumers would not want to repurchase a product again if they were dissatisfied with it after using it. From a theoretical perspective, ECT postulates that satisfaction is a predictor of purchase intentions (Oliver, 1980). This is based on the theory of reasoned action. This theory was formulated in the seventies by Martin Fishbein and Icek Azjen

which states that behaviour is determined by intention and the precursor of intention is attitude (Fishbein and Ajzen,1975). An intention could be considered as a plan to behave in a particular way and the development of that plan is determined by one's attitude at the time.

Bhattacherjee's (2001) IS Continuance Model is underpinned by ECT and the details are discussed in the next section.

2.3.3.2 Bhattacherjee's (2001) ISCM

Bhattacherjee's (2001) ISCM is based on the expectation-confirmation theory. This theory is to study consumer behaviour as it explains the reason why consumers want to repurchase a specific product again (Oliver, 1980). Bhattacherjee's (2001) ISCM model is underpinned by Oliver's (1980) ECT theory, by stating that if users' experiences of actual IS use are equivalent or more than what they initially expected, then their expectation will be positively confirmed and in turn they will be satisfied. This will result in the users intending to use the IS again. The opposite of this is that if the users' expectations are disconfirmed, dissatisfaction will result. Thus satisfaction can be described as a feeling or an affect that is either positive (satisfied) or indifferent or negative (dissatisfied). The Cambridge dictionary[5] defines satisfaction as a fulfilment of one's wishes, expectations, or needs and thus the subsequent feeling (pleasurable) derived from it.

Bhattacherjee (2001) has likened IS users to that of consumers repurchase intention. He argues that a IS user would go through the same evaluation process as a consumer would.

A difference between Bhattacherjee's (2001) ISCM to that of ECT is that it only takes into account post acceptance variables and assumes the user has already adopted the IS

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[5] http://dictionary.cambridge.org/

already and continues to use it. A second difference is that there is a positive association between disconfirmation and perceived usefulness as well. These points are discussed in the hypotheses section.

2.3.3.3 Image theory

Image theory by Beach and Mitchell (1987) is a description of a decision making process of deciding on a particular action by an individual. The decision is often made by ensuring that it is compatible with the individual's principles (self-image). There are two decision making stages when an individual decides upon on a particular action when there are different available actions that can be taken. The first stage is to eliminate all the options that are incompatible with one's principles and goals that need to be achieved and the second stage is then to choose the best option of the remaining options that are left. The second stage of this decision making process is known as the profitability test.

Image Theory underpins the variable of perceived service availability because the argument is that individuals will choose the best perceived service available in order to perform their tasks. The details are discussed in the hypotheses section.

2.3.3.4 Job Characteristic Model

The job characteristic model by Hackman and Oldham (1976) describes five core job characteristics (skill variety, task identity, task significance, autonomy, and feedback) which impact three critical psychological states (experienced meaningfulness, experienced responsibility for outcomes, and knowledge of the actual results). These psychological states will then influence work performance (to name a few such as: to continue to do well at work, have less absenteeism and have job satisfaction).

The job characteristics model will unpin the variable namely result demonstrability. Result demonstrability is defined as the degree that an individual perceives that the

benefits of using a particular technology are tangible, observable and communicable (Moore and Benbasat, 1991). Taking the definition of result demonstrability into account, it is shown that only one dimension of the job characteristics model unpins it. The dimension of the job characteristic model is that of "feedback" which impacts the psychological state of "knowledge of actual results". Feedback is defined as the degree to which workers are provided with clear, specific, detailed, actionable information about the effectiveness of their job performance, thus proving them better overall knowledge of the impact of their work activities (Hackman and Oldham, 1976). In this present study the use of technology (rugged mobile devices) provides the workers with clear, specific, detailed, actionable information thus enabling them to take specific actions (if any) to improve their productivity.

Therefore all the dimensions of the job characteristics model are not relevant to result demonstrability. Fried and Ferris (1987) have concerns that the job characteristic model is extensively multidimensional and questioned if all the dimensions was necessary. Their study assessed the job characteristics model by conducting a comprehensive review of nearly 200 relevant studies on the model and the evidence supported the multidimensionality of the model, but there was less agreement on the exact number of dimensions. The relevant dimension that is needed for this present study has been supported by the study done by Fried and Ferris's (1987). A later study by Johari, Yahya, Mit, and Omar (2011) has shown support for the relevant dimension for this present study as well.

2.3.3.5 Task Technology Fit Model

Goodhue and Thompson's (1995) Technology-to-Performance model states that in order for an IS to have an impact on individual performance, it has to be used and that the IS must be a "good fit with the tasks it supports". The functionality or feature of the technology should match the demands of the task which then results in the individual performance being increased. They go on to define task as the actions required by workers "in turning inputs into outputs." Therefore Goodhue and Thompson (1995)

have argued that the technology characteristic and task characteristic of a particular IS are antecedents of TTF. Although the TTF model has not been underpinned by any theory, the model itself has nevertheless been applied in various IS studies (Irick, 2008).

Irick's (2008) argument is strengthened as Larsen, Sørebø and Sørebø (2009) have also argued that there is a need to bring "work-related" issues into IS continuance research. Therefore they believe in adding TTF to IS continuance theory. Subsequent to this, there have been studies incorporating TTF with IS continuance as done by Larsen et al. (2009) and Lin (2012). TTF is determinant of perceived post usage usefulness. The details are discussed in the hypotheses section.

2.3.4 Model Development (Bhattacherjee's (2001) Core IS Continuance Model)
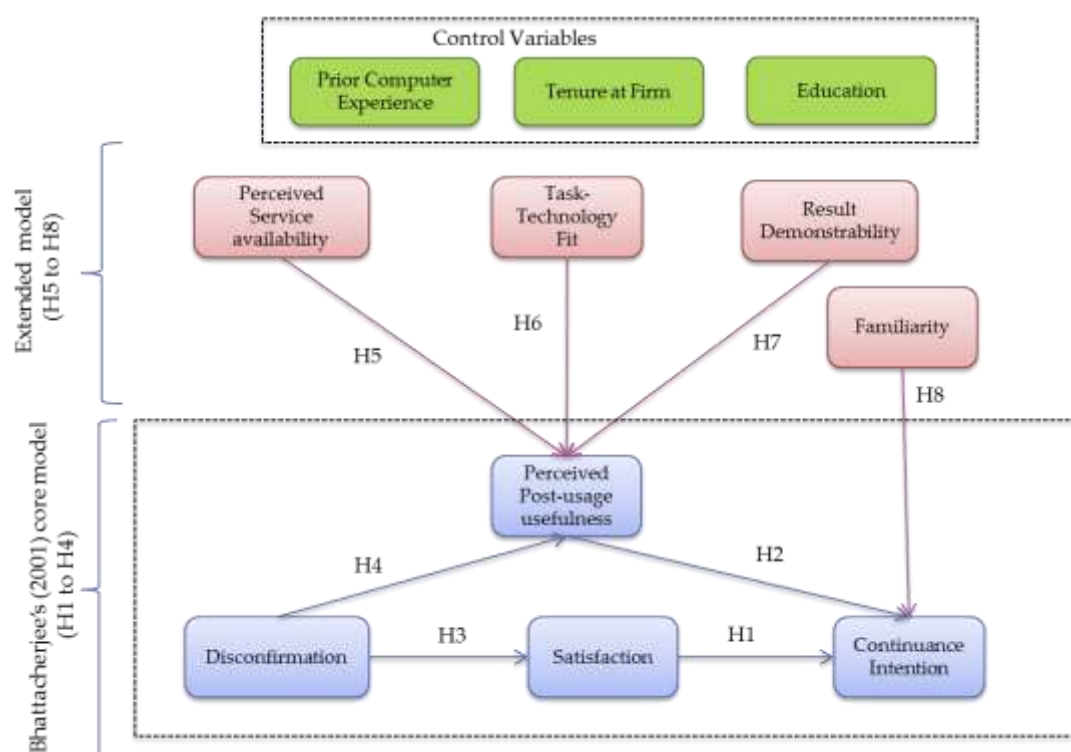
Figure 4 - Adapted from Bhattacherjee's (2001) ISCM

This section discusses the variables of the ISCM. Figure 4 illustrates the hypotheses 1 to 8.

2.3.4.1 Hypothesis 1: Satisfaction as a determinant of IS continuance intention

As mentioned before, the theory of reasoned action (TRA) states that people's behaviour is determined by their behavioural intentions to perform the behaviour, and behavioural intention is determined by their attitude (Fishbein and Azjen, 1975).

An attitude is defined as an organisation of beliefs and feelings resulting in behavioural tendencies towards a social construct (McLeod, 2009; Hogg and Vaughan, 2005). Thus attitude can be described in terms of three components namely affective and cognitive which then influence a behavioural component. The affective component is described has one's feelings about the social construct (for example: "I am scared of snakes") and the cognitive component is one's belief (for example: "I believe snakes are dangerous")(McLeod, 2009). Attitude then determines behavioural intention which then determines how we behave (for example: "Therefore, I intend not to go close to snakes")(Fishbein and Azjen, 1975; McLeod, 2009).

As mentioned before, the definition of satisfaction is a feeling or affect resulting from a cognitive evaluation by users of their expected versus actual experience. Thus satisfaction can be seen as a fulfilment of one's expectations which results in a pleasurable or non-pleasurable feeling. Given the definition of attitude as described in the paragraph above, satisfaction (feeling) is considered as an affective component of attitude.

As both TRA (Fishbein and Azjen, 1975) and TAM (Davis, 1989) have postulated attitude as a predictor of behavioural intention, the logic that satisfaction (affective component of attitude) is a predictor of behavioural intention, can thus be applied.

This argument is also strengthened by the expectation-confirmation theory (ECT), as it states that consumers' intention to repurchase an item is primarily determined by their satisfaction with their previous purchase (Oliver, 1980). Bhattacherjee (2001) has

based his study on ECT and postulated that users intention to continue to use an IS, is determined by their satisfaction from prior use. Thus it can be hypothesised that:

H1: Users' level of satisfaction of using mobile computing services is positively associated with IS continuance intention.

Null hypothesis: Users' level of satisfaction of using mobile computing services is not positively associated with IS continuance intention.

2.3.4.2 Hypothesis 2: Perceived post-usage usefulness as a determinant of IS continuance intention

TAM proposes perceived usefulness (PU) as a determinant to intention to adopt. Bhattacherjee (2001) also draws from TAM (Davis, 1989) by adding PU as a predictor of IS continuance intention. In Bhattacherjee's (2001) ISCM model, perceived usefulness is considered as a belief influencing the post-acceptance attitude, namely IS continuance intention. PU is defined, as the degree to which a person believes that a particular IS will improve his or her performance in a particular job (Bhattacherjee, 2001 and Davis, 1989).

PU originates from the TAM model (Davis, 1989) and thus it is a user's belief, which in turn develops into an attitude, which then results in a particular behaviour. However, beliefs can be influenced by knowledge or experience that was gained in the past (Bhattacherjee et al, 2008). Initial perceptions of usefulness at the adoption stage might differ from what users perceive useful when more knowledge or experience about the IS is gained. Therefore to distinguish between the different constructs Bhattacherjee et al. (2008) called it perceived post-usage usefulness. In line with TAM, Bhattacherjee et al. (2008) have also postulated perceived post-usage usefulness as a determinant of IS continuance intention. Therefore it can be hypothesised that:

H2: Perceived post-usage usefulness is positively associated with IS continuance intention

Null Hypothesis: Perceived post-usage usefulness is not positively associated with IS continuance intention

2.3.4.3 Hypothesis 3: Disconfirmation as a determinant of satisfaction

Bhattacherjee (2001) states that if users' experiences of actual IS use are equivalent or more to what they initially expected, then their expectation will be positively confirmed and in turn they will be satisfied.

For a user to have a feeling or an affect (satisfaction or dissatisfaction) it has to be preceded by an evaluation which is an assessment done by the user (after actual use of the IT artefact) against what the user initially expected (Oliver, 1980 and Bhattacherjee, 2001). Subsequent to the evaluation, (expectation versus reality) a user will develop an affect (attitude). Therefore it can be hypothesised that:

H3: A users' extent of disconfirmation is negatively associated with their satisfaction.

Null hypothesis: A users' extent of disconfirmation is not negatively associated with their satisfaction.

2.3.4.4 Hypothesis 4: Disconfirmation as a determinant of perceived post-usage usefulness

An evaluation by a user is also carried out on perceived post-usage usefulness and therefore this variable is also affected by disconfirmation (Bhattacherjee et al. 2008). Bhattacherjee et al. (2008) argue that a user forms a perception of the usefulness of a particular IS before using it. If the perceived usefulness is what was initially expected this will be positively or negatively disconfirmed. As experience is gained through more usage, users will always adjust their perceptions of usefulness in order to be consistent with the reality of what the IS offers. Bhattachejee (2001) supports this argument with the cognitive dissonance theory by Festinger (1957). This theory posits that users may

experience feelings of uneasiness if their usefulness perceptions are different to what they expected after actual use. The theory suggests that rational users will adjust their uneasiness by either lowering or increasing their perception of usefulness once they know what to expect following their prior experiences.   Therefore it can be hypothesised that:

H4: A users' extent of disconfirmation is negatively associated with perceived post-usage usefulness

Null Hypothesis: A users' extent of disconfirmation is not negatively associated with perceived post-usage usefulness

2.3.5   Hypotheses for the additional determinants for the extended Information Systems Continuance Model (ISCM)

This section discusses three cognitive instrumental determinants of perceived usefulness: task-technology fit, result demonstrability, and perceived service availability. Venkatesh and Davis (2000) argue that people form perceived usefulness judgments by cognitively comparing what an information system is capable of doing with what they need to get done in their job. Cognitive mechanisms are employed by which acts are selected and performed (i.e. decision making) in order to achieve these goals. This behaviour is being driven by a mental representation that links higher-level goals to specific actions that are instrumental for achieving those goals.

Locke and Latham (1990) argue that cognitive mechanisms guide behaviour through a conception-matching process linking instrumental acts to goals. For example, this is in line with the definition of task technology fit that is discussed in detail in section 2.3.5.2, which states that a specific technology should match the task that needs to be completed by the user as part of the job function (i.e. the goal).

Beach and Mitchell (1987) embraced the concepts of a trajectory image, which is a mental representation of the goal and the possible action sequences that can guide behaviour towards that trajectory image. As discussed in section 2.3.3.3, image theory posits two distinct decision stages which is a compatibility and a profitability test that is performed to compare the acceptable options directly with one another to determine the best option to achieve the intended goal.

Following this line of reasoning, the following three sections will discuss that field staff use a mental representation for assessing the match between work goals and the consequences of using the rugged mobile device as a basis for forming judgments about the usefulness of it (i.e. perceived post-usage usefulness). As TRA (Fishbein and Azjen, 1975) have postulated attitude as a predictor of behavioural intention, the logic that perceived post-usage usefulness (attitude) is then the predictor of IS continuance intention. Therefore the determinants of perceived post usage usefulness are instrumental to this present study as it provides insight into the judgments made by field staff who cognitively compare what the mobile device is capable of doing with what they need to do to get the job done and then in turn make a decision to continue or discontinue to use the device.

2.3.5.1 Hypothesis 5: Perceived service availability as a predictor of perceived post-usage usefulness

Perceived service availability is a technology specific belief which is defined as the extent to which a specific technology appliance is perceived to be able to connect to a network anywhere and anytime (Hong and Tam, 2006). This definition is apt in the mobile computing environment as the users' productivity increases, when they are able to access information that is needed at any place or time. The rural areas of South Africa pose a challenge as cellular coverage could be absent. An analysis completed by an organisation called Gr8signal in 2013 indicated that South Africa did not have 100% mobile coverage at that time of the investigation and this coincides with the period of data collection of this present study (Vermeulen, 2013, Anon, 2012c). Gr8signal have

developed an online application[6] where mobile coverage can be studied of the major mobile operators with South Africa. To date it appears there is not 100% mobile coverage. Therefore during the time of the study connectivity remained a challenge for mobile computing services (Islam and Fayad, 2003; Hong and Tam, 2006). Thus if users constantly struggle to connect the device to the backend servers when placed in the field where there is no cellular coverage, the users will perceive the device to be a hindrance as opposed to it being useful.

From an extensive literature review it appears that perceived service availability has not been used in previous IS continuance research before. However, variables with similar definitions to perceived service availability have been used in adoption studies. Venkatesh and Davis (2000) and Davis, Bagozzi, and Warshaw (1992) argue that over and above a particular IS aiding a user to accomplish one's tasks, it should aid it by performing the tasks well. Their argument is in line with the definition of the variable "perceived service availability" although describing it as output quality. The reason is perceived service availability is specific for the mobile whereas output quality is for non-mobile contexts. They have proposed that output quality is an antecedent of perceived usefulness. Venkatesh and Davis (2000) have based their hypothesis on image theory by Beach and Mitchell (1987) as discussed in the previous section. In the context of this study, if the users have the option to choose between different cellular network providers, they would likely choose the one that they perceive to have the best cellular coverage in order to perform their tasks. This would ensure better data coverage and work related information can be transmitted to and from the applications on the rugged mobile computing device without any interruptions due to dropped signal. Field worker technicians will then be able to carry out their tasks efficiently and hence the use of the mobile computing services would be more useful. The perception of one network provider being better than another might not necessarily reflect the actual reality. For example, all the cellular network providers might have the same coverage within a particular area, but the perception by the users that one network provider is better than the other might still exist.

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[6] www.gr8signal.co.za

Venkatesh and Davis (2000) and Davis, Bagozzi,and Warshaw(1992) have shown that output quality is an antecedent to perceived usefulness within an adoption context, therefore this research can similarly postulate:

H5: Perceived service availability has a positive effect on perceived post-usage usefulness

Null Hypothesis: Perceived service availability does not have a positive effect on perceived post-usage usefulness

2.3.5.2 Hypothesis 6: Task-Technology Fit (TTF) as a predictor of perceived post-usage usefulness

TTF has strengths over and above user attitude type theories (Yen, Wu, Cheng and Huang, 2010). The strength of TTF is that it contains task and technology characteristics, but its weakness is that it excludes user attitude about the IS. On the other hand Yen et al. (2010) mentioned that the strength of TAM for example is to understand user attitudes but the model is weak due to not taking task characteristics into account. TAM suggests that when users are presented with a new technology, perceived usefulness and perceived ease-of-use (PEOU) influence their decision to adopt (Davis, 1989). Despite Yen et al.'s (2010) study using TAM as an example, the same argument can hold for IS continuance, as both (TAM and IS Continuance) are based on belief and attitude type theories.

There could be an argument that TTF and perceived post-usage usefulness might result in an overlap when these variables are operationalised or mean the exact same thing. Dishaw and Strong (1999) have argued that there is an element of task fit included into perceived usefulness but the definition is considered too vague (Dishaw and Strong, 1999). In the context of this research, usefulness could mean anything that is useful, as most modern day mobile computing devices have an operating system, capable of

running multiple applications. The standard applications include built-in games, camera functionality, navigation and an Internet browser. Users could find the rugged mobile computing device useful, for other functionality besides the functionality needed for completing the actual task. For example, users could find the use of the navigation functionality to get to a particular site useful to carry out the task there, but not relevant at all when completing the actual task itself.

In the context of this research, the user does a rational assessment of the degree of how the specific technology matches the task that needs to be completed as part of the job function. This assessment *(*knowledge gained through rational assessment*)* done by the user will influence his or her beliefs. It can thus be hypothesised that:

H6: TTF positively influences perceived post-usage usefulness

Null hypothesis: TTF does not positively influence perceived post-usage usefulness

2.3.5.3 Hypothesis 7: Result demonstrability as a predictor of perceived post-usage usefulness

Technology is built for a specific purpose in mind and often this purpose is to improve on what it replaces (Karahana and Straub 1999). This statement can be elaborated further by implying that newer technology should have a distinct advantage over the older technology. The advantage that the new system offers has to be visible to the user in order for him or her to make the judgement that it is perceived to be more useful. If the system is better than its predecessor and the user is unaware of the advantages of the newer technology, then the user might not find it more useful than the older system. This argument ties in with the definition of result demonstrability, which is defined as the degree to which an individual perceives that the benefits of using a particular technology are tangible, observable and communicable (Moore and Benbasat, 1991).

Result demonstrability is based on the job characteristic model by Hackman and Oldham (1976). This model postulates that workers will experience positive effects (such as: to continue to do well at work, have less absenteeism and have job satisfaction) if they have knowledge that they have personally performed well.

For example, if a fieldwork technician was dispatched to a particular residence to attend to an electricity or water supply fault using a new technology, the user has to be aware that the technology is better than the preceding technology that was used, in order for the user to find it useful. Venkatesh and Davis (2000) have also suggested that result demonstrability has a positive effect on perceived usefulness in the adoption context. In the IS continuance use context it can thus be hypothesised that:

H7: Result demonstrability will have a positive effect on perceived post-usage usefulness

Null Hypothesis: Result demonstrability will not have a positive effect on perceived post-usage usefulness

2.3.5.4 Hypothesis 8: Familiarity as a predictor of IS continuance intention

Familiarity is usually defined as a user's level of comfort when using a particular IS based on previous experience or interaction with it (Gefen, 2000; Lee and Kwon, 2011). Lee and Kwon (2011) argue that familiarity is an affective factor, defining it as how much recognisability the user has about the particular IS based on previous association with it or a similar technology (i.e. the user feels a sense of comfort when using the IS).

Familiarity has been used in various other contexts before. For example, a study in the consumer space has shown that familiarity of a particular product at the pre-purchase stage was associated with the consumer intending to repurchase the product again, (Soderlund, 2002).

In the mobile computing context it can be argued that users who are familiar with using a generic consumer smartphone with applications, will most likely feel as comfortable using the rugged mobile device with the similar applications (albeit work related). Thus it can be hypothesised that:

H8: Familiarity is positively associated with IS continuance intention
Null hypothesis: Familiarity is not positively associated with IS continuance intention

2.3.6   Control Variables

2.3.6.1 Education

Previous research has shown that educated workers tend to adopt and use new technologies faster than those with less education (Wozniak, 1987; Krueger, 1993; Lleras-Muney and Lichtenberg, 2002). However, Riddell and Song (2012) argue that these studies may have overestimated the correlations between education and technology use. These studies failed to explain that the possibility that individuals with higher innate ability and stronger motivation to adopt and use technology are also more likely to acquire more schooling. Therefore, Riddell and Song (2012) argue that a true causal link between the effects of education on technology use cannot be determined.

Dunne and Troske (2005) find that the correlation between the use of technology and education is very dependent on the job task being performed. For example, they specifically find that the likelihood of adopting a specialised computer-aided design (CAD) software package for design and engineering tasks is highly correlated with the education of the individuals (i.e. individuals having engineering or architectural design qualifications).

As prior studies have not been consistent in the past in determining if there is a correlation between education and technology use, this present study controls for education to ensure that it does not have an impact on the dependent variable.

2.3.6.2 Tenure at the Firm and Computer Experience

Early work by Fazio & Zanna (1978) in the field of marketing has found that actual product experience generates stronger behavioural beliefs and attitudes than indirect information such as advertising. Moreover, direct experience leads to the formation of behaviour intention, which is readily accessible in the memory, resulting in a stronger relationship between attitudes and behaviour intention (Fazio & Zanna, 1978). Based on prior marketing and psychological studies, there have been various studies that examined the influence of prior experience on the utilisation of IS in a work place (Taylor and Todd, 1995; Karahanna, Straub, and Chervany, 1999; Kim and Malhotra, 2005a). Kim and Malhotra (2005a) showed the sequential updating mechanisms of users' beliefs and attitudes in a longitudinal context in the IS domain. Behavioural beliefs, such as perceived usefulness are updated sequentially as users obtain richer and more reliable knowledge through prior experience on the target system (Kim and Oh, 2011). Limayem and Cheung (2008) also empirically showed that user's prior usage experience had a direct impact on continued use.

It is therefore anticipated that prior experience may influence the dependent variable of this present study. Therefore the control variables of tenure at firm and computer experience are added to the model. Tenure at the firm controls for experience gained doing the work tasks and computer experience controls for previous IS experience.

2.3.7 Chapter Summary

The chapter started with a discussion on the concept of a mobile field worker as well as the concept of workforce management within the utility industry. Thereafter an explanation was given on what is a rugged mobile device and why firms are opting to use it for extending IS services to field staff as opposed to "consumer type" devices.

Following this, a background to IS continuance studies was introduced. Prior literature was reviewed. The research model was presented with the aim of enriching IS continuance theory and its theoretical underpinnings defined. Thereafter, the proposed model is presented via hypotheses, which were tested in this study. A summary of the hypotheses is presented in table 1 below.

Table 1 : Summary of the hypotheses

No.	Hypothesis
H1	Users' level of satisfaction of using the mobile computing services is positively associated with IS continuance intention.
H2	Perceived post-usage usefulness is positively associated with IS continuance intention.
H3	A users' extent of confirmation is positively associated with their satisfaction.
H4	A users' extent of confirmation is positively associated with perceived post-usage usefulness
H5	Perceived service availability has a positive effect on perceived post-usage usefulness (in a IS continuance context)
H6	TTF (knowledge gained through rational assessment) positively influences perceived post-usage usefulness (belief)
H7	Result demonstrability will have a positive effect on perceived post-usage usefulness.
H8	Familiarity is positively associated with IS continuance intention.

The next chapter describes the research method that is used to test the hypotheses.

3 RESEARCH METHODS

3.1 Introduction

This chapter starts with a discussion of the research paradigm that this research undertook. Next the chapter continues with a discussion on the research design, data collection methods that were followed and a full description of the research instrument. Lastly, a discussion on validity and reliability, the data analysis techniques to test the hypotheses are presented and finally the chapter concludes with a discussion on the limitations of the research.

3.2 Research Methodology

3.2.1 Paradigm

The approach a researcher uses to study a particular phenomenon is often referred to as the paradigm. This approach is often determined by how a person views the world. It is the choice of paradigm that sets down the intent, motivation and expectations for the research (Mackenzie and Knipe, 2006).

From a historical perspective, philosopher Francis Bacon (from the 16th century) stated that knowledge can only be derived by observation and thus it is an empirical activity. This was a significant paradigm shift from earlier approaches whereby it was accepted that knowledge could be gained through a set of rational reasoning steps often referred to as rationalism. Auguste Comte attempted to resolve the conflict between these different paradigms in the 18th century as he proposed a hybrid of rationalism and empiricism that is known as positivism. He suggested that theories might be created via reasoning but they can only be verified through empirical testing (Bhattacherjee, 2012).

From an ontological perspective, positivism is considered dualistic in that the researcher and phenomena being studied are seen as separate, independent entities.

From an epistemological perspective, positivists also tend to believe there is no need to build this knowledge through a person's lived experience (Mackenzie and Knipe, 2006).

A counter argument to the positivism paradigm is interpretivism. According to Orlikowski and Baroudi (1991), the researcher can never assume a value-neutral stance by standing back and observing from an outside perspective, as the researcher will always be implicated in the study (ontological). The researcher is always part of the process and therefore a deeper meaning of the phenomena is gained by the researcher personally experiencing it rather than acquiring it from the outside through measurement (epistemological). Interpretivism assumes that people create and associate their own subjective meanings as they interact with the world around them (Mackenzie and Knipe, 2006). Another difference is that interpretivists do not believe that research results can be replicated (i.e. reliability) by others whereas positivists do (Orlikowski and Baroudi, 1991).

In addition to the epistemological , ontological and reliability differences between the two paradigms as described above, there is also a difference on what the research object should be. Positivists believe that the objects being researched have qualities that exist independent of the researcher whereas interpretivists believe that the qualities ascribed to the objects are socially constructed (Bhattercherjee, 2012; Weber, 2004)

Weber (2004) argues that the metatheoretical differences, as described above, between positivism and interpretivism are questionable as neither paradigm can be put into separate "boxes". For example, he mentions he is yet to meet an interpretivist willing to undertake an experiment by jumping off a 10 story building to determine the consequences of the jump, thus indicating that in some cases interpretivists will consider the researcher and the phenomena being studied to be separate. Therefore both paradigms bring particular biases and prejudices to research. Weber (2004) states that the differences lie more with the choice of research methods, rather than any substantive differences at a metatheoretical level. The methods often associated with positivists are work experiments, surveys, and field studies. Interpretivists, on the other

hand, tend to use research methods such as ethnographic studies, henomenographic studies and ethnomethodological studies.

The focus of interpretivism is to be part of the process by either individually sitting with candidates or being part of focus groups, for example (Mackenzie and Knipe, 2006). Due to logistical and time constraints the researcher was not in a position to be part of the research process and thus an interpretivist approach was not deemed feasible for this study.

This research study follows a positivist paradigm as the purpose is to explore the extent that certain determinants explain continued use of mobile computing services on rugged devices by field staff. The objective is to explain the relationships between the variables rather than to understand the meanings of these variables. For example, a relationship between perceived service availability and perceived post-usage usefulness has been determined. The aim is not to explain "why" each individual perceives a service to be available in this instance and thus a much deeper in-depth understanding using qualitative methods was not necessary.

Science can be grouped into two groups, namely natural and social science. Natural science is the study of naturally occurring objects or phenomena using the scientific method. Knowledge for natural sciences is acquired through the scientific method and therefore adheres to four characteristics: replicability, precision, falsifiability and parsimony (Bhattacherjee, 2012). Positivism is associated with the 'scientific method' (Mackenzie and Knipe, 2006).

A positivist approach to this research allows quantitative statistically significant study findings to be generalized to the study population and allows this present study to be replicated by other researchers. Generalization will assist managers of Company A understanding the determinants of mobile computing continued use and apply it across organisation.

It is worth noting that previous research studies in the field of IS continuance, have primarily adopted a positivist approach   (Bhattacherjee, 2001; Deng, Doll and Truong, 2004; Hsieh and Wang, 2007; Kim and Malhotra, 2005a; Larsen, Sørebø and Sørebø, 2009; Lin, 2012; Limayem, Hirt and Cheung, 2007; Sørebø and Eikebrokk, 2008).

3.3 Types of Scientific Research

This research is categorised as explanatory research.

Both descriptive and explanatory research make careful observations and detailed documentation of a phenomenon. However, descriptive research has a lessor purpose than explanatory research. Punch (2013) elaborates on this by mentioning that 'it is possible to describe without explaining but very difficult to explain without describing'.

Explanatory research is often underpinned by theory and seeks explanations of observed phenomena by relating these observations to the relevant theoretical constructs (Bhattacherjee, 2012; De Vaus, 2005). This research is categorised as explanatory research. The study has a clear objective to try and explain the relationship between the antecedents of perceived post-usage usefulness and IS continuance usage intention. Eight hypotheses were formulated. Data was collected using a survey method and inferential statistical techniques such as regression analysis were used to test the research hypotheses. Further details are discussed in subsequent sections below.

The current research could not be considered as exploratory research as this type of research is broad in focus and rarely provides definite answers to specific research issues (Punch, 2013). Exploratory research may thus be an initial feasibility test for a more extensive study or to determine the best methods to be used in a subsequent study (Bhattacherjee, 2012; De Vaus, 2005).

3.4 Research Design

The research design refers to the overall strategy that the researcher undertakes in integrating the different components in a coherent and logical way to effectively address the research problem as best it can. It is often referred to the "blueprint" for the collection, measurement, and analysis of data (Bhattacherjee, 2012). De Vaus (2005) argues that the research problem determines the type of design used and not the other way around.

3.4.1 Population and Unit of Analysis

Company A employs about 4 400 field service workers based at 220 technical service centres across the country. The field service workers of this organisation are each responsible for servicing a section of the organisation's customer base to ensure that there is minimum disruption to the supply of electricity. As the field worker is the user of the rugged mobile device and the objective of the study is to explain the continued use of the services offered on the device by the individual respondent, the unit of analysis is thus the individual.

The target population is all the field workers of company A. Due to logistical reasons, it was not possible to survey all the field workers within the organisation, and a sample was therefore used. Details of the sample and sampling method are discussed below.

3.4.2 Response Rate

Baruch and Holtom, (2008) conducted a study where they identified 490 different studies that utilized surveys and concluded that there was an average response rate of 35.7 percent. Kaplowitz, Hadlock and Levine's (2004) study found that web based surveys achieved comparable response rates to that of hard copy questionnaires sent via mail. Their study indicated an average response rate of 20.7 percent, whereas Bhattacherjee (2012) mentions any number between 15 and 20 percent. This indicates that there is no definitive number that could be used as a guideline but for the purpose

of this research the conservative response rate of 15% was assumed according to Bhattacherjee's (2012) findings.

Hair, Anderson, Babin, and Black (2014) argue that the desired sample size is a ratio of five observations per variable. This will have statistical power that is acceptable for most data analysis techniques such as partial least squares, LISREL and regression.

3.4.2.1 Determining the Sample Frame

All 4 400 employees are spread disproportionately across the organisation across six regions which is representative of its customer base. The sampling frame has a total of 1 200 employees chosen at random and stratified across the 6 regions to be representative of the geographical distribution of the field workers within the organisation. Table 2 below shows details of the regions and the number of employees per region. Access to the human resource database that contains the names of all the field service staff per geographical region was obtained from Company A. The names were entered into a spreadsheet alphabetically and every 3rd person on the list was chosen until the target of 1200 was reached. The sample frame per region is also shown in table 2 below.

Table 2 : Sample Breakdown

Region	South African Provinces	Total number of field service employees	Sampling frame (Every 3rd person on the alphabetical list chosen)	% sample frame to the population
Western	Western Cape and Northern Cape	750	205	27%
Northern	Limpopo and Mpumalanga	1200	327	27%
Eastern	Kwazulu-Natal	500	136	27%
Central	Gauteng	700	191	27%
North West	Free State and North West Province	600	164	27%
Southern	Eastern Cape	650	177	27%
		4400	**1200**	**27%**

3.4.3 Instrument Construction

A structured questionnaire with closed questions was developed to capture information from the participants on each of the study's variables. Multiple scale items that operationalise the variables were borrowed and adapted from the literature to the mobile computing context within the utility industry. The reason for this is to ensure scale reliability which is discussed later in the chapter.

Given that variables are a measurable representation of constructs, responses could still be interpreted differently depending on the understanding of the individual and thus these variables within social science are often measured with multiple scale items (Engel and Schutt, 2012). All variables were measured using multiple items to test the hypotheses within this study.

A cross sectional survey questionnaire (Annexure D) has been drafted to reflect the operationalised variables. The questionnaire consisted of forty worded items to measure the variables as discussed in the previous chapter. The variables were measured using a 7-point Likert scale format. This allowed the respondents to indicate their levels of disagreement or agreement on a scale from 1 (=strongly disagree) to 7 (=strongly agree). Dawes (2008) argues that there could be an effect on the skewness of the distribution when using either a five point or a seven point Likert scale. The focus of the study is IS continuance use and therefore the population of this study are users who have been using the devices for a period of time already. As study participants had been using the mobile devices for some time, it was anticipated that many respondents would indicate continued use of the mobile devices and thus positively skew the distribution. Therefore a 7-point Likert scale was needed as it allowed the responses to be more granular; allowing variance in capturing the respondent's attitude and thus reducing the effect on the non-normality of the distribution.

The questionnaire also consisted of four general questions which aimed to identify the respondents' education level, work experience and experience using technology.

3.4.4 Operational Measures

This study measured eight variables. Table 3 below details the conceptual description, the operational measure items and the authors from whom the measures were adapted from.

Table 3: Operational Measures			
Variable	**Conceptual Description**	**Operational Measure**	**Author(s) derived from**
Perceived Post Usage Usefulness	Perceived post-usage usefulness (renamed as such to distinguish it from the pre-usage "perceived usefulness" construct commonly associated with TAM) reflects a longer-term belief aggregated from prior usefulness perceptions. The perceived post-usage usefulness is defined as the degree to which a person believes that using a particular system would enhance his or her job performance (Bhattacherjee, Perols, and Sanford, 2008)	PU1. Using the mobile computing device in my job will increase my productivity (e.g., make my work faster). PU2. Using the mobile computing device in my job will improve my performance (e.g., make my work better). PU3. Using the mobile computing device in my job will make me more effective (e.g., help me make better decisions). PU4. I will find the mobile computing device to be useful in my job.	Bhattacherjee, Perols, and Sanford (2008)
Disconfirmation	Disconfirmation is defined as a judgment made by the user after the user has evaluated what he/she anticipated of the IS attributes as to the actual IS attributes (Bhattacherjee, 2001)	DC1. Using the mobile computing device improved my performance much more than I had initially expected. DC2. Using the mobile computing device improved my productivity	(Bhattacherjee, 2001)

		much more than I had initially expected. DC3. Using the mobile computing device improved my effectiveness much more than I had initially expected. DC4. My experience with using the mobile computing device greatly exceeded my initial expectations.	
Satisfaction	Satisfaction can be described as a feeling or an affect that is either positive (satisfied) or indifferent or negative (dissatisfied) (Bhattacherjee, 2001).	How do you feel about your overall experience of using the mobile computing device; ST I. Very dissatisfied . . . Very satisfied ST2. Very displeased . . . Very pleased ST3. Very frustrated . .. Very contented ST4. Absolutely terrible .. . Absolutely delighted	(Bhattacherjee, 2001)
Continuance Intention	IS continuance intention is defined as the mental state of a user that represents a commitment to carrying on using the target IS following an initial acceptance (adoption) and the experience gained from initial use (Bhattacherjee, 2001; Bhattacherjee et al., 2008). (Bhattacherjee, 2001).	CI 1. I intend to continue using the mobile computing device on my job. CI2. I intend to continue using the mobile computing device applications for processing more work orders. CI3. I intend to continue	(Bhattacherjee, 2001)

		using the mobile computing device applications for more of my job responsibilities.	
Perceived Service Availability	The degree to which an individual believes that the system performs his or her job tasks well (Venkatesh and Davis, 2000).	PSA1. The quality of the cellular network I get from using the mobile computing is high. PSA2. I have no problem with the quality of mobile computing device. PSA3. I rate the results from the mobile computing device to be excellent.	Venkatesh and Davis (2000)
Task Technology Fit	The ability of wireless technology to support a task, which implies matching of the capabilities of the technology to the demands of the task (Yen, Wu, Cheng and Huang ; 2010). Yen et al (2010) adapted Goodhue and Thompson's (2005) definition to suit a mobile wireless technology environment.	TTF1. The work orders that I receive is accurate enough for me to attend to a fault TTF2. I get the work orders quickly and easily when I need it TTF3. The mobile computing device that gives me the work orders are convenient and easy to use TTF4. The mobile computing device offers me the ability to receive work orders from virtually any location at anytime	Yen, Wu, Cheng and Huang (2010)
Result Demonstrability	The degree to which an individual believes that the results of using a system are tangible, observable, and communicable (Venkatesh	RD1. I have no difficulty telling others about the results of using the mobile computing device.	Venkatesh and Davis (2000)

		and Davis ,2000)	
		RD2. The results of using the mobile computing device are apparent to me. RD3. I would have difficulty explaining why using the mobile computing device may or may not be beneficial.	
Familiarity	Familiarity is usually defined as a user's level of comfort when using a particular IS based on previous experience or interaction with it or similar technology (Gefen, 2000)	F1. I feel familiar using the applications on mobile computing device as its more or less the same as applications on my cell phone F2. I feel familiar with the interface with the mobile computing device F3. I feel familiar with the terms used (e.g. work order, GPS navigation.) on the mobile computing device	(Gefen, 2000)

3.4.5 Measures for Control Variables

This study measured 3 control variables. Table 4 below details the description and how it was measured.

Table 4: Control Variables		
Control Variable	**Description**	**Measures**
Tenure at the Firm	The variable describes how long (years) the respondents have been working for the organisation	• Less than 5 years • years or more but less than 10 years • 10 years or more but less than 20 years • 20 years or more
Computer experience	This variable measures the amount of hours the respondent spends using a computer per week	• I don't use a computer at work or for personal activities • I spend less than 10 hours per week on a computer • I spend more than 10 hours per week but less than 40 hours on a computer per week • I spend 40 or more hours per week on a computer
Education levels	This variable describes the highest education levels obtained from the respondents	• High/Secondary School • Diploma at technical college or Technikon/Technical University • University Degree • No Formal Education but only on the job experience and courses

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3.4.6 Pre-test Study

The questionnaire was pre-tested with 5 members of the managerial staff of Company A; and 3 academic members of staff within the Department of Information Systems in the School of Economic and Business Sciences, at the University of Witwatersrand, Johannesburg.

The objective of a pre-test is to test content validity. Section 3.5.2 elaborates on content validity.

Feedback from the pre-test was used to enhance the questionnaire which included rewording of the items of measurement to ensure better readability and comprehension for the intended audience. For example, one of the original questions was: the mobile computing device that gives me the work orders are convenient and easy to use. The question was updated to: the mobile computing device that gives me the work orders are convenient. The reason for the change is that the original question was asking the respondents to rate the extent to which they agreed with both convenience and ease of use of the mobile device within one question. This could pose an issue as a respondent could agree with convenience but not ease of use.

3.4.7 Pilot-Study

Subsequent to the pre-test, the research instrument was piloted with ten field service technicians in person from the utility organisation and based on their responses the questions were revised accordingly. For example, all words referencing mobile computing device were changed to EDA as this is the term that field service staff are familiar with. EDA refers to Enterprise Digital Assistant. This rewording to EDA was carried out to ensure simplicity for the intended audience.

The objective of the pilot test is to test the research instrument. The pilot test should give advance warning about where the research project could fail or whether proposed

methods or instruments are inappropriate or too complicated for the target audience (Van Teijlingen and Hundley; 2001). The pilot test helps with face validity. See section 3.4 for further details on face validity.

The time taken to complete the questionnaire was also measured during the pilot study. The estimated time taken to complete the questionnaire by the ten respondents was between 10 and 15 minutes.

A final version of the questionnaire can be found in Annexure D.

3.4.8   Administration of the instrument

The majority of the field service workers had access to email or Internet, but they did not have dedicated personal computers (PCs) assigned to them. Each service centre has one or two desktop PCs that are shared among the team as the team spends a considerable amount of time in the field. Electronic administering of the survey questionnaire was thus possible. The survey questionnaire and cover letter (instructions), in both MS Word format and web survey internet URL, was sent using Company A's email service. The survey questionnaire and cover letter were also given to the chosen "mobile champions" of each region. Mobile champions are persons within the organisation that are chosen to aid with the successful implementation of the organisation's projects. The champions conduct regular site visits to the regions to carry out required change management initiatives.

The champions agreed to assist with this research to some extent during their site visits. This was mainly to collect completed surveys of those respondents who wished to complete a printed MS Word document instead. The willingness of the mobile champions to collect the completed printed questionnaires ensured that the research would not be skewed towards technology savvy respondents only, as respondents were able to complete printed questionnaires as well.

The mobile champions were briefed to act as "postmen" only and therefore they played no role in offering advice or clarity to the respondents. This ensured that each respondent only had the cover letter (instructions) to use for guidance.

3.4.9   Ethical Considerations

The University of Witwatersrand adheres to a code of ethics concerning the treatment of human subjects which aligns to the Code of Ethics of the American Anthropological Association[7]. The University's code of ethics is a set of rules that the researcher must follow to ensure that no harm or distress is caused to the respondents. Other important considerations such as deception, lying, and forcing the participant to partake are thus unacceptable. Therefore subjects must give their informed consent to participate in the research voluntarily.

This research involved field workers (human subjects) to participate and thus ethics is an important factor. Ethics promote moral and social values, such as social responsibility, human rights, animal welfare, compliance with the law, and health and safety. Ethical lapses in research can significantly harm humans (Resnik, 2011). For example, a researcher who forces a respondent to participate could jeopardize the psychological health of the person.

Approval for this survey was sought and obtained from the Human Research Ethics Committee (non-medical) of the University of the Witwatersrand. The protocol number is H13/08/37. Please refer to Annexure E for the clearance certificate.

The survey forms were accompanied by a covering letter (please refer to Annexure D), introducing the survey and outlining the ethical considerations. It was emphasised that participation in the research was voluntary and that respondents were free to withdraw at any time. Respondents were also assured that the information they provided would

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[7] http://www.wits.ac.za/academic/researchsupport/19111/code_of_ethics.html

be held confidentially and would only be used in aggregate form without identifying individual respondents as the questionnaire required no personal information. As part of being granted ethical clearance by the University, permission by a senior manager on behalf of Company A was needed to carry out the research (please refer to Annexure E).

3.5 Data Analysis

3.5.1 Data Cleansing and Screening

The captured data was screened and missing values were replaced. The detection of outliers was also tested. The details are discussed in the next chapter.

3.5.2 Reliability and Validity

3.5.2.1 Content and Face Validity

Content and face validity tests were used in the pre-test and pilot phases of this research respectively. These tests are further described below.

Content validity is generally carried out by subject matter experts such as academic colleagues. Content validity is an assessment of how well a set of scale items matches all the areas of the construct being measured (Bhattacherjee, 2012). When there is a consensus reached among these experts then content validity is assumed as these experts need to ensure that the measure represents all the facets of a given social construct (Straub, 1989). The disadvantage is that this measure is to some degree subjective as there needs to be some agreement among the experts in order to have a reasonable content validity (Rubio, Berg-Weger, Tebb, Lee and Rauch, 2003).

Face validity is an assessment of whether the test "looks valid" to the members of the target audience and this is referred to as face validity (Van Teijlingen and Hundley; 2001). This test is also subjective in nature as it is generally carried out by a small sample of the respondents itself during the pilot phase of the research.

3.5.2.2 Internal Validity

Internal validity is defined as the extent to which a causal conclusion based on a study is warranted and this examines whether the observed facts are caused by or correlated to a set of other variables unknown to the model that is being studied (Straub, 1989). This research was done using a cross sectional field survey as opposed to an experimental lab design where variables can be controlled or manipulated independently. A field survey by nature has poor internal validity because the cause and effect is generally measured at the same time (Bhattacherjee, 2012). This field survey captured self-reported measurements, which might not reflect the actual reality (Bhattacherjee, 2012).

As a precaution, hypotheses for this study were underpinned by robust theory and models adapted from well-known literature. The survey questionnaire included controls (for example, prior computer experience, education level and tenure at the firm) to minimise the effect of confounds (Straub, 1989).

3.5.2.3 External Validity

External validity refers to whether the study findings can be generalised from samples to the greater population of that specific demographic (Lee and Baskerville, 2003). The strength of a cross sectional field survey is generally that it incorporates large sample sizes and thus offers stronger external validity as opposed to lab experiments for example (Bhattacherjee, 2012).

This study selected a random sample within a particular organisation. Therefore the findings can only be generalised to the population of field workers working for Company A and thus there is a loss of external validity. This limitation is an inherent feature or limitation of quantitative studies if the sample frame is from one organisation and therefore it would not be statistically and scientifically correct to generalise to other organisational settings other than the context where the theory was tested (Lee

and Baskerville, 2003).

3.5.2.4 Scale Reliability

In social science, constructs have to be operationalised in order to be measured. The measurement instrument that gets developed needs to be able to measure the construct consistently all the time to provide the result, just as a speedometer would consistently measure the speed of car no matter when the speed is read for example. A reliable measurement is very important because the instrument is used to gather data from many respondents overtime.

As measures for particular variables often use multiple items (Bhattacherjee, 2012), a multi item construct is sent to respondents then the extent that they rate those items in a similar manner is a reflection of internal consistency and how reliable the measure is. Cronbach Alpha is a common reliability measure to estimate consistency and has been used for this study (Hair, Anderson, Babin and Black; 2014). A measure of greater than 0.6 for each of the items of the same construct measure compared to other items is an acceptable figure for the reliability for each variable that is measured (Hair et al., 2014). Details are discussed in the following chapter.

To ensure reliability, measurement instruments used by previous researchers have been used as well to measure the variables as described in section 3.4.4. As these instruments were already tested before, the probability of obtaining internal consistency will be greater.

3.5.2.5 Convergent and Discriminant Validity

Principal Components Factor (PCA) analysis was used to examine convergent and discriminant validity. Convergent validity measures goes hand in hand with discriminant validity measures. Convergent validity is the closeness with which a

measure relates to the construct, which is being measured (Bhattacherjee, 2012; Hair et al., 2014). Discriminant validity tests the measures of constructs that should have no relationship; do in fact have no relationships (Bhattacherjee, 2012; Hair et al., 2014).

A factor loading, which represents how much a particular item explains a particular variable, is computed for each item. The composite index score represents the average of scores for those items with significant factor loadings. Factor loadings of between 0.50 and 0.70 are considered practically significant (Hair et al., 2014).

In addition to PCA analysis, the Average Variance Extracted (AVE) was used to establish convergent and discriminate validity as it is a more rigorous test than the former (Fornell and Larker, 1981). The AVE was computed for all variables. According to Fornell and Larker (1981), an AVE value greater or equal than 0.5 indicates convergent validity. The square root of AVE value should be greater than inter-construct correlations for that particular variable to obtain discriminate validity.

The next chapter presents a detailed discussion on convergent and discriminate validity tests and the results obtained.

3.5.3   Hypothesis Testing

Hypotheses were tested using Pearson correlation analysis. The significance of Pearson's correlation coefficient (r) is indicated by the significance level (p). In this study, the significance level required to support a hypothesis is $p < 0.05$ (Hair et al., 2014). A value less than $p < 0.05$ indicates that the observed effect actually reflects the characteristics of the population rather than just sampling error (Hair et al., 2014)

The second step that was applied was multiple linear regression analysis. Regression analysis is generally used to understand how independent variables are correlated to the dependent variable (Bhattacherjee, 2012, Hair et al., 2014). The objective is also to

test the impact (predictive ability) the determinants will have on the dependent variable (analysed by the R-square value)(Bhattacherjee, 2012).

The above mentioned tests assume the data is normal as these are parametric statistical tests (Hair et al, 2014). In the event that the data is not considered normal, non-parametric statistical tests should be considered. According to Leeper (2000), Spearman's correlation is the nonparametric version of the Pearson product-moment correlation. Spearman's correlation coefficient (rho) measures the strength of association between two variables (Leeper, 2000). One of the non-parametric equivalents of linear regressions is quantile regression (Logan and Petscher, 2013; Koenker and Hallock , 2000).

The next chapter presents a detailed discussion on the various methods used to test the hypotheses.

3.5.4 Mediation

The model that is tested in this present study has only mediation and not any moderation relationships. Mediation implies that the effect that an independent variable (A) has on a dependent variable(C) is greater through a mediating variable (B), as opposed to the independent variable (A) having an effect directly on the dependent(C) (Baron and Kenny, 1986). Figure 5 illustrates this.

Figure 5 - Mediation

The four step approach by Baron and Kenny (1986) was used to test mediation in the present study. The 4 steps are described in table 5 below.

Table 5: Baron and Kenny's (1986) four step approach

Step 1	The objective of the first step is to show that the causal variable (A) is correlated with the outcome (C). Use C as the criterion variable in a regression equation and (A) as a predictor. This step establishes that there is an effect that may be mediated.
Step 2	The objective of the second step is to show that the causal variable (A) is correlated with the mediator (B). Use (B) as the criterion variable in the regression equation and (A) as a predictor This step essentially involves treating the mediator as if it were an outcome variable.
Step 3	The objective of the third step is to show that the mediator affects the outcome variable. Use (C) as the criterion variable in a regression equation and (B) as predictor.
Step 4	To establish that (B) completely mediates the (A)-(C) relationship, the effect of (A) on (Y) controlling for (B) should be zero .The effects in both Steps 3 and 4 are estimated in the same equation.

If all four of these steps are met, then it can be said that variable (B) completely mediates the A-C relationship, and if the first three steps are met but not step 4, then partial mediation is indicated. Meeting these steps does not, however, conclusively establish that mediation has occurred because there are other (perhaps less plausible) models that are consistent with the data. The next chapter discusses mediation in detail.

3.6 Limitations

Due to the nature of this study, namely the chosen data collection and sampling methods, a number of limitations have been identified such as:

- An online survey was the chosen means to collect the data. This could have resulted in a sampling bias as it could have excluded respondents that do not have access to computers (Bhattacherjee, 2012). A printed paper version was also provided as an option to reduce this sampling bias.

- The respondents (continuing IS users) have been using the rugged mobile device for about nine months when the study was conducted (Anon, 2012b). One could question that the survey method under-represented IS discontinuers thus resulting in non-response bias (Berg, 2005). The study was conducted in a mandatory setting therefore the majority of the respondents are continuing IS users as expected.

- A survey questionnaire was used and thus the data was collected through self-report. This would result in common method bias as all the independent and dependent variables are measured at the same time using the same instrument (Podsakoff, MacKenzie, Lee and Podsakoff, 2003).

- The measures were also measured at a specific point in time which might not be representative of a respondent at a later stage subsequent to when the measurement was done. Unlike longitudinal studies, the nature of a cross-sectional survey limits the ability to do comparisons across time. Therefore changes in behaviour of the respondents could not be determined (Rindfleisch, Malter, Ganesan, and Moorman, 2008).

- This study measures perceptions of behaviour rather than actual behaviour. Due to confidentiality and ethical considerations, actual data of usage could not be obtained from study participants. However, studies carried out by Davis, Bagozzi and Warshaw (1989) and Taylor and Todd (1995) have shown there is a strong association between intention and behaviour.

3.7 Chapter Summary

In this chapter, the paradigm was outlined and the reasons for a positivist approach as well as a quantitative methodology were argued for this particular study. This study is an explanatory research design as it seeks explanations of observed phenomena. The purpose of this research is identifying relationships between variables and testing hypotheses and it accomplishes this by using quantitative methods and more particularly using inferential statistics.

A self-administered (both online and printed word document options) questionnaire was used as the research instrument. The operational measures for the instrument were adapted from previous studies to help with getting reasonable validity measures. A 7-point Likert scale was used to allow the responses to be more granular to help reduce the effect on the normality of the distribution.

Thereafter the importance of ethics was discussed and the approval for this survey was sought and obtained from the Human Research Ethics Committee (non-medical) of the University of the Witwatersrand.

Thereafter the following were discussed: the reasons for pre-testing and pilot testing; the sampling frame and sampling method; the questionnaire administration method; the strategy for testing reliability and validity; and the strategy for testing hypotheses and limitations of this survey.

The next chapter discusses the research findings.

4 DATA ANALYSIS

4.1 Introduction

This chapter discusses the analysis of the data that was collected using the methodologies as presented in chapter 3.

The chapter is structured into sections which start off with the discussion of the demographics of the sample. Secondly, the data cleanup procedures that were applied are discussed. Following that, reliability and validity testing was computed and the results are presented. Correlation of the dependent and independent variables was computed and then the hypotheses were tested using regression analysis. The chapter ends with a section that discusses which hypotheses have been supported, partially supported or dropped.

4.2 Frequency Distributions

To determine the response pattern of the respondents, frequency distributions for the items were generated prior to data cleansing. This was carried out so that an accurate assessment on the extent to which a user would agree with the items on the questionnaire.

With respect to the dependent variable, the results show that among the respondents the majority of the responses fall between "somewhat agree" to "strongly agree" for each of the three items of the construct "continuance intention". A small percentage of the respondents fall between "strongly disagree" and "undecided". From these results, it appears that a large majority of the respondents plan to continue to use the services offered on the rugged mobile device. The detailed results can be seen in annexure F.

4.3 Data Screening

Data was captured in Microsoft Excel and then copied into SPSS Version 22 for data parametric analysis. Stata Version 13.1 was used for non-parametric analyses. Reverse scoring was required for one case of the variable result demonstrability only as it was negatively keyed.

The data was prepared in three phases. Firstly, the data was examined for missing values and secondly, the data was screened for outliers. Lastly, the data was checked for normality. A detailed discussion of these steps follows in the next three sections of this chapter.

4.4 Missing Values

Self-administered surveys will most likely have missing values where a particular respondent, either intentionally or unintentionally fails to answer a particular question on the survey (Hair et al., 2014).

None of the responses that were received were entirely un-answered. All the feedback that was received had some questions that were answered.

The approach was to remove spoilt responses first. Thereafter the next step was to determine the extent of the missing data for the individual variables, and then the extent of the missing data for the individual cases as well. Finally the overall amount of missing items against the total items was calculated (Hair et.al. 2014).

The first step was to look at individual cases and to determine if there were any spoilt responses. Spoilt responses are questionnaires that have more than 20% of the questions unanswered or when the responses were spoilt by respondents giving the same answer for every single item. Of the 181 responses received, 37 individual

responses were spoilt. This resulted in 144 cases retained and 37 deleted.

For the remaining 144 responses, checks were made to see if there were specific items corresponding to a specific question that were left out by the majority of the respondents. There were no patterns that could be detected of specific questions being left out deliberately. The variables with the most items missing were Satisfaction1 and Satisfaction4 with 12 and 13 items missing, respectively. This equates to 8.3% and 9% respectively which is less than 10% and thus deemed acceptable for an imputation to be applied (Hair et al. 2014). An assumption was made that all missing data were then randomly left out. Therefore, no specific items of variables or entire variables were deleted.

The third step was to determine the missing data by case. Of the 144 cases there were 38 cases that had missing data. Of the 38 cases, 32 of the cases had less than 10% of the data that was missing and thus the missing values were replaced with the series mean for that particular variable to avoid a reduction in the sample size (Hair et al., 2014). According to Hair et al. (2014), the mean substitution imputation would be sufficient as a method to replace the missing data for this instance. For the remaining 6 cases of the 38, there were more than 10% of the items missing but less than 20%. The missing data for these 6 cases were replaced using the "hot deck" imputation method (Hair et.al, 2014). In the "hot deck" method, the value comes from another observation in the sample that is deemed similar or the best known value is used. For example if the items for satisfaction are missing from a particular case, the determinant variables of satisfaction only are matched against another case for similarity. Then the answers of satisfaction of that matching case are used for the case with missing items. The table within Annexure H summarises the missing data per case. There were only a total of 78 missing items out of a possible 4032 items of the overall items. This equates to 1.95% which is less than 10% of all items of the 144 cases.

4.5 Outlier Detection and Removal

Outliers are responses that contain values that are completely out of range compared to the values from the general responses from that particular population. These values are unusually too high or too low. Due to the number of variables of this present study, the univariate method for outlier detection was used. A standardised score was calculated to determine if there were any values greater than the standardised score of +/- 4 on more than one questionnaire item. The standard deviation is dependent on the size of the sample. For small samples, which are 80 responses or less, standard scores of +/- 2.5 can be used and larger samples the threshold for the standard score is +/-4 (Hair et al., 2014).

No extreme values were detected and therefore no outliers were removed.

4.6 Sample Demographics

4.6.1 Response Rate

A total of 181 survey responses were collected over a 6 week period from 4th Nov 2013 to 10 December 2013. From the 181 responses, 144 responses were retained for analysis due to 37 responses being omitted due to missing values. Of the 144 responses only 11 used a printed version of the questionnaire. A t-test was run to determine if there was significance on the dependent variable between those completing the questionnaire online versus those using the printed format. The t-value is 0.9862 which is non-significant. Therefore analysis was conducted on all 144 responses.

The response rate was calculated and found to be 12% which is considered slightly below the average of 15% (Bhattacherjee, 2012). The time limitation could have resulted in a number of respondents not responding as they could have been absent

from work at the time. Additional follow ups with the field workers could not be done, as that required more time. Table 6 illustrates the details.

Table 6: Response Rate

Number of questionnaires sent (sample frame)	Number of responses received	Responses retained	Response rate (%) (retained / sample frame)
1200	181	144	12%

4.6.2   Tenure at Firm of the Respondents

Table 7 illustrates the distribution of the workers' years of service at the organisation. The majority of field service workers have been working for the organisation for less than five years with a representation of 53.5%. The second largest representation at 23.6% was field service workers working for the organisation for 5 years or more but less than 10 years. This was followed by workers who have more than 20 years at the organisation with a representation of 11.1% of the sample.

The organisation embarked on a recruitment drive over the last few years in order to increase the field technician work force. This was a strategy, together with introducing the services on the rugged mobile devices, deployed in order to reduce restoration times of services offered by the utility organization. Thus there is a larger percentage of workers that are working less than 5 years for the organization and the second largest category is 5 years or more but less than 10 years. This indicates how the organization grew in terms of resources being employed.

Table 7 : Number of years working for the organization

		Frequency	Percent
	Not Specified	11	7.6
	Less than 5 years	77	53.5
	5 years or more but less than 10 years	34	23.6
	10 years or more but less than 20 years	6	4.2
	20 years or more	16	11.1
	Total	144	100.0

4.6.3   Education Levels of the Respondents

Table 8 illustrates the highest education levels obtained from the respondents. The majority of the field service workers have obtained a diploma from either a technical college or a technical university (formally known as a Technikon in South Africa) with a representation of 57.6%. This is followed by those who have obtained a secondary school or high school certificate representing 26.4% of the population sampled. A small percentage of 4.2% had no formal education as well as 4.2% having university degree.

 The job description for field technicians state that a minimum of a diploma from a technical college or a technical university (previously known as a technikon) is required to qualify for the role. Thus the largest percentage of respondents falls into the above mentioned category. University graduates tend to fulfill more network planning and engineering roles within the organization and thus there is a very small percentage of the respondents that fall into this category. Respondents that fall into the Secondary School education category are the 2nd largest group. This is a historical legacy as people have been employed in the past without tertiary qualifications before the new qualification requirements have been introduced.

Table 8 : Highest Qualification

	Frequency	Percent
Not Specified	11	7.6
High/Secondary School	38	26.4
Diploma at technical college or Technikon/Technical University	83	57.6
University Degree	6	4.2
No Formal Education but only on the job experience and courses	6	4.2
Total	144	100.0

4.6.4 Computer Experience of the Respondents

Table 9 summarises the computer experience of the respondents. The majority of the workers spend less than 10 hours per week on the computer with a representation of 39.6% of the sample, followed by 25.7% of the respondents who spend more than 10 but less than 40 hours on a computer. This is in line with the respondents' job function as most spend time in the field and therefore they are not desk bound.

Table 9 : Computer Experience

	Frequency	%
Not Specified	12	8.3
I don't use a computer at work or for personal activities	11	7.6
I spend less than 10 hours per week on a computer	57	39.6
I spend more than 10 hours per week but less than 40 hours on a computer per week	37	25.7
I spend 40 or more hours per week on a computer	27	18.8
Total	144	100.0

4.7 Preparation for Factor Analysis

According to Hair et al. (2014), factor analysis can be applied to a sample size where there is a ratio of five observations per variable. The proposed model has eight variables thus resulting in a sample size of 140 to be deemed adequate for PCA. The data of this study resulted in 144 usable observations.

4.7.1   Inter-Item Correlations

Items intended to measure the same construct should be highly correlated with each other. If visual inspection of the resultant correlation matrix reveals no substantial number of correlations greater than 0.3 then factor analysis will be inappropriate and should be excluded (Hair et al., 2014). The reason is that it could reduce the factorability of the data.

None of the items have scored less than 0.3 and thus no items were excluded at this stage.

To further assess the appropriateness of factor analysis, the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy (MSA) method was applied and found to be 0.900. The minimum value recommended is 0.5 and anything above 0.8 is categorised as meritorious (Hair et al., 2014).

4.8 Convergent and Discriminant Validity

4.8.1 Principal Components Factor Analysis

The visual inspection of a matrix as done by the inter item relations as described in the above section does not provide precise insights and is thus only a first step in the process. Although all the items scored above 0.3, it was not possible to determine

precisely which items correlated with each other to distinguish between the various construct items.

Principal components factor analysis is the technique used for examining the factor structure of the data and to demonstrate convergent validity by showing that all items measuring a construct load highly onto the same component (Hair et al., 2014). Principle component analysis can also demonstrate discriminant validity by showing items having low cross-loadings loads poorly onto other components (Hair et al., 2014). PCA (i.e. particularly the Varimax orthogonal rotation method) provides a simple illustration to identify multiple measures of a construct that are related, and more related to each other than to measures of other constructs (Hair et al., 2014).

The Varimax orthogonal rotation method was applied. The objective of a rotation method is to simplify the rows and columns of the factor matrix to ease interpretation of the data. The Varimax method focuses mainly on simplifying the columns by optimising the loadings of a variable on one factor (Hair et al., 2014).

Hair et al. (2014) argue that within factor analysis certain critical assumptions need to be made first. These initial assumptions are more conceptual in nature as opposed to statistical. One of these basic assumptions is assuming that there is some underlying structure that exists within the set of selected variables. Hair et al. (2014) further argue that it is up to the particular researcher that any observed patterns should be conceptually valid. Therefore the option of extracting to a predetermined number of 8 factors initially was chosen based on this research's objectives as opposed to the method of using factors with eigenvalues greater than 1.0. This was to ensure that items should have high loadings on a single factor taking into consideration the number of variables which is 8 in this study. All items that cross-loaded (load highly on two or more factors) were deleted. Eight iterations of PCFA were run to arrive at an optimal solution.

Table 10 displays the construct items that were excluded from further analysis.

Table 10 : Retained and Excluded Construct Items

Construct	No of Initial Items	No of retained Items	Items	Status of the Item	Reason for exclusion	
Perceived Post-Usage Usefulness	4	2	PostUsefulness1	Retained		
			PostUsefulness2	Retained		
			PostUsefulness3	Excluded	Cross loaded on a different factor	
			PostUsefulness4	Excluded	Cross loaded on a different factor	
Disconfirmation	4	2	Disconfirmation1	Excluded	Cross loaded on a different factor	
			Disconfirmation2	Excluded	Cross loaded on a different factor	
			Disconfirmation3	Retained		
			Disconfirmation4	Retained		
Continuance Intention – Dependent Variable	3	2	ContinuanceInt1	Retained		
			ContinuanceInt2	Retained		
			ContinuanceInt3	Excluded	Cross loaded on a different factor	
Perceived Service Availability	3	2	PSA1	Retained		
			PSA2	Retained		
			PSA3	Excluded	Cross loaded on a different factor	
Task Technology Fit	4	2	TTF1	Retained		
			TTF2	Retained		
			TTF3	Excluded	Cross loaded on a different factor	
			TTF4	Excluded	Cross loaded on a different factor	
Result Demonstrability	3	0	ResultDemon1	Excluded	Cross loaded on a different factor	Variable excluded due to 2 items deleted leaving an isolated item.
			ResultDemon2	Excluded	Cross loaded on a different factor	
			ResultDemon3 (reverse keyed)	Excluded	Cross loaded on a different factor	
Familiarity	3	3	Familiar1	Retained		
			Familiar2	Retained		
			Familiar3	Retained		
Satisfaction	4	4	Satisfaction1	Retained		
			Satisfaction2	Retained		
			Satisfaction3	Retained		
			Satisfaction4	Retained		

The optimised solution following the various iterations of PCFA resulted in the retention of a total of 15 items for the independent variables and 2 items for the dependent variable. As one of the variables was deleted after the first round of iterations, extraction across 7 factors instead of 8 was done. PCFA was run including all variables at once as opposed to separating the independent from dependent variable. The 7 factors which are representative of the 7 variables within the model, accounts for 89.22% of the total variance.

As per table 11, the items related to a particular variable loaded highly on a single component with scores above 0.50. This shows evidence of unidimensionality, i.e. representing a single phenomenon and thus providing additional evidence of construct validity. Hair et al. (2014) argue that the size of the factor loadings to be considered significant is dependent on the sample size. Thus, they identify that a factor score of 0.50 will be deemed significant if the sample size is at 120. The sample size of this study is 144 and therefore 0.5 can be considered significant. The lowest factor loading as per table 11 is 0.539 with the highest being 0.905. All scores below 0.45 were suppressed and are not shown in table 11.

Table 11: Validity and Reliability Test Results

	Perceived Post Usage Usefulness	Disconfirmation	IS Continuance Intention	Perceived Service Availability	Task Technology Fit	Familiarity	Satisfaction
PostUsefulness1	.710						
PostUsefulness2	.649						
Disconfirmation3		.838					
Disconfirmation4		.539					
ContinuanceInt1			.813				
ContinuanceInt2			.854				
PSA1				.875			
PSA2				.867			
TTF1					.840		
TTF2					.767		
Familiar1						.750	
Familiar2						.768	
Familiar3						.748	
Satisfaction1							.884
Satisfaction2							.905
Satisfaction3							.852
Satisfaction4							.855
Cronbach's Alpha	.719	.815	.949	.930	.853	.901	.967
AVE	0.46	0.5	0.76	0.65	0.70	0.57	0.76
SQRT AVE	0.68	0.71	0.87	0.81	0.84	0.75	0.87

The criterion that each item loaded higher than 0.5 on it respective component was met and thus it can be concluded that there is evidence of convergent validity. Items that are not highly correlated (i.e. cross loadings lower than 0.45) are not shown and therefore providing evidence of discriminate validity as well.

4.8.1   Average Variance Extracted (AVE)

In addition to factor analysis, the Average Variance Extracted (AVE) was also used to establish convergent and discriminate validity (Fornell and Larker,1981). The AVE was computed for all variables by the formula as shown below, where λ_I is the loading of x_I on X, Var denotes variance, ε_I is the measurement error of x_I and Σ denotes the sum (Fornell and Larker,1981):

$$AVE = \frac{\Sigma\,[\lambda_I^2]\,Var\,(X)}{\Sigma\,[\lambda_I^2]\,Var\,(X) + \Sigma\,[Var\,(\varepsilon_I)]}$$

According to Fornell and Larker (1981), an AVE value greater or equal to 0.5 indicates convergent validity and the square root of the AVE value should be greater than the inter-construct correlations for that particular variable. All the variables showed evidence of convergence using this criterion, besides perceived post usage usefulness with an AVE value of 0.46.

As can be seen in table 15, the square root of the AVE scores exceeded the correlation scores of the variables in question besides perceived post usage usefulness. Thus discriminant validity can be assumed for the rest of the variables using this criterion, besides perceived post usage usefulness.

However, convergent and discriminant validity will be assumed for perceived post usage usefulness based on the argument that if the AVE is less than 0.5 but the

composite reliability is greater than 0.6, the convergent validity of the construct is adequate for a value as low as 0.4 (Fornell and Larker, 1981). The composite reliability for perceived post usage usefulness is 0.632.

4.9 Scale Reliability

4.9.1 Cronbach Alpha

Cronbach's alpha is a statistical measure to present evidence of scale reliability by indicating the degree to which the set items are measuring a single variable (Bhattacherjee, 2012). Hair et al. (2014) recommend values greater than 0.7. The results as illustrated in table 11 indicate that items related to a particular variable have all scored greater than 0.7 thus showing evidence of scale reliability.

4.9.2 Item-to-Total correlations

The item-to-total correlations show figures greater than 0.4 (as seen in table 12) and thus no further items or variables have been dropped. The item-to-total correlation is to check if any item in the set is inconsistent with the averaged behaviour of the others (Hair et al., 2014)

Table 12: Corrected Item-Total Correlation

	Corrected Item-Total Correlation
Perceived Post Usage Usefulness 1	.585
Perceived Post Usage Usefulness 2	.585
Disconfirmation 3	.688
Disconfirmation 4	.688
Continuance Intention 1	.904
Continuance Intention 2	.904
Perceived Service Availability 1	.872
Perceived Service Availability 2	.872
Task Technology Fit 1	.745
Task Technology Fit 2	.745
Familiarity 1	.844
Familiarity 2	.843
Familiarity 3	.740
Satisfaction 1	.909
Satisfaction 2	.947
Satisfaction 3	.895
Satisfaction 4	.925

4.10 Normality

Normality is a fundamental assumption within multivariate analysis and it is defined as the shape of the data distribution for a particular variable in relation to the normal distribution (Hair et al., 2014). If this variation from the normal distribution is quite large, then certain statistical tests become invalid. There are various tests to describe the distribution if it differs from the normal distribution. Hair et al. (2014) warn that statistical tests used to test normality are less interpretable in smaller samples (less than 30) and quite sensitive in large samples exceeding 1000 observations. This

research sample is within these boundaries and therefore the normality statistical tests yields significant results.

Composite scores were calculated for each variable, with the average score of all relevant scale items weighted equally. Seven composite scores were calculated corresponding to the seven variables. The composite scores where used to statistically test univariate normality.

The concepts of skewness and kurtosis were calculated to describe the shape of the distribution of the data (Hair et al., 2014). Table 13 displays the descriptive statistics of the composite scores, as well as values for skewness and kurtosis for the corresponding variables. With the exception of familiarity and the dependent variable (IS continuance intention) the skewness and kurtosis values were within the -1 to +1 range and -3 to +3 range respectively (Hair et al., 2014). Both familiarity and IS continuance intention were negatively skewed. Hair et al. (2014) argue that if the distribution is negatively skewed then the appropriate technique to be employed is a square or a cubed transformation. Table 14 illustrates the new values of the squared transformed values. Data transformation on the independent variable (i.e. familiarity) was carried out and resulted in a skewness value of -0.606 and a kurtosis value of - 0.504. Familiarity can now be considered normal (Hair et al., 2014). Data transformation (squared transformation) on the dependent variable (IS Continuance intention) improved the normalisation of the distribution with a skewness value of -0.956 and a kurtosis value of 0.454. Using the skewness and kurtosis tests the distribution of the IS continuance intention is considered normal after data transformation. However, both the Shapiro-Wilk and Kolmogorov-Smirnov tests indicated significance at the p<0001 level thus indicating that non-normality could still exist. As the dependent variable is critical to this study, a conservative approach was followed by assuming the variable to be non-normal. Therefore in addition to the parametric tests, non-parametric statistical tests have been applied to the dependent variable to ensure the integrity of the results and this will be described further in section 4.12.3.

Table 13: Descriptive Statistics for the Composite Values of the Variables

Composite Variable	Mean		95% Confidence Interval for Mean		5% Trimmed Mean	Median	Variance	Std. Deviation	Min.	Max.	Range	Inter quartile Range	Skewness		Kurtosis	
	Statistic	Std. Error	Lower Bound	Upper Bound									Statistic	Std. Error	Statistic	Std. Error
N=144																
Independent Variables																
Perceived Post Usage Usefulness	5.1932	0.1339	4.928	5.458	5.3088	5.5	2.582	1.607	1	7	6	2	-0.952	0.202	0.079	0.401
Disconfirmation	5.0465	0.1211	4.807	5.286	5.1419	5.228	2.113	1.4536	1	7	6	1.5	-0.984	0.202	0.547	0.401
Satisfaction	4.7216	0.1313	4.462	4.981	4.7933	5	2.485	1.5763	1	7	6	2	-0.583	0.202	-0.273	0.401
Perceived Service Availability	4.6244	0.1493	4.329	4.920	4.6938	5	3.211	1.7920	1	7	6	2.5	-0.581	0.202	-0.706	0.401
Task Technology Fit	5.1513	0.1228	4.906	5.394	5.2545	5.5	2.172	1.4739	1	7	6	1.5	-1.000	0.202	0.568	0.401
Familiarity	5.4111	0.1234	5.167	5.655	5.5401	6	2.191	1.4803	1	7	6	1.33	-1.238	0.202	0.972	0.401
Dependent Variable																
Continuance Intention	5.737	0.1156	5.509	5.966	5.9132	6	1.923	1.3867	1	7	6	1.75	-1.825	0.202	3.491	0.401

Table 14: Descriptive Statistics for Composite Values of the Variables (Transformed Variables)

Composite Variable	Mean		95% Confidence Interval for Mean		5% Trimmed Mean	Median	Variance	Std. Deviation	Min.	Max.	Range	Inter quartile Range	Skewness		Kurtosis	
	Statistic	Std. Error	Lower Bound	Upper Bound									Statistic	Std. Error	Statistic	Std. Error
N=144																
Independent Variables																
Familiarity (Squared Transformed)	31.46	1.133	29.2	33.7	32.1	36	184.7	13.59	1	49	48	15.1	-0.606	0.202	-0.50	0.401
Dependent Variable																
Continuance Intention (Squared Transformed)	34.83	1.0627	32.73	36.93	35.87	36	162.6	12.753	1	49	48	21	-.956	.202	.454	.401

4.11 Hypothesis Testing

The above mentioned sections have provided evidence of validity and reliability of the data. Based on this, correlation and regression analysis (parametric and non-parametric) were applied for the purpose of testing the research hypotheses. The details are discussed in this section.

4.11.1 Correlation Analysis

Bivariate correlation is used to test the relationship between two variables. The bivariate correlation coefficient (r - value) is a statistical measure of the strength of the relationship between two variables (Mertler and Vannatta, 2002).

Pearson's product moment correlation analysis was computed to show the relationships among the variables with specific reference to the hypotheses of this study. The significance level (alpha) is accepted to be 0.05 across all the computations performed (Hair et al., 2014).

The values in table 15 suggest that there are significant intercorrelations between variables.

Table 15: Bivariate Pearson Correlation

	Perceived Post Usage Usefulness	Disconfirmation	Satisfaction	Perceived Service Availability	Task Technology Fit	Familiarity	Continuance Intention
Perceived Post Usage Usefulness	1						
Disconfirmation	0.693**	1.000					
Satisfaction	0.621**	0.536**	1.000				
Perceived Service Availability	0.558**	0.562**	0.478**	1.000			
Task Technology Fit	0.650**	0.689**	0.484**	0.513**	1.000		
Familiarity	0.656**	0.625**	0.628**	0.552**	0.570**	1.000	
Continuance Intention	0.592**	0.653**	0.597**	0.494**	0.533**	0.682**	1.000
SQRT AVE	0.69	0.71	0.87	0.81	0.84	0.75	0.87

** Correlation is significant at the 0.01 level (2-tailed).

As discussed in section 4.10, IS continuance intention in not considered to be normally distributed. Therefore in addition to the Pearson Correlation tests above, Spearman Correlation for IS continuance intention and its independent variables were computed. According to Leeper (2000), Spearman's correlation is the nonparametric version of the Pearson product-moment correlation. Spearman's correlation coefficient (rho) measures the strength of association between two variables (Leeper, 2000).

Table 16: Spearman Rho Correlation

	Perceived Post Usage Usefulness	Satisfaction	Familiarity	IS Continuance Intention
IS Continuance Intention	0.576**	0.631**	0.631**	1.000

** Correlation is significant at the 0.01 level (2-tailed).

The values in table 16 above suggest that there are significant inter-correlations between the dependent variable and its corresponding independent variables.

4.11.2 Regression Analysis

The advantage of regression analysis over bivariate correlation is that regression analysis provides an indication of the cumulative effects of the independent variables on the dependent variables.

Regression analysis was computed for the relationships between the independent variables (i.e. perceived post-usage usefulness, familiarity and satisfaction) and the dependent variable (i.e. IS continuance intention (squared transformed)). This was to determine the predictive power of each of these independent variables in predicting IS continuance intention. This refers to the confirmatory approach (Hair et al., 2014).

The R^2 is 56.2 suggesting that the independent variables of perceived post-usage usefulness, familiarity and satisfaction explain approximately 56.2% of the variance in IS continuance intention. This is significant at the $p<0.001$ level.

The independent variable that has the largest significant effect on IS continuance intention is familiarity. It has a standardised beta coefficient of 0.477, which is significant at the $p <0.001$ level. The other predictor variables, namely perceived post-usage usefulness (0.172) has a non-significant effect and satisfaction (0.193) is significant at the $p < 0.05$ level.

As the model identified control variables, regression analysis, as reported above, was tested in the presence of the 3 control variables namely, prior computer experience, tenure at firm and education level.

The effects of the control variables with a R^2 of 3.9 are non-significant. None of the individual control variables had any significance. However, the main effects of the controls variables resulted in a slight increase in the R^2 value, which is significant at the $p<0.001$ level.

Further in this model, task technology fit, perceived service availability and disconfirmation jointly explain 57.2% (R^2 = 57.2) of the variance in perceived post-usage usefulness with standardised beta coefficients of 0.249 ($p < 0.01$), 0.226 ($p < 0.01$) and 0.398 ($p < 0.001$) respectively. The effect of the control variables (R^2 of 5.8) in this instance, are also non-significant.

Disconfirmation explains 27.9% (R^2 = 27.9) of the variance in satisfaction with a standardised beta coefficient of 0.469 ($p < 0.001$). The effect of the control variables (R^2 of 6.7) in this instance, are also non-significant.

Figure 6, Table 17, 18 and 19 summarises the findings using linear regression as discussed above
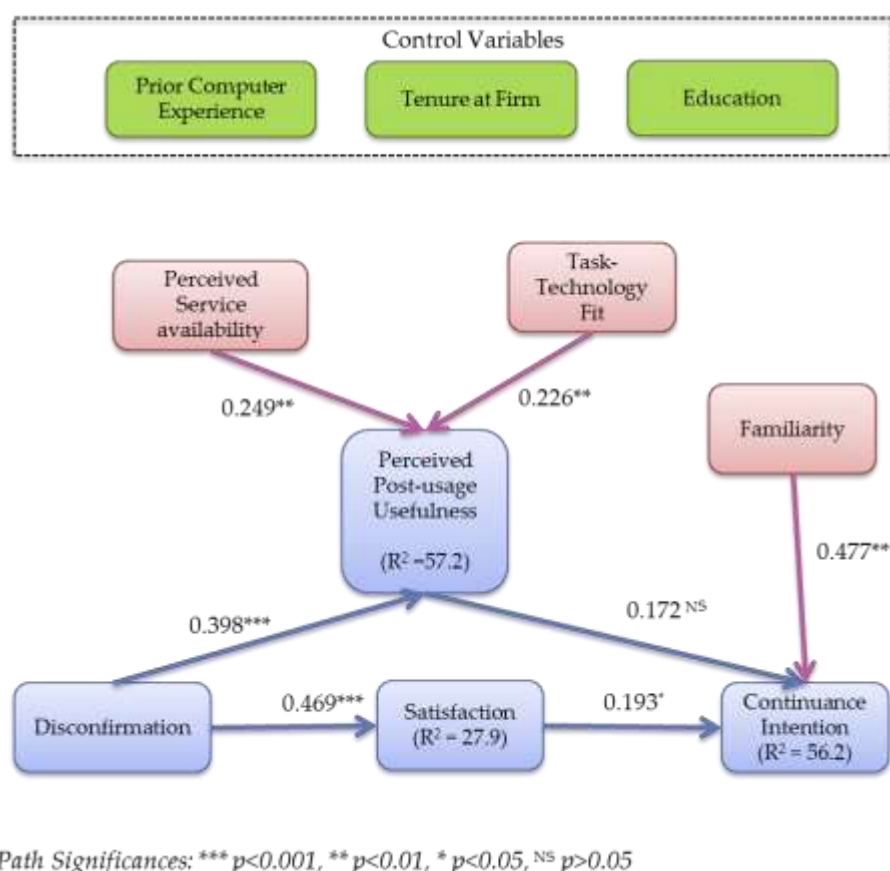
Figure 6 : Linear Regression Analysis on IS Continuance Intention (squared transformation)

Table 17: OLS regression analysis with IS Continuance as Dependent Variable (Squared Transformed variables)

	R Square	Sig. F Change	R Square Change	F Change	Independent Variables	Standardized Beta Coefficients	t	Sig.
Dependent Variable: IS Continuance Intention (Squared Transformation)	0.562	0.000	.523	45.417				
Impact of the control variables	0.039	0.850	.039	.531				
					Familiarity (Squared Transformed)	.477	5.475	.000
					PPPU	.172	1.941	.055
					Satisfaction	.193	2.214	.029

Table 18: OLS regression analysis with perceived post usage usefulness as the dependent variable

	R Square	Sig. F Change	R Square Change	F Change	Independent Variables	Standardized Beta Coefficients	t	Sig.
Dependent Variable: Perceived Post Usage Usefulness	.572	0.000	.514	45.701				
Impact of the control variables	.058	.058	.805	.612				
					Disconfirmation	.398	4.776	.000
					PSA	.249	2.895	.005
					TTF	.226	2.914	.004

Table 19: OLS regression analysis with satisfaction as the dependent variable

	R Square	Sig. F Change	R Square Change	F Change	Independent Variables	Standardized Beta Coefficients	t	Sig.
Dependent Variable: Satisfaction	.279	0.000	.211	34.000				
Impact of the control variables	.067	.493	.067	.940				
					Disconfirmation	.469	5.83	.000

4.11.3 Linear Regression on Ranked Transformed Variables

The previous section described linear regression of IS continuance intention with the assumption that it had a normal distribution based on squared transformation. Squared transformation improved the normalisation of the distribution with a skewness value of

-0.956 and kurtosis value of 0.454 (Groeneveld and Meeden, 1984). However, both the Shapiro-Wilk and Kolmogorov-Smirnov tests indicated significance at the p<0001 level, which shows that non-normality could still exist. Based on the various tests for normality showing different results, a more conservative approach was taken by opting for additional tests to be computed on the dependent variable. The aim of the additional tests is to add to the findings of this research. Another transformation technique was used called ranked transformation. Ranked transformation was applied to IS continuance intention using the guidelines presented by Conover and Iman (1981) and Conover (2012). The ranking transformation replaces the raw number entries with its rank among the data across all cases (or average rank in case of ties). According to Conover (2012), rank transformation is a convenient way to bridge the gap between parametric and nonparametric methods in statistics. Conover (2012) advises that researchers should first apply classical parametric statistical procedures and then perform the same operation on the ranks of the data instead of the data themselves.

Ranking transformation on the variables of IS continuance intention and familiarity was done and OLS linear regression computed again.

The R^2 is 51.2 suggesting that the independent variables of perceived post-usage usefulness, familiarity and satisfaction explain roughly 51% of the variance in IS continuance intention. This is significant at the p<0.001 level.

Familiarity has the largest significant effect on IS continuance intention. It has a standardised beta coefficient of 0.386, which is significant at the p <0.001 level. The other predictor variables, namely perceived post-usage usefulness (0.145) has a non-significant effect and satisfaction (0.274) is significant at the p < 0.05 level.

The above mentioned regression analysis was also done in the presence of the 3 control variables namely, prior computer experience, tenure at firm and education. The effects of the control variables (R^2 of 5.7) are non-significant. None of the individual control variables had any significance. However, the main effects of the control variables

resulted in a slight increase in the R^2, which is significant at the p<0.001 level. Figure 7 and table 20 highlights the linear regression analysis results computed on the ranked transformed IS continuance intention variable.

Path Significances: *** p<0.001, ** p<0.01, * p<0.05, NS p>0.05
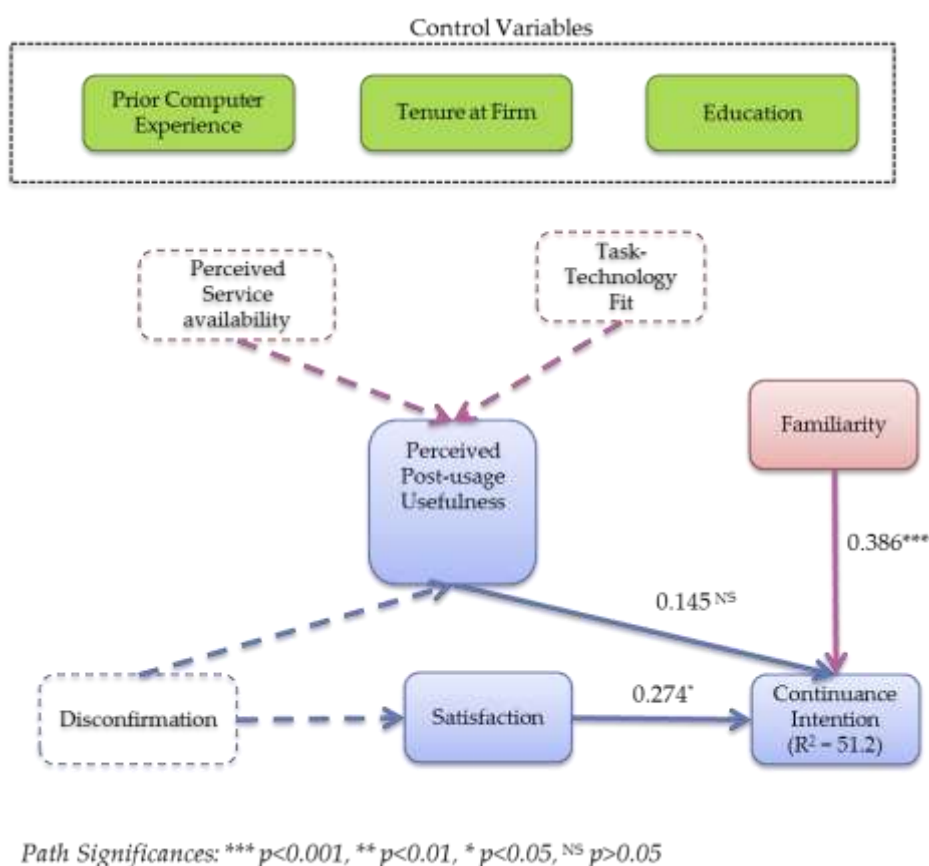
Figure 7 – Linear Regression Analysis on IS Continuance Intention (Rank Transformed)

Table 20: OLS regression analysis (Ranked Transformed variables)

	R Square	Sig. F Change	R Square Change	F Change	Independent Variables	Standardized Beta Coefficients	t	Sig.
Dependent Variable: Is Continuance Intention (Ranked Transformed)	.512	0.000	.455	35.491				
Impact of the control variables	.057	.628	.057	.788				
					Familiarity (ranked transformed)	.386	4.422	.000
					Satisfaction	.274	3.005	.003
					PPUU	.145	1.594	.114

4.11.4 Quantile Regression

The previous section described the method of OLS linear regression of ranked transformed variables. As mentioned above, Conover (2012) argues that rank transformation is to bridge the gap between parametric and nonparametric methods in statistics. However, this is not full non-parametric regression analysis. This section describes quantile regression analysis.

Logan and Petscher (2013), and Koenker and Hallock (2000) argue that the traditional ordinary least squares (OLS) linear regression analysis is not appropriate if data is not evenly distributed. The method of least squares results in estimates that approximate the conditional mean of the response variable given certain values of the predictor variables. Quantile regression on the other hand aims at estimating the effect of the predictor variables at any point on the conditional distribution. (Logan and Petscher 2013; Koenker and Hallock, 2000). Quantile regression answers the question, "what is the marginal effect of an explanatory variable at an arbitrary point in the conditional distribution of the dependent variable" (Morrison, 2011). Few studies within the IS adoption and IS continuance space have used quantile regression for data analysis. A study conducted by Adhikari, Mishra and Chintawar (2009) in the subject of technology adoption by farmers, and a study by Gholami, Higón, Hanafizadeh, and Emrouznejad (2010) in IT diffusion, have opted for quantile regression. However their studies focused purely on non-parametric statistical methods and therefore they have not presented any comparative results from parametric tests.

The median value of IS continuance intention is 6. Quantile regression analysis was carried out at the median point on the distribution. In this instance the median is a measure of the location on the distribution where it is skewed. Therefore the regression computed at this point (median) will be more representative of responses of the majority of sample as opposed to the computation done at the mean.

Familiarity continues to be the largest significant effect on IS continuance intention. It has a standardised beta coefficient of 0.28, which is significant at the $p < 0.01$ level. The other predictor variables, namely perceived post-usage usefulness (0.209) has a non-significant effect and satisfaction (0.104) is significant at the $p < 0.05$ level.

The above mentioned regression analysis was also done in the presence of the 3 control variables namely, prior computer experience, tenure at firm and education. The effects of the control variables are non-significant. Table 21 and Figure 8 summarises these results computed using quantile regression on IS continuance intention.

Table 21: Quantile Regression on IS Continuance

Dependent Variable : IS Continuance Intention				
Quantile	**Independent variables**	**Coefficient**	**Significance P< x**	**Pseudo R Squared**
0.5 Quantile (Median = 6)				30.4
	Familiarity	0.28	0.002	
	Satisfaction	0.104	0.009	
	Perceived Post-Usage Usefulness	0.209	0.169	
	Control Variables : non-significant impact			
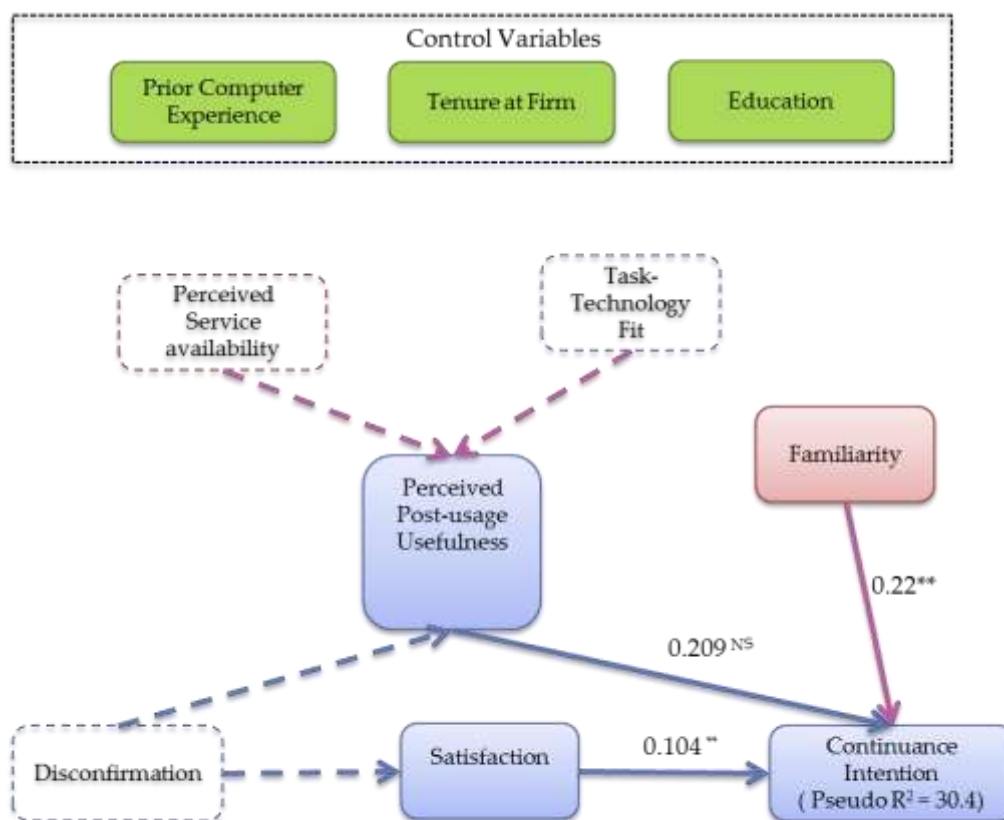
Figure 8 – Quantile Regression Analysis on IS Continuance Intention

4.12 Test for Mediation

The study proposed four mediation relationships. The first relationship proposed that perceived post usage usefulness mediates between the perceived service availability (PSA) and IS continuance intention. The second relationship proposed that perceived post usage usefulness mediates between task technology fit (TTF) and IS continuance intention. The third relationship proposed that perceived post usage usefulness mediates between disconfirmation and IS continuance intention. Lastly, satisfaction mediates between disconfirmation and continuance intention.

The four step Baron and Kenny (1986) approach was used to test the mediating effects of the relationships.

Figure 9 illustrates the first mediating relationship.
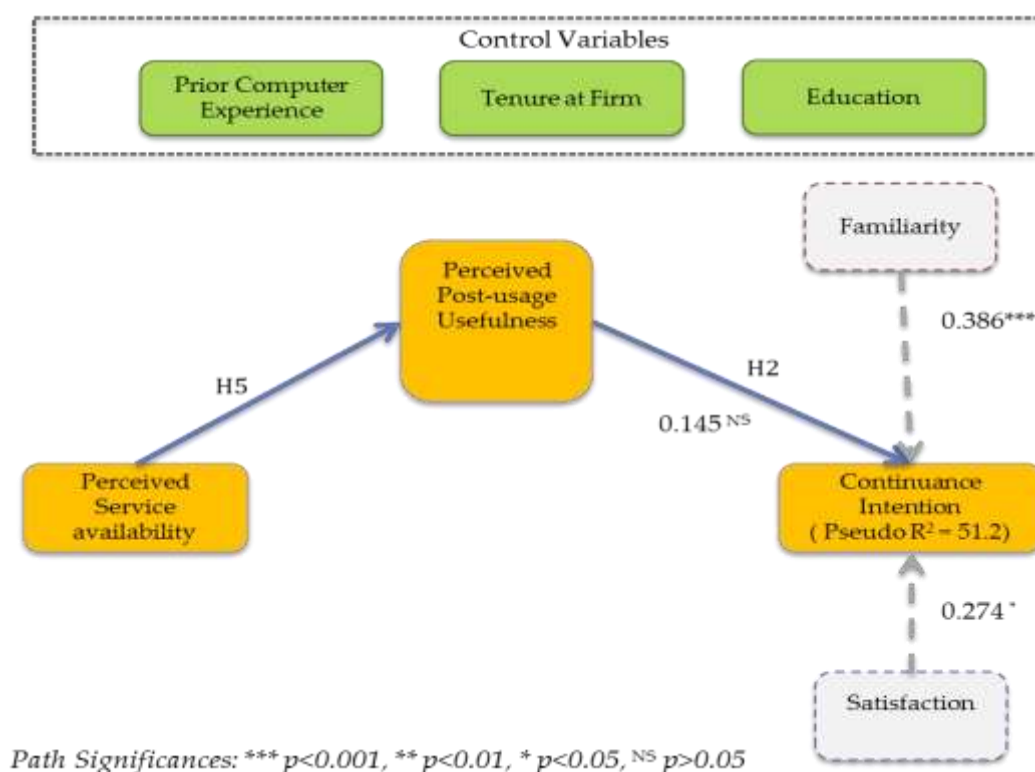
Figure 9 : Mediation of perceived post-usage usefulness on PSA and IS continuance intention

The first step regression analysis indicates that there is a significant relationship ($ß = 0.175$) at the $p < 0.05$ level between perceived service availability and continuance intention (as seen in table 22). However, as discussed in section 4.11.3 perceived post-usage usefulness loses its significance in the presence of satisfaction and familiarity (as seen in figure 9). Thus there is no relationship between perceived post usage usefulness and continuance intention. As the mediator is not related to the dependent variable in this instance, it can be seen that perceived service availability is a direct predictor of continuance intention and perceived post usage usefulness has no role in the relationship.

Table 22: Direct Relationship between PSA and Continuance Intention

	Standardized Beta Coefficients	Sig.
Perceived Service Availability	.0.175	.031
Dependent Variable: Continuance Intention		

Path Significances: *** p<0.001, ** p<0.01, * p<0.05, NS p>0.05
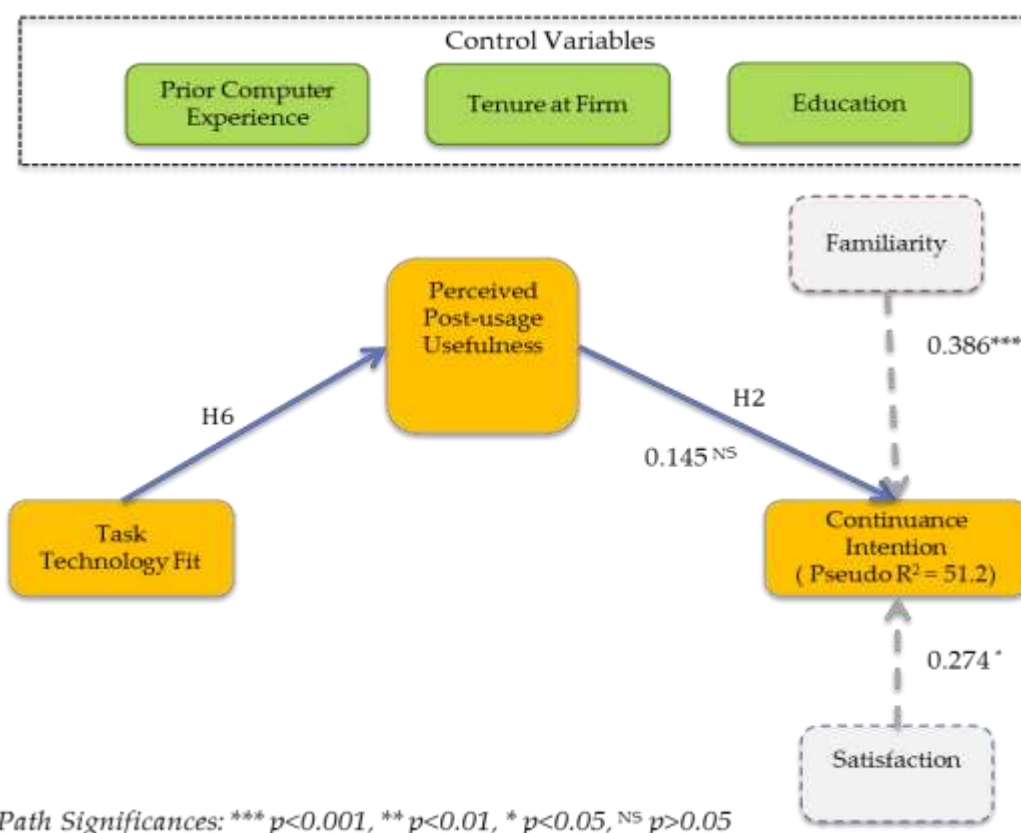
Figure 10 : Mediation of perceived post usage usefulness on TTF and Continuance Intention

The four steps Baron and Kenny (1986) mediation test was used again on the relationship whereby perceived post usage usefulness mediates between the Task Technology Fit and IS continuance intention (as seen in figure 10).

The results indicate that there is a significant relationship (ß = 0.168) at the p<0.001 level between TTF and IS continuance intention (as seen in table 23). Similarly, as discussed in previous mediation relationship, perceived post-usage usefulness loses its significance in the presence of satisfaction and familiarity (as seen in figure 10). Thus there is no relationship between perceived post usage usefulness and continuance

intention. As the mediator is not related to the dependent variable in this instance, it can be seen that task technology fit is a direct predictor of continuance intention and perceived post usage usefulness has no role in the relationship.

Table 23: Direct Relationship between TTF and Continuance Intention

	Standardized Beta Coefficients	Sig.
Task Technology Fit	.168	.036
Dependent Variable: Continuance Intention		
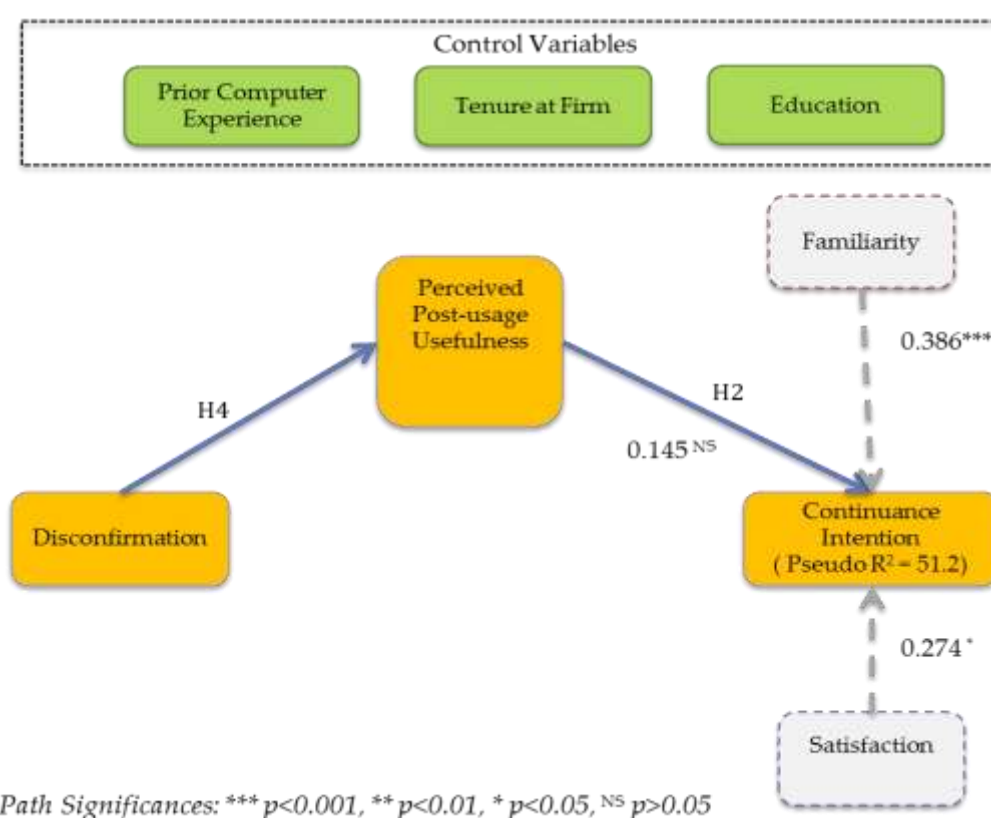
Figure 11 : Mediation of perceived post usage usefulness on Disconfirmation and Continuance Intention

Again, as discussed in the previous paragraph, the mediation tests was performed on the relationship whereby that perceived post usage usefulness mediates between the disconfirmation and IS continuance intention (as in seen in figure 11).

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The results indicate that there is a significant relationship (ß =.376) at the p < 0.001 level between disconfirmation and continuance intention (as seen in table 24). As there is no relationship between perceived post usage usefulness and continuance intention, disconfirmation has a direct relationship with continuance intention and perceived post usage usefulness has no role in it.

Table 24: Direct Relationship between TTF and Continuance Intention

	Standardized Beta Coefficients	Sig.
Disconfirmation	.376	.000
Dependent Variable: Continuance Intention		
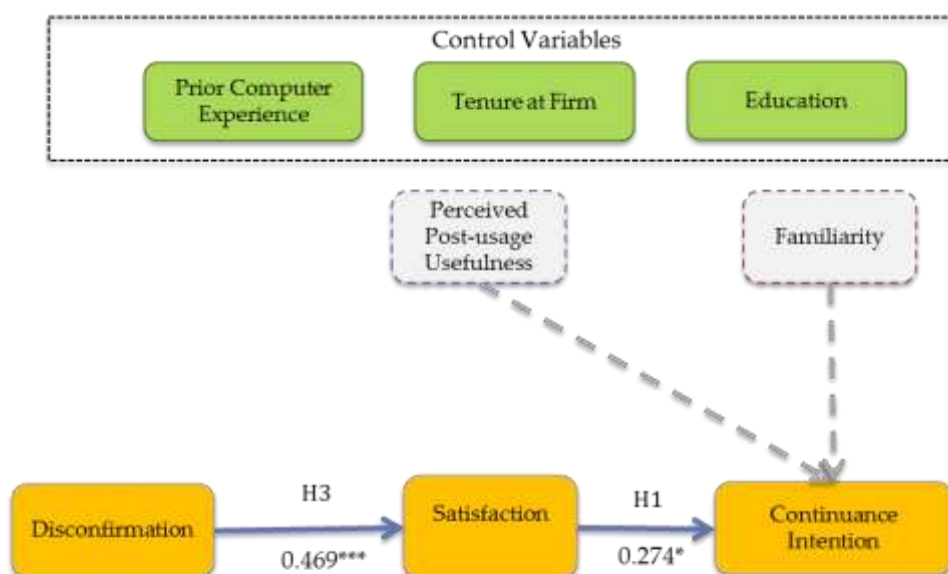
Figure 12 : Mediation of Satisfaction on Disconfirmation and Continuance Intention

The final mediating relationship for the proposed model is that satisfaction mediates between disconfirmation and IS continuance intention as seen in figure 12. The four step Baron and Kenny (1986) approach was used to test the mediating effects of the relationships. The results indicate that there is a significant relationship (ß = 0.423) at the p < 0.001 level between disconfirmation and continuance intention in the presence of familiarity and perceived post-usage usefulness. There is a significant relationship (ß

= 0.469) at the p<0.001 level between disconfirmation and satisfaction. There is also indication that there is significant relationship (ß = 0.259) at the p<0.01 level between satisfaction and IS continuance intention in the presence of familiarity and perceived post usage usefulness.

The final step of regression analysis indicates that disconfirmation continues to be significant at the p<0.001 level as seen in table 25 in the presence of satisfaction, familiarity and perceived post usage usefulness thus indicating that satisfaction partially mediates between disconfirmation and IS continuance intention only.

Table 25: Mediation of Satisfaction on Disconfirmation and Continuance Intention

	Standardized Beta Coefficients	Sig.
Satisfaction	.239	.005
Disconfirmation	.411	.000
Dependent Variable: Continuance Intention		

4.13   Additional Assumptions

In addition to the tests of normality of the variables, there are statistical assumptions of multiple regressions that should not be violated (Hair et al, 2014). These are collinearity, assumption of linear relationships, heteroscedasticity and normality of the residual distribution. These tests and results are shown in Annexure G.

4.14   Chapter Summary

This chapter presented the results of data analysis that was done. Firstly, the data was screened and tested for evidence of reliability and validity. Secondly, correlation analysis was performed to test the relationships between two variables. There was evidence that there were relationships between all the variables, thus providing support for the hypotheses under test. Thirdly, regression analyses (OLS and Quantile) were used to test the combined effects of the independent variables perceived post usage usefulness, satisfaction and familiarity on the dependent variables, IS continuance

intention, taking into account the control variables. Similarly, regression analysis (only OLS) was used to examine the effect of PSA, TTF and disconfirmation on perceived post usage usefulness. Finally, as the model contained mediation relationships, these were also examined.

Of the eight hypotheses proposed, one was dropped due to no evidence of any reliability. The remaining seven hypotheses were either fully supported or partially supported. Table 26 on the following page summarises the results of all the tests performed for the hypotheses.

The next chapter discusses and interprets key findings made. In addition, limitations and future areas of research are discussed.

Table 26: Summary of the Findings of the Statistical Tests

Hypotheses	Proposition	Pearson Correlation	Spearman Rho Correlation	OLS Regression	Ranked Transformation on IS Continuance Intention and Familiarity and OLS Linear Regression	Quantile Regression - 0.50 Quantile (Median = 6)	Overall Finding
1	Users' level of satisfaction of using the mobile computing services is positively associated with IS continuance intention.	Supported	Supported	Supported	Supported	Supported	Supported
2	Perceived post-usage usefulness is positively associated with IS continuance intention	Supported	Supported	Not Supported	Not Supported	Not Supported	Partially Supported
3	A users' extent of disconfirmation is negatively associated with their satisfaction.	Supported	N/A	Supported	N/A	N/A	Supported
4	A users' extent of disconfirmation is negatively associated with perceived post-usage usefulness	Supported	N/A	Supported	N/A	N/A	Supported
5	Perceived service availability has a positive effect on perceived post-usage usefulness (in a IS continuance context)	Supported	N/A	Supported	N/A	N/A	Supported
6	TTF (knowledge gained through rational assessment) positively influences perceived post- usage usefulness (belief)	Supported	N/A	Supported	N/A	N/A	Supported
7	Result demonstrability will have a positive effect on perceived post-usage usefulness	Dropped	Dropped	Dropped	Dropped	Dropped	Dropped
8	Familiarity is positively associated with IS continuance intention	Supported	Supported	Supported	Supported	Supported	Supported

5 DISCUSSION OF RESULTS

5.1 Introduction

The objectives of this research were to propose and validate an extended IS continuance model with the focus on the determinants for Perceived Post-Usage Usefulness and IS Continuance Intention. The core model was based on the IS continuance model by Bhattacherjee (2001). Additional constructs have been imported and adapted from adoption-focused studies and added as determinants to Perceived Post-Usage Usefulness and IS Continuance Intention.

This chapter discusses the implications of the findings made in the previous chapter. The explanations are based on the observed data together with the theoretical underpinnings as discussed in chapter 2, as well as additional literature that was sourced to explain the phenomena.

The discussion chapter is structured into four parts. The first part is to explain the dependent variable. Thereafter, the variables are grouped together and explained in their respective parts. The second part will focus on the three predictors (i.e. Familiarity, Perceived Post Usage Usefulness and Satisfaction) that explain the dependent variable of IS Continuance Intention. The third part of the discussion explains the determinants (i.e. Perceived Service Availability, Task Technology Fit and Result Demonstrability) of Perceived Post-Usage Usefulness. Lastly, an explanation of Satisfaction is presented with Disconfirmation as its determinant.

5.2 Dependent Variable – IS Continuance Intention

The present study's dependent variable is IS continuance intention which is defined as field workers (individuals) making a conscious decision to continue to use mobile computing services on rugged devices for work purposes.

The theory of reasoned action (TRA) states that attitude determines behavioural intention (IS Continuance intention), which then determines actual behaviour (Fishbein and Azjen, 1975). Due to the limitations of this study, it was not possible to obtain data of the actual use of the rugged mobile devices by the field staff, but it is assumed that there is a strong association between intention and behaviour. Studies carried out by Davis, Bagozzi and Warshaw (1989) and Taylor and Todd (1995) have validated this association. Thus it can be said that the field workers' actual usage is a reflection of their intention to continue to use the rugged mobile devices.

One of the key findings of this study is that the dependent variable showed evidence of non-normality, as most of the field workers indicated that they would to some extent continue to use the rugged mobile device. As the distribution of the dependent variable of this study was negatively skewed and the first remedy applied was a squared transformation technique. This resulted in an acceptable value for skewness but there was still evidence of non-normality using both the Shapiro-Wilk and Kolmogorov-Smirnov tests.

The reason for the non-normality could be that most of the respondents are willing to abide by the organisations rules, which is enforced by an authority figure and therefore intend to continue to use the mobile device (Hartwick and Barki, 1994; Venkatesh and Davis, 2000). The theory of planned behaviour (TPB) by Ajzen (1991) was developed to improve on the theory of reasoned action (TRA) by Fishbein and Azjen (1975) by accounting for situations where performing a behaviour was not entirely under the control of the individual (Brown, Massey, Montoya-Weiss and Burkman, 2002). In addition to attitude, TPB adds that subjective norm and perceived behavioural control could influence an individual's behavioural intention. Subjective norm reflects the degree to which a user will engage in a particular behaviour due to perceived social pressure (from superiors or peers) and perceived behavioural control refers to individuals' perceptions of their ability to perform a given behaviour (Ajzen, 1991). Taylor and Todd (1995) and Brown et al. (2002) have shown that subjective norm and perceived behavioural control explain significant variance in behavioural intention. As

company A has about 220 service centres across the country, field workers will report to different supervisors, therefore perceptions towards a particular authority will vary among them. In this present research, the results show that the majority of the responses (based on the median value) indicate that the users agree to continue to use the device and thus posing the challenge in obtaining a normal distribution. Taylor and Todd (1995) suggest the reason for the link between subjective norm and behavioural intention is that the workers might feel that they could lose their jobs if they do not do what they are told by their management (subjective norm).

As there was conflicting evidence presented by the various normality tests, this study has opted for a conservative approach and concludes that normality does not exist. Therefore more conservative tests (for example rank transformation method, quantile regression) were carried out on the data to ensure the integrity of the results as discussed below.

5.3   Explaining IS Continuance Intention

The approach that this section follows is firstly to explain Bhattacherjee's (2001) IS continuance model and to explain the results that he and other researchers using the model obtained from their studies in both voluntary and mandatory settings. The results of this study are discussed against the results of the above mentioned previous literature.

5.3.1   Explaining IS Continuance Intention – Voluntary Setting

To recap section 3.3.1, Bhattacherjee (2001) has underpinned his study with ECT and postulated that users' intention to continue to use an IS, is determined primarily by their satisfaction from prior use. Bhattacherjee's (2001) study further supports the ECT theory as his analysis indicated that satisfaction was a stronger predictor than

perceived usefulness of IS continuance intention. Kim (2012), Lin and Wang (2012), Liao, Palvia and Chen (2009), Thong, Hong and Tam (2006) and Larsen, Sørebø and Sørebø, (2009) have used the core of Bhattacherjee's (2001) IS continuance model and have presented similar results where satisfaction was the stronger predictor of IS continuance intention than perceived usefulness.

Bhattacherjee's study in 2001 was carried out via a cross-sectional field survey of online bank users, which is considered a voluntary setting. Kim's (2012), Lin and Wang's (2012), Liao, Palvia and Chen's (2009), Thong, Hong and Tam's (2006) and Larsen, Sorebo and Sorebo's (2009) studies have also been carried out in voluntary settings.

5.3.2   Explaining IS Continuance Intention – Mandatory Setting

Bhattacherjee et al's (2008) data (7 years later after his 2001 study) was gathered via a longitudinal survey of employees of an organisation (mandatory setting). This 2008 study indicates that perceived post-usage usefulness was the stronger determinant of IS Continuance Intention than Satisfaction. Bhattacherjee et al. (2008) argue that although users are dissatisfied with the IS use, they may still continue to use it if they consider it to be useful for their tasks at work. Limayem and Cheung(2008), Lin (2012), and Hsieh and Wang (2007) have used the core of Bhattacherjee's (2001) IS continuance model within a mandatory setting and have presented similar results whereby perceived usefulness was the stronger predictor of IS continuance intention as compared to satisfaction.

5.3.3   Present Study, Mandatory Setting – Adding Familiarity as an additional variable

This study goes a step further and differs from both Bhattacherjee's (2001) and Bhattacherjee et al's (2008) studies by adding another predictor to IS continuance intention, namely familiarity. When familiarity is added as a predictor, the effect of perceived post usage usefulness becomes non-significant. Familiarity becomes the

largest significant predictor of IS continuance intention. The other predictor variables, namely perceived post usage usefulness has a non-significant effect in the presence of familiarity and satisfaction loses some of its effect but remains significant.

As mentioned in chapter 2, familiarity is usually defined as a user's level of comfort on using a particular IS based on previous experience or interaction with it (Gefen, 2000; Lee and Kwon, 2011 and Li 2014). Lee and Kwon (2011) argue that familiarity is an affective factor, defining it as how much recognisability the user has about the particular IS based on previous association with it or a similar technology. According to Lee and Kwon (2011), familiarity is created and grows accumulatively over time and thus it is not a specific event. This could best be explained that the more a user continues to use the services on the rugged mobile device, the more familiar the user becomes with it. Thus the complexity of using the device is reduced through improved understanding of how the applications of rugged mobile devices work and how it relates to job procedures (Gefen, 2000). Therefore the complexity of a target IS is integral to users becoming familiar with it.

Yuan and Zheng's (2009) study indicated that task complexity for mobile knowledge workers is higher than that for mobile field workers, as field workers tend to carry out more repetitive tasks in their work. Field workers usually follow a standard process on how to carry out their tasks and their jobs become routine (Yuan and Zheng, 2009). As usage of the device by the field worker increases, the user uses less cognitive reasoning in assessing the applications on the rugged device and then affective factors play a more important role in determining usage (Lee and Kwon, 2011; Kim, Malhotra and Narasimhan, 2005). Therefore cognitive factors such as perceived post usage usefulness play an important role in continued IS usage, but its importance could decrease further over time (Kim and Malhotra, 2005b). Kim et al. (2005) and Ajzen (2002) have argued that cognitive reasoning would involve the formation of judgements and then intentions, and the more users make the same judgements, the more their cognitions would become stabilized and ultimately stored in memory. If the environment is routine (e.g. field service environments), the stored judgements would

be instantly retrieved from memory, and thus guide subsequent intentions (Kim et al., 2005; Ajzen, 2002). As the user becomes more familiar with the repetitive job tasks of using the mobile device and as the job becomes routine, then affective factors (i.e. familiarity) are stronger predictors of IS continuance intention than the cognitive factors (Lee and Kwon, 2011). Kim et al. (2005) have argued that the evaluation-intentions relationship is generally weaker among heavier users, thus suggesting that an increase in past use (familiarity) will result in user behaviour becoming less evaluative and more affective.

Some could question whether there are similarities between perceived ease of use (PEOU) and familiarity or whether the two terms could be used interchangeably. Perceived ease of use is considered a cognitive belief (as opposed to an affective belief) whereby a user will make a rational decision on why they perceive a target system to be effortless to use (Kim and Malhotra, 2005a; Karahanna and Straub, 1999). Bhattacherjee (2001), Bhattacherjee et al. (2008) and Karahanna and Straub, (1999) argue that when users gain experience with target systems, less effort is needed by the user and less cognitive evaluation is needed and thus the effect of PEOU decreases over time. Therefore as experience is gained, cognitive evaluations (PEOU) decreases over time, and familiarity (affective) increases; as these cognitions stabilize and stored in memory (Kim et al., 2005; Ajzen, 2002). According to Bhattacherjee (2001) and Bhattacherjee et al. (2008), PEOU has an inconsistent effect on IS Continuance and therefore it was not included in their studies. This strengthens the argument that PEOU in an IS continuance study plays a less important role.

In summary, the variables of satisfaction, perceived post usage usefulness and familiarity are independent predictors of IS continuation intention. However, perceived post usage usefulness is no longer significant in the presence of familiarity when analysed together. Therefore the second hypothesis which proposes that perceived post-usage usefulness is positively associated with IS continuance intention, is partially supported. The first hypothesis which proposes that users' level of satisfaction of using the mobile computing device is positively associated with IS continuance intention, is

fully supported. The eighth hypothesis which proposes that familiarity is positively associated with IS continuance intention, is also fully supported.

5.4   Explaining Perceived Post-Usage Usefulness

To summarise a snippet from chapter 1, Venkatesh and Bala (2008) have argued that research should not just be about validating and testing a model that makes little sense to someone in industry and thus indicating that studies should be more beneficial to practitioners. They were calling for studies to focus on the determinants of the key variables in IS adoption related studies. Thus the present study has proposed task technology fit, perceived service availability and result demonstrability as determinants of perceived post-usage usefulness in order to understand what makes technology useful within the context of IS continuance studies. More specifically, this study aims to explain what field service staff of an organisation consider useful in using a rugged mobile computing device to carry out their job tasks, and thus perceived post-usage usefulness being an important driver for the user to intend to continue to use the device.

5.4.1   Task Technology Fit

The sixth hypothesis proposes that the determinant task technology fit (knowledge gained through rational assessment) positively influences perceived post-usage usefulness (belief). This hypothesis is also supported. Task-technology fit is another determinant that is "work-related". Thus the result of the analysis could aid someone in industry and thus be beneficial to practitioners (Larsen, et al., 2009). Goodhue and Thompson (1995) mention that an information technology system must be a "good fit for the tasks it supports" and this is referred to as task-technology fit.

As described in chapter 2, in the context of this study, most modern day mobile computing devices have an operating system capable of running multiple applications

and thus it is comparable to PCs (Salleh et al., 2009; Hong and Tam, 2006 ; Yuan, Archer, Connelly and Zheng, 2010). Users could find the services on the rugged mobile computing device useful, for other functionality besides that which is required for completing the actual task (Yuan et al., 2010; Hong and Tam, 2006). For example, the field technician could find the navigation application useful for getting to a particular site, but may not find other task-related applications on the mobile computing device as useful (Yuan et al., 2010).

Dishaw and Strong (1999) and Pagani (2006) argue that if the tasks of users are too large and complex, then generally the availability of a particular IT system to the support all the tasks, becomes slim. Thus the deduction can be made that the probability of fit between technology and task decreases as task requirements increase (Dishaw and Strong; 1999). As mentioned in the above section, Yuan and Zheng's (2009) study indicated that task complexity for mobile field workers is much lower than knowledge workers. Thus the mobile applications on the device are more likely to enable the processes and tasks as accurately as possible (Dishaw and Strong, (1999); Yuan and Zheng, (2009); Klopping and Mckinney, 2004).

Numerous other studies have presented a correlation between TTF and PU (Yen, Wu, Cheng and Huang, 2010; Klopping and McKinney, 2004; Dishaw and Strong, 1999; Yuan et al., 2010). Therefore it can be deduced that where applications on the rugged mobile device are integrated with the processes and tasks as accurately as possible, the rugged mobile device would be perceived to be useful (Yen et al., 2010).

5.4.2 Perceived Service Availability

One of the hypotheses (hypothesis number 5) proposes that perceived service availability has a positive effect on perceived post-usage usefulness. Results from this study support this hypothesis.

The definition of perceived service availability within the context of the present study is a technology specific belief, which is defined as the extent to which the rugged mobile computing device is able to connect to a cellular network anywhere and anytime in order for the mobile applications to assist field workers to carry out their tasks (Hong and Tam, 2006). The field workers' productivity increases when they are able to access information that is needed at any place or time via a mobile device (Islam and Fayad, 2003; Pagani, 2006; Yuan et al., 2010).

Venkatesh and Davis (2000) have argued that output quality is a predictor of perceived usefulness and that output quality takes a much more important role in relation to a system's job relevance. Thus applying Venkatesh and Davis's (2000) argument to the present study, it can be argued that field workers will perceive the device to be useful if there is a perception of service quality as the mobile device is very relevant to perform their jobs.

Studies done by Davis et al. (1992), Venkatesh and Davis (2000) and Venkatesh and Bala (2008) have presented that there is a relationship between output quality (in the present study known as perceived service availability) and perceived usefulness. Their results are similar to the results of this present study. Therefore, if the mobile device is within cellular network coverage, then using the application to perform the job will be possible and then the device could be perceived as useful (and vice versa) (Pagani, 2006).

5.4.3   Result Demonstrability

The seventh hypothesis proposes that result demonstrability positively influences perceived post-usage usefulness (belief). Result demonstrability is defined as the degree to which an individual perceives that the benefits of using a particular technology are tangible, observable and communicable (Moore and Benbasat, 1991). Field technicians are generally dispatched to go out to restore a service or to fix a fault at a remote location for a particular customer (Salleh et al., 2009; Yuan et al., 2010). The

applications on the mobile computing device will help the field worker in completing this task as well as keep track of the history by updating the back end servers with information (Salleh et al., 2009; Yuan et al., 2010). For example, if the field worker provided regular milestone feedback then there is a detailed record of how long it took to restore the service or fix the fault (Salleh et al., 2009; Yuan et al., 2010). Thus all the data that is accumulated, can be used by the field worker to present evidence to management of his/her job performance (Salleh et al., 2009). The mobile computing device has enabled the field worker to see tangible and observable results by providing historical data and thus they are able to communicate it to management if there is a need (Salleh et al., 2009). If mobile computing is able to allow the field worker to demonstrate results then the field worker would deem it to be useful. The study done by Venkatesh and Davis (2000) has corroborated the relationship between result demonstrability and perceived usefulness. This hypothesis was however not supported in this present study, as the variable of result demonstrability was dropped because of lack of convergent and discriminant validity.

The operational definition of the construct included an item that was negatively-keyed and others positively keyed. Generally this should not be an issue, but in retrospect and taking the type of respondents into consideration this could have possibly confused the users when answering the questions. Swain, Weathers and Niedrich (2008) argue that data collected through multi-item Likert scales that contain reversed items often exhibit problems, such as unexpected factor structures and diminished scale reliabilities. These problems arise when respondents select responses on the same side of the scale neutral point for both reversed and nonreversed items, a phenomenon they called "misresponse." Swain,Weathers and Niedrich (2008) found that misresponse to reversed Likert items averaged approximately 20%, and it could be attributed to reverse scoring appearing more complex than positively keyed items and thus confusing the respondent.

On the other hand, some would say that the reason for lack of convergent and discriminant validity for result demonstrability, is as a result of acquiescence bias. This

bias is when respondents have a tendency to agree or disagree with all the questions (Watson, 1992). As all the other variables of this study showed evidence of convergent and discriminant validity, it cannot be regarded as acquiescence bias.

Thus seventh hypothesis which proposes that result demonstrability positively influences perceived post-usage usefulness is unsupported.

5.5 Explaining Satisfaction

In the present study, disconfirmation explained 28% of the variance in satisfaction in the presence of control variables thus there is a possibility that satisfaction could have other salient predictors than those identified by Bhattacherjee's (2001) IS continuance model. As discussed in chapter 2, Disconfirmation is a cognitive belief developed following and an evaluation done by the user (after actual use of the IT artefact) against what the user initially expected and which in turn determine their satisfaction (Bhattacherjee, 2001). The reverse applies if the expectation is negatively disconfirmed. The importance of disconfirmation has been validated in various research contexts in both voluntary and mandatory settings. The mandatory settings are studies done by Bhattacherjee et al. (2008), Sorebo and Eikebrokk (2008) and Hsieh and Wang (2007). Although all these studies have put forward that satisfaction is a function of disconfirmation, Hsu, Lin and Tsai (2014) and Chiu, Hsu, Sun, Lin and Sun (2005) have gone a bit further and argued that not all disconfirmations are important and it is insufficient to treat it as an overall concept. The reason is that IS users will consider and expect different features while evaluating the target system. It is very likely that some features meet users' expectation while other features do not and thus disconfirmation is different (Hsu et al., 2014). Hsu et al. (2014) and Chiu et al. (2005) have mentioned that users generally take utilitarian and hedonic features into consideration when evaluating. From the utilitarian side, users form expectations first before using a system and then cognitively assess the task related benefit based on functional attributes, such as 'usefulness' (Hsu et al., 2014). From a hedonic perspective, users form expectations

of the potential entertainment or enjoyment they will get from using the system (Hsu et al., 2014).

During the time of the present research, there appears to have not been enough studies to present evidence on which type of confirmation is more applicable to a mandatory context. However, studies done by Jin, Lee and Cheung (2010), Hsu et al. (2014) and Chiu et al. (2005) have shown that utilitarian disconfirmation to be the stronger and more important predicator to satisfaction than hedonic, despite the contexts of their studies varying from users of social networking sites to users of e-learning services at a university.

In this study, the hypothesis (hypothesis 3) is supported that satisfaction is associated with the disconfirmation but the type of disconfirmation cannot be proposed at this stage.

5.6 Conclusion

The findings in this study confirm theoretical arguments presented in various prior literature as to what extent the determinants of perceived post-usage usefulness and IS continuance intention (in terms of affective and cognitive factors) explain the continued use of services on rugged mobile computing devices by field workers of a South African energy utility organisation.

This study improves on IS continuance theory by firstly arguing that perceived post usage usefulness loses its significance in the presence of familiarity in predicting IS continuance intention. Satisfaction remains significant but familiarity (affective factor) is the stronger predictor of IS continuance intention as opposed to the cognitive factors.

Secondly, it was argued that task technology fit and perceived service availability are predictors of perceived post usage usefulness. These hypotheses were supported.

The following chapter discusses the contributions made by the current study to both theory and practice.

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6 CONCLUSION

6.1 Introduction

This chapter starts off by providing a summary of the current study. It is then followed by discussing the contributions and implications of the findings made for both research and practice. Limitations of the study are then discussed and future research opportunities identified at the end of the chapter.

6.2 Summary of the Key Findings

The objective of this study was to propose an extended model to improve our understanding of IS continuance theory. This present study achieves this by explaining the extent to which determinants of perceived post-usage usefulness and continuance intention in terms of affective and cognitive factors explain the continued use of rugged mobile computing services by field staff of a South African energy utility organisation. Prior studies in the IS continuance research field have mainly focused on the office worker (often referred to as the knowledge worker) as the user. However, information systems can now be introduced to professions such as delivery persons, transport drivers and field technicians as result of the availability of rugged mobile devices that is able to withstand harsh working conditions. Thus, this study examined the "intention" of field workers to continue to use mobile computing services on rugged devices within a utility organisation.

The context of this study allowed for a survey instrument to be sent to field service workers of the utility organisation and 144 usable responses were obtained. Following the testing for validity and reliability, the hypotheses were tested using both parametric and non-parametric correlation and regression statistical analyses.

Firstly, it was argued that perceived post usage usefulness loses its significance in the presence of familiarity in predicting IS continuance intention. Thus, familiarity (affective factor) is the stronger predictor of IS continuance intention as opposed to the cognitive factors. This contributes to the existing body of knowledge by affirming that there is a possibility that affective factors are better at explaining IS continuance intention than cognitive factors.

This study also presented evidence that most users would intend to use the device in a mandatory setting. This resulted in a dependent variable that was non-normal. More conservative non-parametric statistical methods were used, to verify the validity of the results achieved by normal parametrical statistical methods. There are previous studies in IS continuance that have focused on non-parametric statistical methods in the past, but during the time this present research was conducted, there appeared that there were no known studies that have presented comparative results of both parametric and non-parametric tests.

It was also argued that task TTF and perceived service availability are predictors of perceived post usage usefulness. This also contributes to the existing body of knowledge as these variables have extensively been used in TAM based studies but not adapted to IS continuance studies within a mobile computing mandatory context, which were known of at the time when this research was carried out.

6.3   Contribution to Research

This study also makes a contribution to theory in that it adds to the existing body of knowledge in the field of IS continuance.

This is achieved by demonstrating that the core IS continuance model by Bhattacherjee (2001) can be extended to include additional constructs to better predict IS continuance. The additional constructs have been adapted for IS continuance from

adoption-focused studies, and added as determinants to perceived post-usage usefulness and IS continuance intention.

In addition to the cognitive factors, an affective factor was added as a predictor of IS continuance intention. As a result, this study presented that the affective factor to be the stronger predictor of IS continuance intention as opposed to the cognitive factors. This further contributes to the existing body of knowledge by affirming that there is a possibility that affective factors are better at explaining IS continuance intention than cognitive factors.

All the constructs have been operationalised, using measures as described in previous literature and adapting it for this specific context. As a result, a contribution to research is also made through the validation of these scales to test the hypotheses of the extended model in the field of mobile computing use by field service staff. The hypotheses were tested using both parametric and non-parametric statistical analysis techniques. Both statistical techniques are very rarely used in IS Continuance studies. Another contribution is made by demonstrating that the use of mobile computing services by field service staff in a South African utility organisation (mandatory) setting can be empirically observed and thus the extended IS Continuance model being validated and following the results a new model is proposed (Figure13).
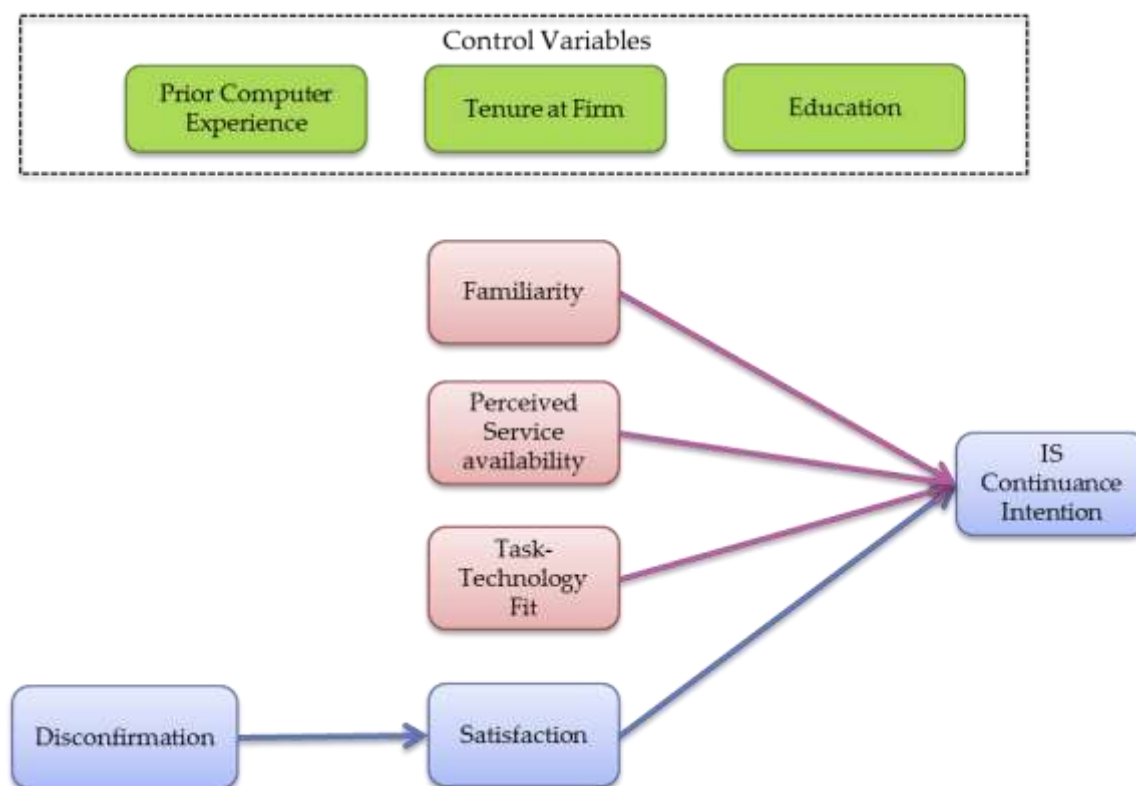
Figure 13 : Proposed IS Continuance Model for Mobile Computing Use by Field Staff

6.4   Contribution and Recommendations to Practice

This study offers some insights to practitioners who are planning to implement a mobility solution for their field workers. The insights discussed below list factors that need to be considered to ensure that their users will continue to use the technology after initial adoption.

Smartphones are gaining traction in the mass market and by the end of 2015, it is likely that half of all South African adults will be using a smartphone (Goldstuck, 2014). As a result of this increased usage of consumer gadgets, some field workers might expect their mobile work devices to be as easy to use as their personal devices. This means that organisations should consider creating an experience that mimics that of consumer smartphones (Cole, Lee, Reddy and Wei, 2013). Sufficient time should be taken by organisations when designing the user interface of the applications. This study

indicated that familiarity is the strongest predictor of IS continuance intention. Thus if the user interface of the device used for work purposes is quite similar to that of consumer devices then it is more likely that the user will be more familiar with it and continue to use it.

As mentioned in the study, familiarity grows accumulatively over time and thus it is not a specific event. Therefore, when practitioners implement mobile devices for field workers in their organisations, they should ensure there is sufficient practical training for the users as opposed to just theoretical training. Refresher practical training is highly recommended as the more time the user spends on the device the more familiar the user gets with the device and it then becomes second nature. Organisations should also look into providing "warm" on-the-job training (such as a hotline and expert user groups) for users to further build up familiarity with the device.

Utility companies should also ensure that they develop process-specific applications. This will ensure that mobile field workers have access to and can send back the right information to the back office so it can enable them to complete their tasks that they supposed to do. If the technology does not fit the task as accurately as possible, then field workers will most likely resort to old processes that do not require mobile devices to complete the job. Utility organisations will generally have disparate workforces each working according to their own processes. It is not uncommon, for instance, for an organisation's operations to comprise many work tasks such as maintenance, restoration, patrol and inspection, and customer-driven work. Each function has some unique requirements and therefore the organisations should ensure there is a central control or architecture function to ensure these processes do fit the technology. Without a central oversight function, the processes and device applications might end up being a mismatch over time and thus lead to users not using it. In addition, to increase the likelihood of users continuing to use the device, organisations should involve a small numbers of users at every major phase of the project, including process design, proof of concept, user acceptance testing and phased deployment as this would ensure that the technology matches the task.

Connectivity is one of the most pivotal components of mobility. Field workers who work for utility organisations generally have to work in urban as well as rural areas and may find various limitations in cell phone network connectivity that might hinder the services offered by the mobile device. This can easily lead to a level of frustration with field workers. Therefore practitioners should ensure that the field service applications on the device must be able to work in both online and offline mode. This will aid field technicians to be able to access and send critical information and update records that will sync once they reach an area of connectivity.

Mobility represents the future for the utility industry as it will enable significant operational improvements (Cole, Lee, Reddy and Wei, 2013). However, a mobile implementation for field staff might have its challenges that need to be addressed in terms of the 'people', 'process' and 'technology' model. This study contributes to the industry by offering insights in the context of IS continuance.

6.5   Limitations of the Study

Due to the nature of this study, there are a number of limitations. A self-reported questionnaire was used as a survey instrument and as a result it captures users' "intentions" as opposed to actual usage in the field. Due to ethical reasons, actual data of usage of the field workers of the organisation in question could not be obtained as the database contained personal information which could not be shared.

There is a possibility of common method bias as all the independent and dependent variables are measured at the same time using the same instrument (Podsakoff et al., 2003). This is due to the limited time period for the collection of data for this particular study, and thus all the variables had to be measured at the same time. This time limitation could have also resulted in a number of respondents not responding as they could have been absent from work at the time. This short time window for data collection could have also resulted in the response rate of 12%, as more follows ups

could not be done. It could be argued that the response rate could have been influenced by a non-response bias. Due to the time limitations, a section of the non-respondents could not be polled to test the significance of this bias. However, this bias is mitigated as the sample demographics have included all field technicians from one organisation and as the study was carried in a mandatory setting, the majority of the users were already using the devices for a period of time already.

Despite the response rate of 12%, this was more than sufficient for the statistical techniques needed for this study. During the statistical analysis, there was a possibility of not controlling for all confounds within this study, but analyses have indicated that the controls that were catered for were not significant to influence the results.
Since the research was carried out in a utility organisation within South Africa, the results cannot necessarily be generalised to all organisations or to other countries.

Caution should also be taken not to make causal inferences, especially since familiarity and IS continuance intention may be driven by the mandatory nature of use (they have a shared cause) rather than familiarity driving IS continuance intention. The results of this study should be carefully interpreted.

Recommendations have been made in the following section for any researchers who wish to continue with further studies in this particular subject area.

6.6   Future research opportunities

There have been many studies in the area of IS continuance but most of the models have been using cognitive factors to explain IS Continuance such as studies by Bhattacherjee, (2001) and Bhattacherjee et al., (2008). However, there has been studies looking at affective behaviours as well, such as studies by Lee and Kwon (2011), Agarwal and Karahanna (2000), Kim Chan and Chan (2007) and Zhang and Sun (2006). This present study has combined cognitive and affective factors to explain IS continuance. However, other researchers have argued that IS continuance is actually habitual and they have

proposed empirical models based on habit (Cheung and Limayen, 2005, Kim et al. 2005; Limayem et al. 2007). Because there are so many different types of avenues followed in the field of IS continuance, there are future research opportunities to test the strength of all these types of empirical models within one study and context and thus obtain a fair comparison of each. This could offer further insight by determining which model is better at explaining IS continuance intention.

This present study was a cross-sectional study, but there is an opportunity for the results to be strengthened if the study design was longitudinal instead. A longitudinal study design will allow several observations of the same field service staff over a period of time and thus able to detect developments or changes in the characteristics of the target population and how it affects the hypotheses over time.

This study also just touched on the use of quantile regression analysis to test the hypotheses. The advantage of quantile regression over OLS regression is that it can estimate the effect of the predictor variables at any point or quantile on the distribution as opposed to using the average of the entire distribution. Therefore there is an opportunity to use quantile regression and test a few more points or quantiles on the distribution curve. This will give great insight into the model by providing separate results of those respondents whom have agreed not to continue to use the target system against those who have agreed to continue to use it. The distribution of IS continuance intention can be divided in as many quantiles as deemed appropriate for a particular study and the results can be compared against each other.

Finally, there is an opportunity to carry out this study across multiple organisations that uses mobile devices for field staff and this would validate the model even further.

6.7 Conclusion

Although a considerable amount has been written about IS continuance and many suggestions of future research have already been identified, this research has delved

around various areas and therefore it seems that there are more questions raised than answered. From a methodological point of view, the question that could be asked is why do IS researchers opt to normalise data as much as possible to fit particular parametric statistical techniques? Is this done purely out of convenience? Should it not be more accurate to choose the appropriate statistical technique to fit the characteristics of the data instead, as opposed to the other way around? Researchers in the IS field should consider breaking away from this tradition and look at the alternative instead. For example, quantile regression offers a more complete statistical model than OLS regression (Yu, Lu and Stander, 2003).

The *pièce de résistance* of this research report is answering the call of De Guinea and Markus (2009) whereby they called for IS continuance research that focuses on behaviour that is not consciously controlled (influences of emotion on behaviour) to that of cognitive reasoning. By developing an extended IS continuance model, this study has answered the main research question, and found that when faced with tasks which are repetitive in nature, field workers in a mandatory setting are more influenced by affective factors than cognitive.

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8 ANNEXURE A – TOP 25 IT JOURNALS

List of Top 25 Journals Adapted from (Mylonopoulos and Theoharakis 2001) and (http://home.aisnet.org/displaycommon.cfm?an=1&subarticlenbr=356)	
1	MS Quarterly
2	Communications of the ACM
3	IS Research
4	Journal of MIS
5	Management Science
6	IEEE Transactions (various)
7	Journal of Information Technology
8	Decision Sciences
9	Decision Support Systems
10	Information and Management
11	European Journal of IS
12	Journal of the AIS
13	ACM Transactions (various)
14	Data Base
15	Organization Science
16	Information Systems Journal
17	Academy of Management Journal
18	Communications of the AIS
19	IEEE Computer
20	Journal of Strategic IS
21	Admin. Science Quarterly
22	Academy of Management Review
23	Int'l Journal of E-Commerce
24	ACM Computing Surveys
25	Accounting, Management & IT

9 ANNEXURE B – SEARCH RESULTS FROM PICO FRAMEWORK

9.1 Study Selection

In order to begin searching for articles to determine the extent to which the topic has been covered before, keywords that reflect the topic of interest have to be identified. An adapted version of the PICO framework was used for this particular research to build the search string as seen in the figure below.

Population	mandatory OR workers OR employee OR organisation
AND	
Intervention	mobile OR "information systems" OR "information technology"
AND	
Outcome	"continued use" OR "continuance" OR "post-adoption use"

Figure 14 - Adapted PICO Framework (Sayers, 2008)

According to Sayers (2008), the PICO framework aids searching for all possible combinations of search terms. The search terms are linked together through logical Boolean operators (Sayers, 2008). All search terms under one heading are linked by a Boolean OR, and each group is linked by a Boolean AND. In this research paper there is a minimum of three search terms in each thematic group and there are three thematic groups. Therefore the adapted version of the PICO framework will yield ($3!^3$=216) 216 search combinations when applied to the various online databases.

9.2 Search Strategy

According to Schwartz and Russo (2004), 6 databases are sufficient to be searched in order to obtain research from the top 25 IS journals. They recommend the following 6 databases: Ebsco Host Business Source Premier; ISI Web of Science; Proquest; Science Direct; JSTOR and ACM Guide. The top 25 IS journals according to Mylonopoulos and Theoharakis (2001) can be seen in annexure A.

In addition to entering a search string, certain databases allowed filters to be applied. The following were applied: peer reviewed journals only (where possible); time frame from 1985 to present and English language only.

The Science Direct and JSTOR databases allowed subject areas to be included or excluded. Due to the nature of these two databases, filtering on subject areas was necessary due to the databases vast coverage of various subjects such as agriculture to veterinary science for example. Table 27 indicates the subject areas selected for the Science Direct and JSTOR databases.

Database	Subject areas searched for:
Subject areas were included for JSTOR	Social Sciences, Psychology, Management and Organisational Behavior, Business.
Subject areas were included for Science Direct	Business, Management and Accounting, Computer Science.
Table 27: Selected Database Subject Areas	

Applying the search string and the filtering criteria yielded 767 results in total. On certain databases, automatic filtering of non-journal articles was not effective and all these were excluded manually. Identification on title reviews was carried out for relevance. Any article not relating to technology adoption and continuance use (and relevant synonyms) was excluded. In the absence of an unclear title or lack of information, the abstracts were reviewed instead. This resulted in the exclusions of

non-IT artefact studies, trade journals, and articles without abstract. The remaining articles abstracts were screened and non- empirical studies, studies not underpinned by a particular theory or model and qualitative study designs were excluded. This resulted in 139 articles.

The remaining 139 articles were all related to adoption and post-adoption of IT studies in various different contexts. Due to the nature of the question, studies that were specifically related to post-adoption IT usage were included and IT adoption only studies were excluded. This was carried out doing extract reviews. Further extract reviews and detailed reading were carried out on the remaining studies of post-adoption use. All contexts in a voluntary setting were excluded. This included all post adoption studies done in the context of e-commerce from a customer perspective; use of online banking and self-service technologies; web or mobile internet use; use of e-auction sites and use of social media sites. Annexure B illustrates the complete procedure of the searching method used to obtain the final list of articles.

The final list consisted of 9 articles of which all were read further in detail and discussed in the following sections below. Annexure C provides more detail on each study.

Bhattacherjee's (2001) research was carried out in the context of online banking by customers, which is a voluntary setting. This paper had to be included as an exception as the model that he proposed is foundation of the present research as well

Search String - ("information technology" OR "information systems" OR mobile) AND ("continued use" OR "continuance" OR "post-adoption use") AND ("worker" OR "employee" OR "mandatory" OR "organization")

- The following filters were applied to all databases:

  - Journals only (where possible)
  - Time Frame 1985 – Present
  - Language: English Only

- The Science Direct and JSTOR databases allowed subject areas to be included or excluded.

  - The following subject areas were included for JSTOR: Social Sciences, Psychology, Management and Organisational Behavior, Business.

  - The following subject areas were included for Science Direct - Business, Management and Accounting

- The Proquest search yielded 1101 results from various journals. The top journals according to Schwartz and Russo(2004) were selected.

  - The Journal of Computer Information Systems, European Journal of Information Systems, MIS Quarterly, Decision Sciences, Information Technology & People, Journal of Information Technology, Journal of Enterprise Information Management , Information Technology and Management

| EBSCO (n=9) | ISI Web of Science. (n=7) | Proquest (n=102) | Science Direct (n=289) | JSTOR (n=210) | ACM Guide (n=67) |

Search results excluding duplicates (n=367)

Further exclusions were done.
- Exclusions of non-IT artifact studies, trade journals, and articles without abstract and full text that filters could pick up
- Non- empirical studies
- Studies not underpinned by a particular theory or model
- Excluded Qualitative study designs

- Due to nature of certain databases, automatic filtering of non-journal articles was not effective and all these were excluded manually.

- Identification on title was carried out for relevance. Any article not relating to technology use, perceptions and intention; adoption and extended use (and relevant synonyms) were excluded

Search results excluding duplicates
(n=139)

Search results
(n=139)

Further exclusions were done.
- Studies specifically related to IT Adoption only as apposed IT post adoption.
- Studies specifically related to post adoption use in a voluntary setting or consumer context as opposed to a mandatory work setting

Results
(n=21)

Further exclusions were done.
- Studies specifically related to post adoption use at organisational level as opposed to individual level (2)
- Studies specifically with the context of a tertiary or higher learning institution where use of an IT phenomena was voluntary (11). Studies where E-learning was mandatory was not excluded.

Final results
(n=9)

10 ANNEXURE C – LITERATURE REVIEW

Reference	Context	Purpose of Study	Methods Used	Demographics/Level of study	Variables Examined	Key Findings	Limitations
Information Technology Adoption Across Time: A Cross-Sectional Comparison of Pre-Adoption and Post-Adoption Beliefs Author(s): Elena Karahanna, Detmar W. Straub and Norman L. Chervany Source: (1999) MIS Quarterly, 23(2), pp. 183-213	Financial institution headquartered in the Midwest in 1993.	The current study combines innovation diffusion and attitude theories in a theoretical framework to examine differences in pre-adoption and post-adoption beliefs and attitudes. The theoretical model for the study combines aspects of the Theory of Reasoned Action (Fishbein and Ajzen 1975) with aspects of Innovation Diffusion Theory (Rogers 1983) in a complimentary manner.	A cross-sectional field study was conducted. Descriptive statsitics and Partial Least Squares (PLS) were used to analyze the data	951 Questionnaires sent to the financial institution employees. The response rate was 28.2%. Of these, 107 were from potential adopters of Windows and 161 were from users of Windows. Nineteen of the 107 potential adopters had no knowledge of Windows and they were, therefore, dropped. The final sample for potential adopters was 77 and for users 153,	Dependent Variable: Behavioural Intention Independent variables: Attitude, Subjective Norm and Perceived Voluntariness	Study is conducted in a mandatory setting and the results show that influences from the organizational environment as positive effect on uses to adopt at the beginning stages but does not have a big effect for continuance. On the other hand user attitude has a more of an effect on continued use. Users and potential adopters differ in the set of behavioural beliefs underlying attitude. Potential adopters have a richer set of behavioral beliefs than users. Whereas potential adopter attitude is composed of trial ability,	Sample is in one organisation only. Measurements were taken one point in time. The organization has migrated to a new Windows OS across time thus there were 2 questionnaires. One for those that have be migrated for a few months (post adoption) and another for those that is about to be migrated. Measurement is

							perceived usefulness, result demonstrability, visibility, and ease of use, user attitude is composed of perceived usefulness and image. Work networks are important determinants of subjective norm for both adopters and users. However the groups differ which influences them.	self-reported which would likely be differences to actual usage.
Expectation Disconfirmation and Technology Adoption: Polynomial Modeling and Response Surface Analysis Authors: V. Venkatesh & S Goyal Source: (201) MIS Quarterly, 34(2),	Organisation where employees are introduced to a new technology and hence required mandatory usage. The technology was a HR system.	The purpose of this study is to enhance the understanding of the Expectation-Disconfirmation Theory (EDT). The authors used polynomial modeling and response surface analysis as opposed to just linear analysis to test EDT. Secondly the authors draw on theories of cognitive dissonance, realistic job preview and prospect theory to propose an enhanced version of EDT	First measurement was carried out 1 week after training. The second measurement was carried out after 6 months which allowed sufficient post adoption experience. Polynomial	1141 out of 2500 employees responded of which 41% were female. The average age was 36 years and had about 7.6 years computer experience.	Dependent variable: Behavioral Intention The other variables are Disconfirmation, and Usefulness (Attitude) While the original EDT research used satisfaction as a	Venkatesh and Goyal argues that cognitive dissonance theory mentions that there are various degrees of intensity in relation to discomfort. Hence there should be level of disconfirmation in the EDT theory. Based on this they draw on the conclusion that even if there is positive or negative disconfirmation on what the user initially expected the result would be negative on behvaioural intention with negative	Polynomial modeling does have its limitations. First it suffers from the same limitations as linear regression analysis in that it assumes no bias but the co-efficients estimates tend to biased in reality

pp. 281-303			modeling and response surface analysis was applied to analyze the data.		predictor of behavioural intention, this study focuses on usefulness and attitude as direct predictors of behavioural intention.	disconfirmation having a greater impact on behavioural intention. Venkatesh & Goval argues the greater the degree of difference between the pre and post exposure usefulness the rate of Behavioural Intention decreases at a faster rate. Their findings are in line with the original studies but provide a better insight as the original studies only focused on absolute values.	Also polynomial modeling can only be applied to studies using congruence between component measures. (e.g pre and post usefulness. Measurement is self-reported which would likely be differences to actual usage.
Explaining Employees' Extended Use of Complex Information Systems Authors: J.J. Po-An Hsieh and Wei Wang	Mandatory setting in the manufacturing industry in China. Employees are using an ERP system	Purpose of this study is to investigate extended use of complex IS. Extended use is defined as exploiting more functionality of a system as opposed to mere basic functionality. With extended use companies can realize the full benefits from the investment	Data Collection: Field survey of employees. Structural Equation Modelling was applied for data analysis. This procedure	A response of 200 employees. Female respondents made up 54%. Most of the respondents were between 18 years to 39 years of age. The majority of respondents had a bachelor's degree.	Dependent variable: Extended Use. Independent variables: Perceived usefulness; Perceived ease of use; confirmation of expectation	The hybrid model best describes extended use. The dominant variable having most effect on extended use is PEOU. This contradicts most studies that says PU is the dominant. Satisfaction has liitle impact on extended use. The reason being that when the user gains	Data was collected at one point in time as opposed to a longitudinal study. Survey was carried out on employees of 1 firm only.

Source: (2007) European Journal of Information Systems 16, pp.216–227			was applied to both TAM and ISC and a hybrid of the two models.	Only 1.1% had a junior high school or lower qualification and 23% had senior high school qualification	with satisfaction as intermediary variable	experience on routine functionality they have gained satisfaction as it was mandated to them. When the users have to use the extended features the satisfaction is marginal as they already achieved the basics already. The satisfaction compared to the extra effort they have to endure now for the additional use is more important. Hence PEOU is more important.	Measurement is self-reported which would likely be differences to actual usage.
Explaining IS continuance in environments where usage is mandatory

Authors: Øystein Sørebø and Tom Roar Eikebrokk

Source: (2008) Computers in Human Behavior 24, pp. 2357–2371 | Mandatory setting in a Scandinavian Ferry company that has been using computers since the 1980s.

Employees are mandated to using a cash transaction system | Purpose of this study is to explain IS continuance in a mandatory setting by proposing a model and empirically testing it | Data Collection: Field Survey.

Structural Equation Modelling was applied for data analysis.

The procedure was applied to the proposed model only | The employee's of the ferry firm that were surveyed were mostly shop assistants or waiters. There was a 32% response rate to the survey. Average age is 40yrs old, held a college degree and had 10 years computer experience. | Dependent variable: User Satisfaction.

The other variables are PU, Confirmation, and Ease of Use.

This is an adapted model from Bhattacherjee's (2001) model. The Intend to Use | Satisfaction is adequate criterion to measure for continued use in a mandatory setting. PEOU is a significant antecedent for satisfaction and the primary variable to influence satisfaction.

PU was not so significant. As the IS is mandated and there is no choice hence the usefulness might be too obvious or ignored and ease of use becomes more important to the users. | Data was collected at one point in time as opposed to a longitudinal study.

Survey was carried out on employees of 1 firm only.

Measurement is self-reported which would |

					variable was excluded because in a mandatory it's not appropriate. Users are mandated to use the IS irrespective if the usage is shallow which causes unproductivity.\n\nBhattacherjee's (2001) model also excluded PEOU which was included in this model.		likely be differences to actual usage
Understanding Web-based Learning Continuance Intention: The role of subjective task value\n\nAuthors: Chao-Min	Taiwanese university students were surveyed who registered for an e-learning course. Although this is considered a	Purpose of this study is exploring individual's intention to continue using web based learning by investigating the impact of "value" and "fairness".	Data Collection:\n\nField Survey.\n\nConfirmatory factor analysis was applied to assess the construct	A response rate of 33.7% of which 61% were female. 56% of the respondents have earned a bachelor's degree and 25% received a master's degree. The average age was 27 years, with	The study draws on the concept of Subjective Task value and fairness theory.\n\nFairness is defined with three dimensions	Students who experience high levels of distributive and interactional fairness were more satisfied to use the system. Procedural fairness did not make a big enough impact.\n\nThe influences of attainment	Only tested on part-time students as they were the only group to be offered a web based learning course and those who were active

| Chiu , Eric T.G. Wang

Source: (2008) Information & Management 45, pp. 194–201 | voluntary setting, the fact that credits are issued for the course could be seen as the IS is enforced. If the students do not use the IS then they will not obtain the credits for the course. It's a similar scenario to a work environment, if the employee does not use a particular IS that's crucial to the success of the job, he/she stands a chance of disciplinary action. | | validity | 80% at least taken one e-learning course and spends average of 17h per week using the internet | namely Distributive, Procedural and Interactional.

Subject –Task Value is defined by 4 components namely Attainment value, Intrinsic Value, Utility value and Cost

All of these variables have impact on Satisfaction which in turn influences Continuance Intention hence being the dependent variable.

The Subject Task Value | value, intrinsic value and utility value were significant and cost was not.

The key finding is that utility value and satisfaction make a contribution to intention to use the system. | on the course. Results could be different for others.

The study was done at one point in time. Longitudinal studies could achieve a different result. |

					components have a direct relationship with Continuance Intention as well.		
An empirical analysis of the antecedents of web-based learning continuance

Authors: Chiu, Sun, Sun and Ju

Source: (2007)Computers & Education, 49, pp.1224–1245 | Taiwanese university students were surveyed who registered for an e-learning course. Although this is considered a voluntary setting, the fact that credits are issued for the course could be seen as the IS is enforced. If the students do not use the IS then they will not obtain the credits for the course. It's a similar | Purpose of this study is to explore individual's intention to continue using web based learning by investigating the impact of "UTAUT" extended with the "expectancy-value model". | Data Collection:

Field Survey.

Confirmatory factor analysis was applied to assess the construct validity | A response rate of 9.5% of which 51% were female. Average age was 34 years, with 77% at least taken 1 e-learning course and spends average of 20h per week using the internet. | Dependent variable : Continuance Intention.

UTAUT Variables:

Performance expectancy, effort expectancy and social influence.

Subject Task Value variables: attainment value (the personal importance of doing well on a task), intrinsic value (enjoyment from performing | Performance expectancy (pre exposure usefulness) and utility value (post-exposure usefulness) has the same effect on continuance intention for working professionals with limited time for continuing education.

Social influence and facilitating conditions were not significant predictors of continuance intention.

Additionally, social isolation, delay in response, and risk of arbitrary learning were not significant negative predictors of continuance. Apparently learners feel that social isolation and delay in response are negative | Only tested on part-time adult learners as they were the only group to be offered a web based learning course. And those who were active on the course. Results could be different for others.

Study was done at one point in time. Longitudinal studies could achieve different result. |

	scenario to a work environment, if the employee does not use a particular IS that's crucial to the success of the job, he/she stands a chance of disciplinary action.				the activity), and utility value (how well the task relates to current and future goals) In addition self-efficacy was included in the extended model while the cost component of subjective task value was conceptualized in terms of the negative aspects of engaging in the task	aspects of Web-based learning, but they still have strong intentions to continue using it Intrinsic value was the strongest predictor on continuance intention	
Predicting Different Conceptualizations of System Use: The Competing Roles of Behavioral Intention, Facilitating	Employees of a telecommunications firm being introduced to web based transactional systems	Purpose of this paper is to introduce another variable namely "Behavioural Expectation" to address some of the shortcomings of "Behavioural Intention" The second objective of this paper is to understand the	A survey was done at the introduction of the new technology and every 3 months for duration of 9 months data was collected.	321 employees provided responses (46% response rate) at all 3 points of measurement during the 1 year duration of study. 34% were female.	Dependent Variable: IS Use. Use is divided into 3 grading's namely Frequency, Duration and Intensity	Behavioral intention related more strongly to duration of use and behavioral expectation related more strongly to frequency and intensity of use. The results from our longitudinal study provided	Prior research has suggested some limitations of self-reported use as opposed to actual use

| Conditions, and Behavioral Expectation

Authors: Venkatesh et al.

Source: (2008) MIS Quarterly 32(3), pp. 483-502 | | dependent variable of system use better by testing behavioural intention and expectation and facilitating conditions against the 3 conceptualisations of system use namely frequency, duration and intensity | Data was analysed using Partial Least Squares(PLS). This technique is a form of structural equation modeling, | Average age was 37.2 years spanning all levels in the organisational hierarchy | The independent variables are Behavioural Intention which is predictor of Behavioural Expectation which is in-turn a predictor of Use.

The other independent variable is Facilitation Conditions which is predictor of Behavioural Expectation which is in-turn a predictor of Use

Gender, Age and Experience are moderating variables | strong support for their proposed model explaining 65%, 60%, and 60% of the variance in duration, frequency, and intensity of system use respectively, thus explaining substantially more variance compared to prior research according to Venkatesh et al. | |
| Perceived Fit and Satisfaction on Web Learning | Students at a Taiwanese university. | The purpose of this paper is integrate the IS continuance model with task-technology fit | Data Collection: Field survey. | 165 students responded with 55% being female. They had | Mediating variable: VLS Continuance | All constructs had a positive effect however perceived fit was 3 times more important | "Positive impact on Learning" is measured |

Performance: IS Continuance Intention and Task-Technology Fit Perspective. Author: Wen-Shan Lin Source: (2012) International Journal of Human-Computer Studies, Article in Press.	Although this setting is considered voluntary, it was included in the final articles of this systematic literature review. Students will register for the particular course and this particular course the users use a VLS as an aid to distribute class material, give feedback and submit coursework online. In order to obtain the credits for this course it	to better understand intention to continue using the virtual learning system(VLS) and the impact it has on learning. In other words how does variables perceived fit and satisfaction influence continuance which in turn has a positive impact on learning	Structural Equation Modeling was applied for data analysis. The procedure was applied to the proposed model only	an average of between 1 and 2 years' experience using VLS. 98.8% have submitted work online which was one of the basic functionality of the system. The students were mostly doing IS and business administration at the university.	intention. Dependent variable: perceived impact on learning The other antecedent variables: fit and satisfaction.	than satisfaction on perceived impact on learning The relationship between continuance intention on "perceived impact on learning" is not as big as fit and satisfaction on "perceived impact on learning"	subjectively as opposed to using real scores achieved in assessments. Perceived fit could be operationalized in a different way. In this instance it is defined as the ability to gather, construct and share information using VLS.

	implied that that if the VLS system should be used otherwise the student would not be successful.						
The influence of individual differences on continuance intentions of enterprise resource planning (ERP) Author(s): Chou, Shih-Wei; Chen, Pi-Yu Source: (2009) International Journal Of Human-Computer Studies ,Volume: 67 Issue: 6 Pages: 484-496	Survey Questionnaire sent to 15 firms in 6 industries in Taiwan	The purpose of this paper to propose if individual differences such as computer self-efficacy, computer anxiety and personal innovativeness, on continuance intention	A cross-sectional field study was conducted. Descriptive statistics and Partial Least Squares (PLS) were used to analyze the data	302 responses were received from individuals from 15 firms in 6 industries in Taiwan	Computer self-efficacy, computer anxiety and personal innovativeness, on Satisfaction and continuance intention	The research shows that in addition to satisfaction and PU , computer self-efficacy, computer anxiety and personal innovativeness are predictors of continuance intention	The population sample were mostly developers and some users. User beliefs change over time and this study is cross sectional and not longitudinal

Table 28 Summary of literature of studies of IS continuance in a mandatory setting

11 Annexure D - Cover Letter and Questionnaire

February, 2013

Dear Sir/Madam

My name is Shamil Talip. I am a student studying information systems at Wits University. I am conducting a survey on the EDA (Mobile Computing Device) for my Masters degree thesis. The purpose of the study is to examine the factors that will explain the continued use of rugged mobile computing devices (with work related applications) by field workers of a South African energy utility firm. As there are about 4400 field workers across all 9 provinces in South Africa using rugged mobile computing devices, a stratified random sample of field workers was chosen.

If you are a field worker that has been given a rugged mobile computing device as part of tasks you have to carry out, I would like to personally invite you to participate in the above-mentioned research project by completing this survey. If you wish to participate, please go to the URL below or if you wish, you could print the word document and drop it off with your mobility champion

http://kwiksurveys.com/s.asp?sid=hou2hc7a6ktpeof217339

The survey should only take about 15 minutes of your time. There is no compensation for responding nor is there any known risk. In order to ensure that all information will remain confidential, please DO NOT put your name or employee number on the survey. All answers will be kept confidential. Only group results will be presented (not individual answers) to my university supervisor and examiners. This research has been approved by the University's ethics committee. Your help with this research is strictly voluntary and there are absolutely no consequences if you wish not to partake in this survey.

Return of an answered survey will indicate your consent to participate in this study. The results of this survey will be presented to Wits University as part of my degree.

If you have questions or concerns, please contact me at 0720356287 or Shamil.Talip@gmail.com

Thank your for your time and consideration.

Sincerely,

Shamil Talip

EDA Survey Questionnaire

31 Questions and only takes **8 to 10 minutes**. Completely **<u>Anonymous.</u>** No name, ID or Unique number needed.

For the following 24 questions in this section, please indicate the extent to which you agree or disagree with each statement.

	Strongly Disagree	Disagree	Somewhat disagree	Neither agree or disagree	Agree	Agree Somewhat	Strongly Agree
Using the EDA allows capturing milestone feedback better (i.e. improves performance)	○	○	○	○	○	○	○
Using the EDA's GPS functionality gets you to site quicker (i.e increases productivity)	○	○	○	○	○	○	○
Using the EDA helps to make better decisions as the work order contains more information (more effective)	○	○	○	○	○	○	○
I find the EDA to be useful in my job	○	○	○	○	○	○	○
Capturing milestone feedback is better than I had initially expected	○	○	○	○	○	○	○
Getting to site quicker is better than I had initially expected	○	○	○	○	○	○	○
Work order information on the EDA is better than I had initially expected.	○	○	○	○	○	○	○
My experience with using the EDA exceeded my initial expectations.	○	○	○	○	○	○	○
I intend to continue using the EDA on my job.	○	○	○	○	○	○	○
I intend to continue using the EDA applications for processing work orders.	○	○	○	○	○	○	○
I intend to continue using the EDA applications like GPS for my job responsibilities	○	○	○	○	○	○	○

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The quality of the cellphone network when using the EDA is good.	○	○	○	○	○	○	○
I can easily access with the EDA as the cellphone signal is excellent.	○	○	○	○	○	○	○
I rate the information sent to the EDA to be excellent.	○	○	○	○	○	○	○
The work orders that I receive is accurate enough for me to attend to a fault.	○	○	○	○	○	○	○
I get the work orders quickly when I need it.	○	○	○	○	○	○	○
The EDA that gives me the work orders are convenient and easy to use	○	○	○	○	○	○	○
The EDA enables me to to receive work orders from any location	○	○	○	○	○	○	○
I am happy telling others about the features of the EDA.	○	○	○	○	○	○	○
I can see the advantages of using the EDA.	○	○	○	○	○	○	○
I find it difficult to explain the benefits of using the EDA	○	○	○	○	○	○	○
I feel familiar using the EDA as its more or less the same as my cell phone	○	○	○	○	○	○	○
I feel familiar with the interface of the EDA	○	○	○	○	○	○	○
I feel familiar with the terms used (e.g. work order, GPS navigation.) on the EDA	○	○	○	○	○	○	○

On scale of 1 star up to 7 stars how do you feel about the overall experience of using the EDA?

	1 Star (*)	2 Stars (**)	3 stars (***)	4 stars(****)	5 stars(*****)	6 stars (******)	7 stars (*******)
With 1 star being very dissatisfied up 7 stars being very satisfied	○	○	○	○	○	○	○
With 1 star being very displeased up 7 stars being very pleased	○	○	○	○	○	○	○
With 1 star being very frustrated up 7 stars being very happy	○	○	○	○	○	○	○
With 1 star being very terrible up 7 stars being very happy	○	○	○	○	○	○	○

General Questions

How long you working for the company ?

- ○ less than 5 yrs
- ○ 5 years or more but less than 10 years
- ○ 10 years or more but less than 20 years
- ○ 20 years or more.

What is your highest qualification?

- ○ ☐ I completed high school
- ○ ☐ I went to college or technikon to get a Diploma
- ○ ☐ I went to university
- ○ ☐ In house company qualifications only

Personal Computing Experience (e.g. checking emails, work related activities.

- ○ I don't use a computer for work or for personal activities
- ○ I spend less than 10 hours per week on a computer
- ○ I spend more than 10 hours per week but less than 40 hours on a computer per week
- ○ I spend 40 or more hours per week on a computer

THANK YOU

Sample screen shots of the online version of the questionnaire

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Satisfaction rating of the EDA

2 On scale of 1 star up to 7 stars how do you feel about the overall experience of using the EDA?

	1 Star	2 Stars (**)	3 stars (***)	4 stars	5 stars	6 stars	7 stars
With 1 star being very dissatisfied up 7 stars being very satisfied	○	○	○	○	○	○	○
With 1 star being very displeased up 7 stars being very pleased	○	○	○	○	○	○	○
With 1 star being very frustrated up 7 stars being very happy	○	○	○	○	○	○	○
With 1 star being very terrible up 7 stars being very happy	○	○	○	○	○	○	○

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3 How long you working for the company ?

○ less than 5 yrs   ○ 5 years or more but less than 10 years   ○ 10 years or more but less than 20 years   ○ 20 years or more

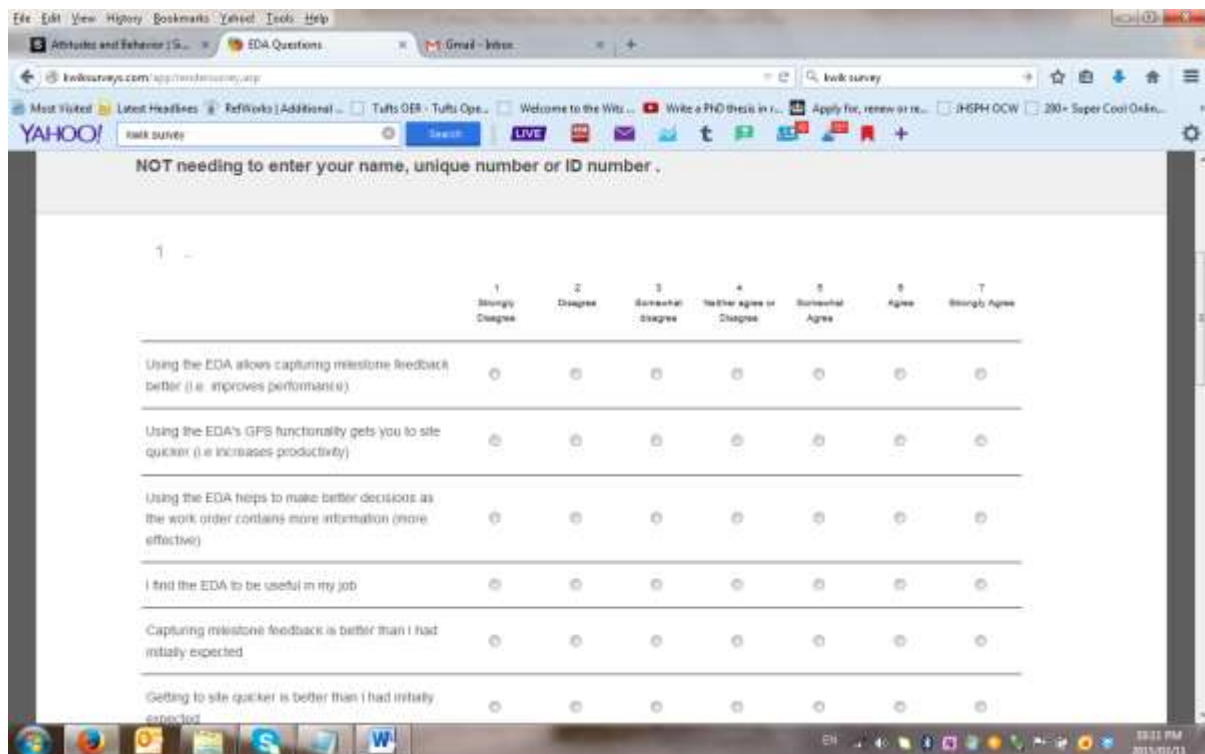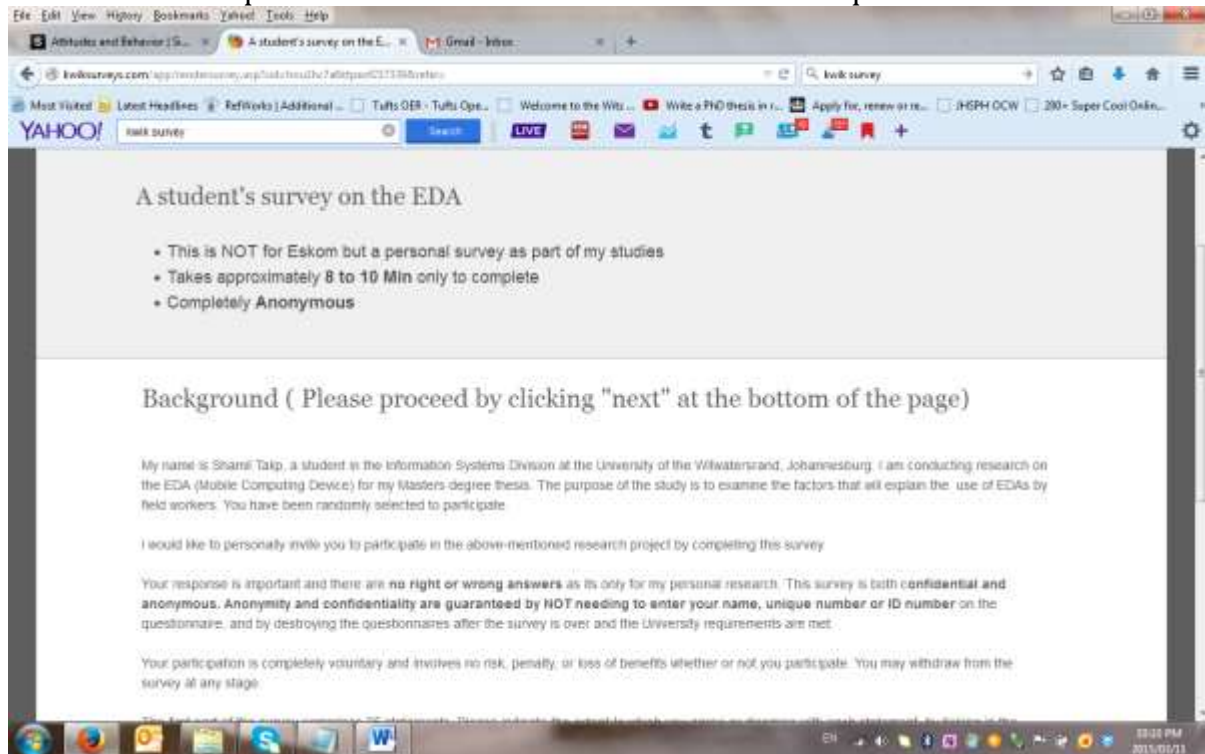4 What is your highest qualification?

☐ I completed high school

☐ I went to college or technikon to get a Diploma

☐ I went to university

☐ In house company qualifications only

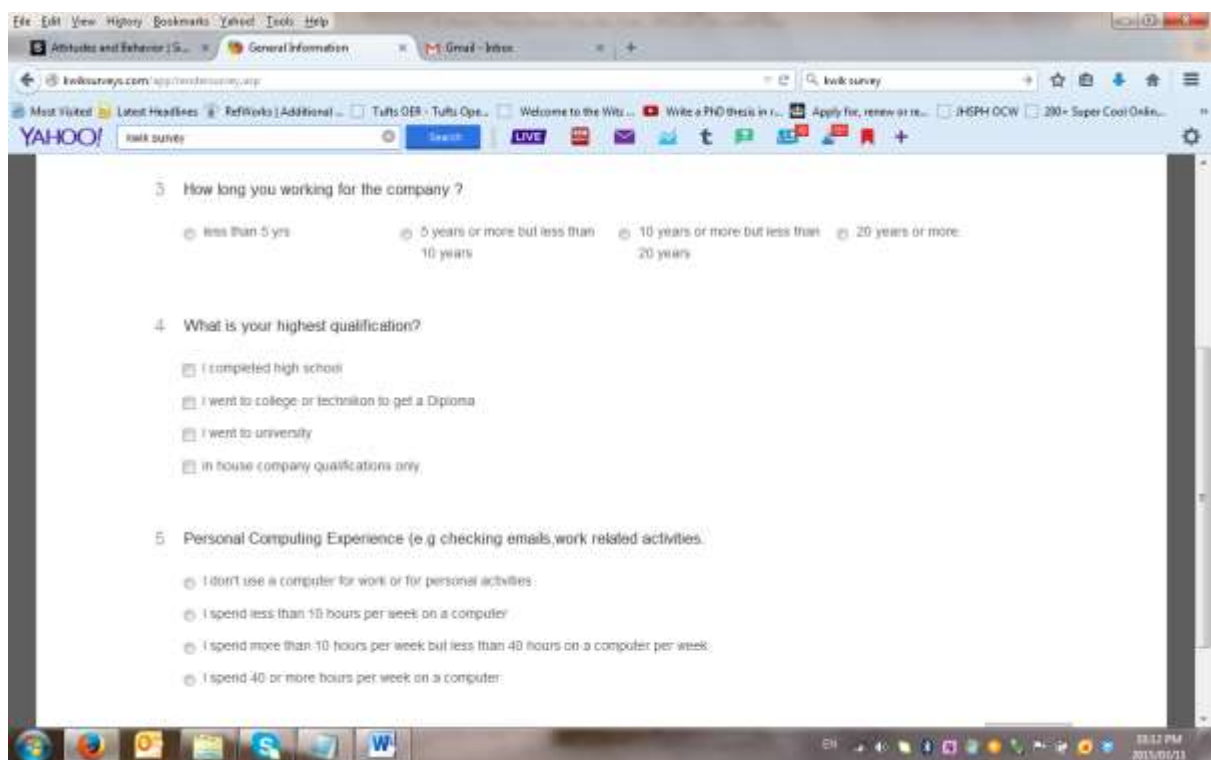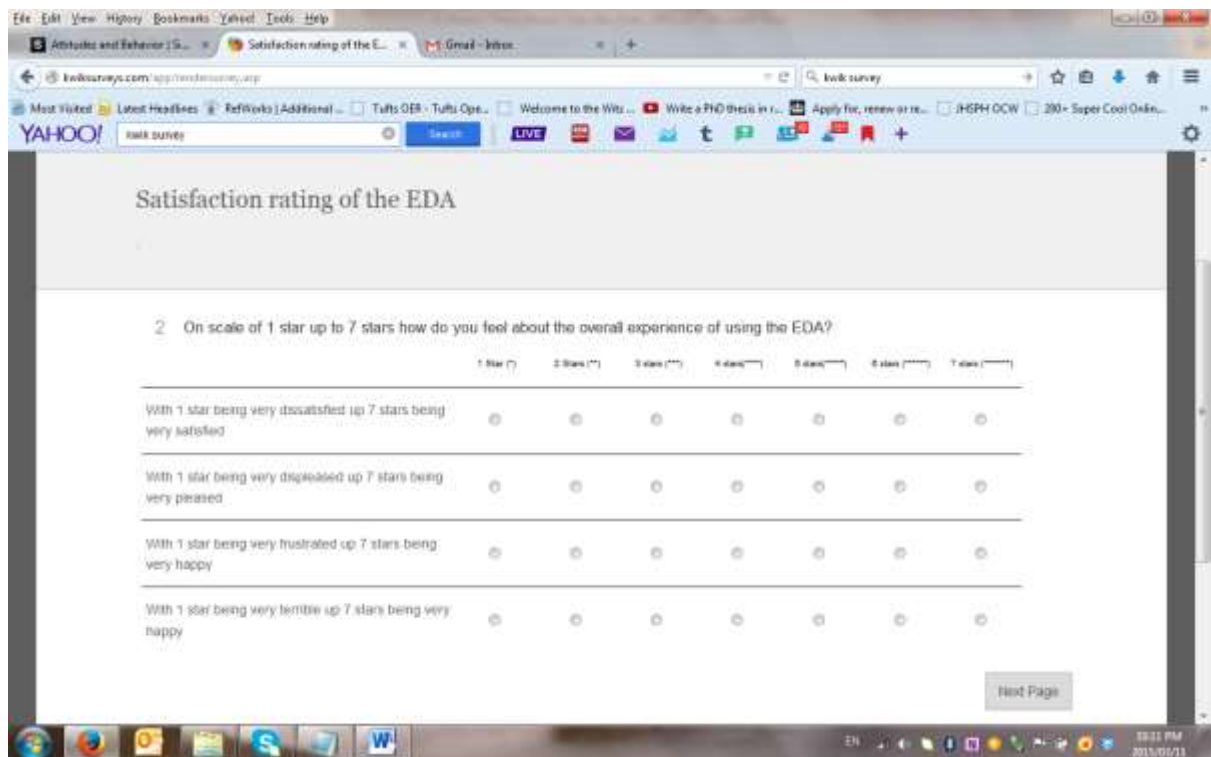5 Personal Computing Experience (e.g checking emails, work related activities)

○ I don't use a computer for work or for personal activities

○ I spend less than 10 hours per week on a computer

○ I spend more than 10 hours per week but less than 40 hours on a computer per week

○ I spend 40 or more hours per week on a computer

12 ANNEXURE E – ETHICS CLEARANCE & PERMISSION

⊛ Eskom

Date: 4th July 2013

Enquiries:
Tel +27 (53) 830-5900

PERMISSION TO CONDUCT A SURVEY

We hereby support Shamil Talip's application, a Masters Student from the University of the Witwatersrand, to conduct a survey with our field service staff. We support the issuing of self-administered questionnaires to our field staff during August 2013 and acknowledge that participation in the survey is completely voluntary.

Permission is granted to Shamil Talip subject to his obtaining ethical clearance to conduct research from the Ethics Committee of the University of the Witwatersrand, Johannesburg and by abiding to its terms.

I have been informed of Shamil Talip's line of research and of the nature of the intervention of the respondents filling in a self-administered questionnaire and the anonymity of the participants guaranteed.

Yours sincerely

Hugh McGibbon
GENERAL MANAGER (Northern Cape)

Eskom Distribution
P.O. Box 606 Kimberley 8301   Eskom Tower 4 George St Kimberley
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Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)
R14/49 Talip

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER H13/08/37**
PROJECT TITLE	Determinants of IS continuance: The role of mobile computing services by field service staff in a South African mandatory setting
INVESTIGATOR(S)	Mr S Talip
SCHOOL/DEPARTMENT	Economic and Business Sciences
DATE CONSIDERED	16/08/2013
DECISION OF THE COMMITTEE	Approved Unconditionally
EXPIRY DATE	11/09/2015
DATE 12/09/2013	**CHAIRPERSON** _____ (Professor T Milani)

cc: Supervisor : J-M Bancilhon

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10003, 10th Floor, Senate House, University.

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to completion of a yearly progress report.**

_____
Signature

_____/_____/_____
Date

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

13 ANNEXURE F – FREQUENCY TABLE

These tables illustrates the frequency of responses of the dependent variable

ContinuanceInt1			
	Frequency	Percent	Valid Percent
Strongly Disagree	5	3.5	3.5
Disagree	2	1.4	1.4
Somewhat Disagree	4	2.8	2.8
Undecided	12	8.3	8.3
Somewhat Agree	17	11.8	11.8
Agree	50	34.7	34.7
Strongly Agree	54	37.5	37.5
Missing			
Total	144	100.0	100.0

ContinuanceInt2			
	Frequency	Percent	Valid Percent
Strongly Disagree	5	3.5	3.6
Disagree	3	2.1	2.2
Somewhat Disagree	2	1.4	1.4
Undecided	7	4.9	5.0
Somewhat Agree	26	18.1	18.7
Agree	55	38.2	39.6
Strongly Agree	41	28.5	29.5
Missing	5	3.5	
Total	144	100.0	100.0
ContinuanceInt3			
	Frequency	Percent	Valid Percent
Strongly Disagree	14	9.7	9.7
Disagree	7	4.9	4.9
Somewhat Disagree	1	.7	.7
Undecided	10	6.9	6.9
Somewhat Agree	32	22.2	22.2
Agree	42	29.2	29.2
Strongly Agree	38	26.4	26.4
Missing			
Total	144	100.0	100.0

14 ANNEXURE G – ASSUMPTIONS THAT SHOULD BE VIOLATED FOR MULTIPLE REGRESSION

14.1 Dependent Variable: Continuance Intention and Independent Variables: Satisfaction, Familiar perceived post usage usefulness

Multicollinearity occurs when two or more independent variables in a multiple regression are highly correlated. If present, regression estimates for the independent variables become unstable. To test the effects of multicollinearity, tolerance and variance inflation factor (VIF) values are calculated. Tolerance values were calculated to be above the value of 0.1 and VIF is less than five. Therefore no significant evidence of multicollinearity within the results was found (Hair et al., 2014). Details are found in tables 29 and 30 below.

Dependent Variable: Continuance Intention	Collinearity Statistics	
	Tolerance	VIF
Satisfaction	.507	1.972
Familiar	.506	1.977
perceived post usage usefulness	.488	2.048
Table 29: Multicollinearity Results		

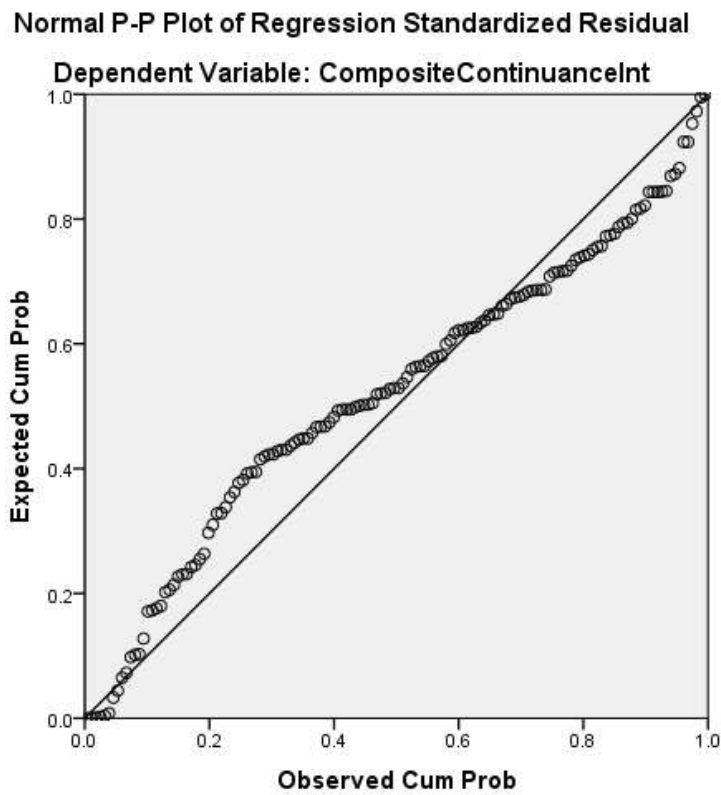| Dependent Variable: perceived post usage usefulness	Collinearity Statistics	
	Tolerance	VIF
PSA	.613	1.630
TTF	.512	1.952
Disconfirmation	.539	1.854
Table 30: Multicollinearity Results		

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Figure 15 – Normal P-P plot

The points as seen on the above plot (figure 15) do not hug the line therefore indicating the distribution of the dependent variable to be non-normal hence ranked transformation was applied for OLS and quantile regression was used for the non parametric regression tests.
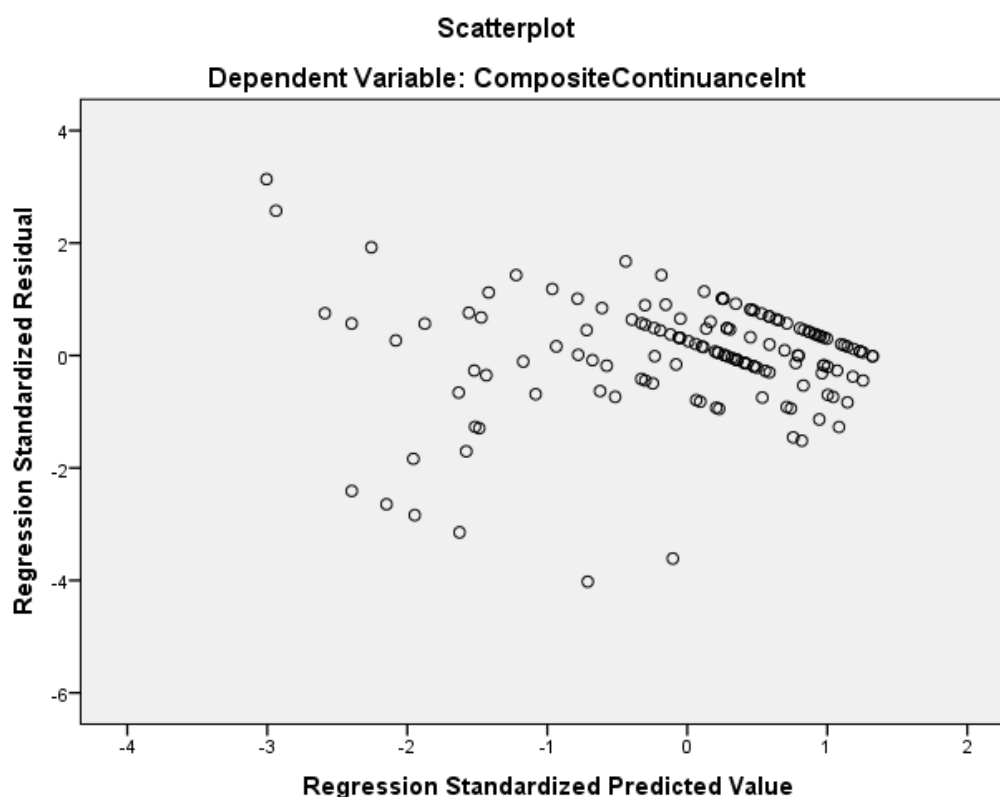
Figure 16 - Scatterplot

A fan shaped pattern cannot clearly be determined in the plot above (Figure 16) therefore the data is assumed for heteroscedasticity. There is also no curved pattern therefore linearity is assumed as well.

14.2 Dependent Variable: perceived post usage usefulness and Independent Variables: PSA, TTF, Disconfirmation

Tolerance values were calculated to be above the value of 0.1 and VIF is less than five. Therefore no significant evidence of multicollinearity within the results was found (Hair et al., 2014). Details are found in table 31 below.

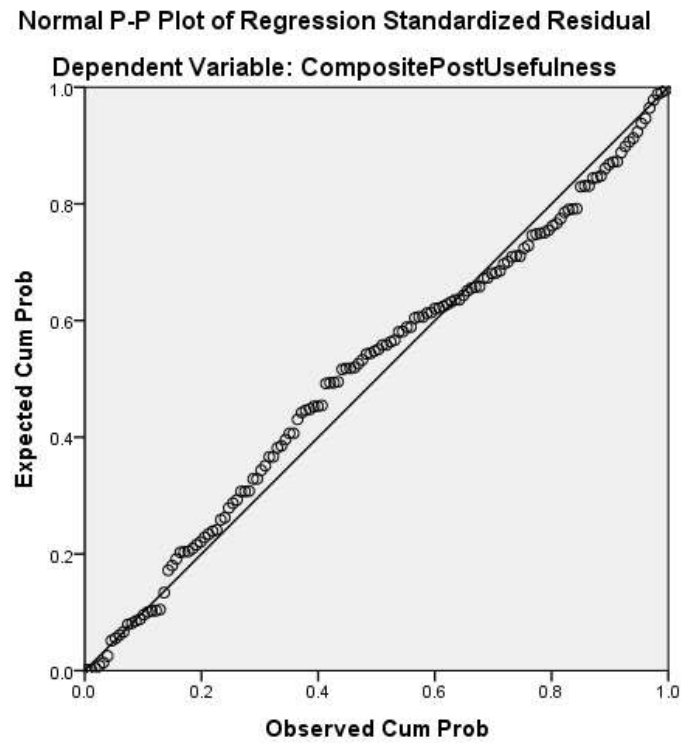| Dependent Variable: perceived post usage usefulness		Collinearity Statistics	
		Tolerance	VIF
	PSA	.654	1.529
	TTF	.502	1.990
	Disconfirmation	.467	2.142
Table 31: Multicollinearity Results			

Figure 17 – Normal P-P plot

The points as seen on the above plot (Figure 17) do hug the line somewhat therefore indicating the distribution be normally distributed hence OLS regression was sufficient in this instance.
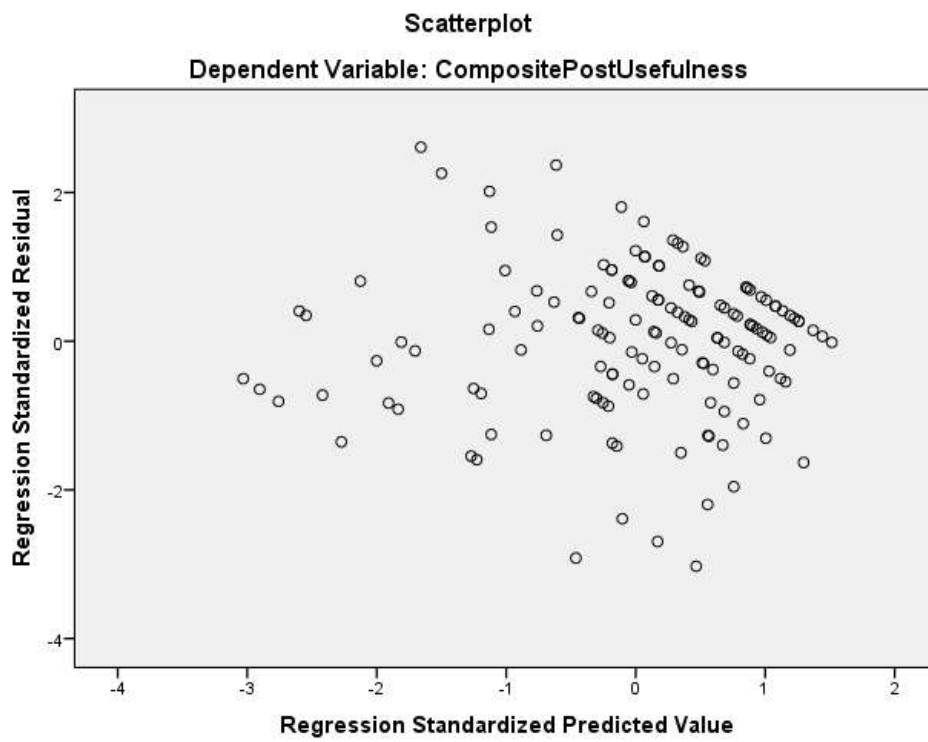
Figure 18 - Scatterplot

A fan shaped pattern cannot clearly be determined in the plot (Figure 18) above therefore the data is assumed for heteroscedasticity. There is also no curved pattern therefore linearity is assumed as well.

15 ANNEXURE H – MISSING DATA BY CASE

Case	Number of Items Missing	Number of Questions(items) in Questionnaire	% Missing
1	1	28	3.6%
2	1	28	3.6%
14	2	28	7.1%
19	1	28	3.6%
25	1	28	3.6%
27	1	28	3.6%
37	1	28	3.6%
49	1	28	3.6%
63	1	28	3.6%
64	3	28	10.7%
65	1	28	3.6%
66	1	28	3.6%
68	1	28	3.6%
69	5	28	17.9%
72	1	28	3.6%
76	1	28	3.6%
79	4	28	14.3%
80	2	28	7.1%
82	4	28	14.3%
83	5	28	17.9%
85	1	28	3.6%
87	5	28	17.9%
95	1	28	3.6%
96	2	28	7.1%
99	2	28	7.1%
100	1	28	3.6%
103	4	28	14.3%
110	2	28	7.1%
111	3	28	10.7%
113	5	28	17.9%
119	4	28	14.3%
121	2	28	7.1%
129	1	28	3.6%
131	1	28	3.6%
132	1	28	3.6%
134	1	28	3.6%
135	1	28	3.6%
143	3	28	10.7%
Total	78		7.3%

Table 32: Patterns of missing data by case

End