TECHNOLOGY ACCEPTANCE, PSYCHOLOGICAL ATTACHMENT AND TECHNOSTRESS

Etienne Erasmus, L.Th, N.Dip, Dip. Data, MSc

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Promoter: Prof. C. van Eeden
Co-promoter: Prof. S. Rothmann
Vanderbijlpark
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COMMENTS

The reader is reminded of the following:

- The references as well as the editorial style as prescribed by the Publication Manual (6th edition) of the American Psychological Association (APA) were followed in this thesis.
- The thesis is submitted in the format of four research articles.
- The researcher deems it essential to refer to the founding research material as a premise of departure in ensuring continuity of the theory. Therefore, reference will be made to the original publications of Ajzen and Fishbein (1980) and Fishbein and Ajzen (1975) who were the founders of the Theory of Reasoned Action (TRA), Davis (1989) and Davis et al. (1989) founders of the Technology Acceptance Model (TAM), Kelman (1958; 1961) founder of Psychological Attachment, as well as Rosen and Weil (1992; 1997) and Rosen, Sears and Weil (1987) founders of technostress.

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SUMMARY

Subject: Technology acceptance, psychological attachment and technostress

Key words: Enterprise resource planning, information system, technological acceptance model, perceived usefulness, perceived ease of use, attitude toward using, behavioural intention to use, actual system use, psychological attachment, internalisation, identification, compliance, technostress.

Technology has been an integral part of human life since the 19th century's Industrial Revolution, and the advancement of technologies has continued into the 21st century. Of all new emerging technologies, the computer has been identified as the most important, most complex and fastest emerging technology. In order for businesses to compete and survive within the business world, they are compelled to adopt new computer technologies. However, computers alone cannot improve organisational performance. Computers need to be accepted, optimally used and utilised by employees in order for an organisation to succeed. One such technology is SAP AG's Enterprise Resource Planning (ERP) system which is a real-time, fully integrated business system used by more than 170 000 organisations in 120 countries.

Measuring information system success has been a concern since its inception due to its complexity and difficulty to appraise. Researchers traditionally attempted to measure success by the delivering of a functional information system product within certain monetary and time constraints. Subsequently, evidence suggested that a more accurate measure of success lies within the field of system use. One model of assessing and predicting user acceptance and which has gained popularity in recent years is the Technology Acceptance Model (TAM). Apart from accepting the SAP ERP system, users should also be of the intention to continuously use it as a job requirement. The model for measuring user commitment is psychological attachment which determines whether the commitment is insincere and temporary, or long-lasting. Further, not only do users need to accept and continuously use an information technology like SAP ERP; they also need to be able to cope while using it. If not, psychological stress known as technostress develops and prevents the optimal use of this system.

With these three possible explanations for computer technology avoidance as a premise of departure, this study aims to determine the congruence, if any, between the sub-constructs of the TAM (perceived ease of use, perceived usefulness, attitude toward using, behavioural intention to use and actual system use), psychological attachment (compliance, identification and internalisation), and technostress (negative computer thoughts) within a South African SAP ERP user environment. A cross-sectional survey design was used rendering a convenience sample of N = 241 from among the SAP ERP user fraternity at a South African steel manufacturer. The measuring instruments used were the 23-item Technology Acceptance Questionnaire (TAM), the 10-item Psychological Attachment Questionnaire (PAQ) and the 20-item Computer Thoughts Survey (CTS-C).

Study 1 which was a literature review confirmed conceptual congruence in that although the technology acceptance model was the most parsimonious, powerful and widely applied theoretical model, it was constrained due to the omission of social influence (psychological attachment) as a contributing factor in the processes of behavioural change towards technology acceptance. Furthermore, it was found that technostress lowers employee efficiency and creates dissonance in the work environment, resulting in acceptance, hesitance or resistance towards the technology in question. Congruence was established between the system itself (technology acceptance), social relationships (psychological acceptance), and inherent psychological stress (technostress).

The aim of study 2 was to test the technology acceptance model within a South African SAP ERP user environment. Structural equation modelling confirmed that positive inter-construct relationships exist between all TAM constructs. Actual system use, which is the measurement for technology acceptance, was directly affected by behavioural intention to use and indirectly by perceived usefulness. In turn, behavioural intention to use was directly affected by perceived usefulness, attitude toward using and indirectly by perceived ease of use. Attitude toward using was directly affected by perceived ease of use and perceived usefulness. Perceived usefulness was directly affected by perceived ease of use.

Study 3 revealed that internalisation had a direct positive effect on behavioural intention to use and an indirect effect on actual system use via behavioural intention to use. Furthermore, in this study identification had direct positive effects on internalisation, perceived usefulness, perceived ease of use and actual system use. Indirect effects emerged between identification

and behavioural intention to use via internalisation as well as behavioural intention to use via perceived usefulness. Compliance, on the other hand, had negligible, negative direct effects on all TAM constructs of which the most prominent was that on attitude toward using.

Results acquired from structural equation modelling in study four confirmed that weak negative relationships existed between technostress and all TAM constructs. This finding is contrary to other studies and can be attributed to the fact that participants in this study were at large, proficient around SAP ERP and therefore experienced low levels of technostress. Furthermore, aspects such as effective training, clear deadlines, effective teamwork, recurrent performance evaluations, job security, career development and realistic job load are all antidotes for technostress which is believed to be current within the participant fraternity.

In a concluding chapter the conclusions derived from the literature review, as well as the empirical research were presented and recommendations flowing from this research study were made.

CHAPTER 1

INTRODUCTION

This thesis focuses on technology acceptance within a South African corporate ERP user environment and specifically the influence of psychological attachment (social influence) and technostress on the adoption of such a system.

Chapter 1 contains the problem statement, research objectives, research method and the division of chapters.

1.1 BACKGROUND AND MOTIVATION OF THE RESEARCH

Technology has been an important part of human life since the 19th century's Industrial Revolution, and technology's advance has led to the development of the most important (Manzano, 1999), yet most complex (Weil & Rosen, 1997b), and fastest emerging (Bellis, 2001) piece of technology in today's society, namely the computer.

The presence of computer and information technologies in today's organisations has expanded dramatically. Some estimates indicate that, since the 1980s, about 50 percent of all new capital investment in organisations has been in information technology advancement. Yet, for technologies to improve productivity, they must be accepted, used and exploited by employers and employees in organisations (Venkatesh, Morris, Davis, & Davis, 2003).

While more and more jobs require computer skills, users are becoming more adept at utilising information technology, whilst coping with the continued infusion of new technologies, devices and applications (Falaleeva & Johnson, 2002). Unsuccessful interactions with such technologies can, however, result in frustration on the part of the user and can lead to further unfavourable encounters with computer-related technology (Falaleeva & Johnson, 2002). People vary in their orientation towards using technology. Some organisations face user resistance and/or a lack of confidence in new computing technology which affect their return on investment and prevent or impair performance improvements (Alrafi, 1998).

Previously, the majority of research in this field of computer-human interaction has focused on improving computer-related technology as a tool, but recently research has begun to focus on the individual's perceptions of, and reactions toward, computing technology (Falaleeva & Johnson, 2002). The theoretical conceptualisations of the technology acceptance model (TAM) (Davis, 1986), psychological attachment (Kelman, 1958), and technostress (Brod, 1984) have contributed to the better understanding and securing of computer technology acceptance in the workplace.

In this study, arguments to the effect of computer technology on its users will commence with reference to the founding authors and materials. This is done with the understanding that although being old resources, the effects of computer technology on the end-user have remained similar but with increasing intensity since its inception in growing user dependency and connectivity (Harper, Rodden, Rogers, & Sellen, A. (2008).

1.1.1 The Technology Acceptance Model (TAM)

Davis (1986) developed the technology acceptance model (TAM) (see Figure 1) to explain computer-usage behaviour based on Fishbein and Ajzen's (1975) Theory of Reasoned Action (TRA). TRA asserts that beliefs influence attitudes, which lead to intentions, and therefore generate behaviour (Alrafi, 1998; Chuttur, 2009).

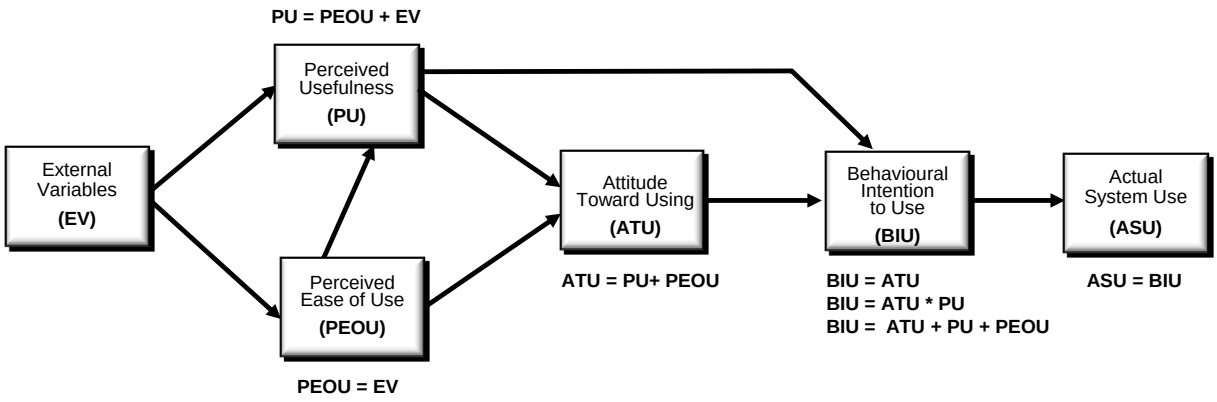

Figure 1. Technology acceptance model (adapted from Davis, Bagozzi, & Warshaw, 1989)

The aim of the TAM is to provide an explanation of the determinants of computer acceptance that are, in general, capable of explaining user behaviour across a broad range of end-user

computing technologies and user populations, while at the same time being both parsimonious and theoretically justified (Davis, 1989).

The TAM proposes that perceived usefulness (PU) and perceived ease of use (PEOU) are the fundamental determinants of user acceptance. Perceived usefulness is defined as the degree to which a person believes that using a particular system would enhance his or her job performance; perceived ease of use is defined as the degree to which a person believes that using a particular system would be free of effort. The two determinants were found highly correlated to self-reported usage. Both perceived usefulness and perceived ease of use predict attitude toward using (ATU) the system, indicating the user's desirability of using the system. Attitude toward using and perceived usefulness influence the individual's behavioural intention to use (BIU) the system. Actual system use (ASU) is therefore predicted by behavioural intention to use. This is consistent with logical relationships that when a person finds a system easy to use and useful, he or she would have a higher motivation to use it (Davis, 1989; Will, 2003).

According to Davis (1989), the following three distinct acceptance behaviours exist, namely **(1)** $BI = PU + PEOU + A$; **(2)** $BI = PU + A$; and **(3)** $BI = PU$.

A review of empirical research on Information System (IS) acceptance and usage indicates that the TAM is an influential model in this stream of technology acceptance research, making an important theoretical contribution toward understanding IS usage and IS acceptance behaviours (Malhotra & Galletta, 1999). However, the model, with its original emphasis on the design of system characteristics, does not account for the role of external physical and/or social environmental variables or for psychological influences in the adoption and utilisation of new information technologies. Regarding the moderating role of external variables on technology adoption, Davis (1986) and Davis et al. (1989) merely refer to external variables having an influence on both the PEOU and PU of technology, but no specific reference is made about the nature or source of such variables. This represents an important area requiring further research (Amoako-Gyampah & Salam, 2003; Malhorta & Galletta, 1999; Saadé & Kira, 2006).

1.1.2 Psychological Attachment

Davis (1986) emphasised that knowledge about the role of psychological influences in information technology acceptance and usage is important for understanding the 'real world' application of the TAM. For this purpose Davis suggested that Kelman's (1958) theoretical distinction between the processes by which social influences affect behaviour is used (Malhorta & Galletta, 1999, 2005).

Kelman (1958) argued that it is not enough to know that there has been a measurable change in an individual's behaviour and attitude, but also to know whether the change is superficial and transient or is a lasting change, manifested in systems usage behaviour and integrated in the person's values (Malhotra & Galletta, 2005).

Subsequently Malhotra and Galletta (2005) built forth on Kelman's (1958) model and distinguished between three different processes of social psychological influence that affect individual behaviour, namely compliance, identification, and internalisation; referred to as *psychological attachment*. *Compliance.* When an individual adopts the induced behaviour not because he or she believes in its content, but with the expectation of gaining rewards or avoiding punishment. *Identification.* When an individual accepts social influence because he or she wants to establish or maintain a satisfying self-defining relationship with another person or group. *Internalisation.* When an individual accepts social influence because it is congruent with his/her value system. By distinguishing between these processes, one could ascertain if usage behaviour is caused by the influence of referents on the individual's intent or by his/her own attitude (Boros, 2008; Gupta & Venugopal, 2008; Rupp, Williams, & Aguilera, 2011).

While compliance denotes public conformity without private acceptance of the behaviour, identification and internalisation indicate public conformity that is accompanied by increasing levels of private acceptance (Petty, 2012; Rupp et al., 2011). Meaningful predictions of system usage behaviour thus depend upon knowing the nature and depth of change in those behaviours that are reflected in subsequent actions (Malhotra & Galletta, 2005).

Although researchers such as Boros (2008), Malhorta and Galletta (1999, 2005), Petty (2012), Rupp et al. (2011), Singh, Gupta, and Venugopal (2008), did some preliminary research on the extended TAM to include psychological attachment, further research is warranted.

1.1.3 Technostress

The rapid growth in technology over the last three decades has been well documented. Accompanying such growth has been an equally rapid increase in the struggle to keep up with technology. The move to the Information Age, with its changes and need for adaptation to technology, has been rapid and stressful for many people. While many people have increased their usage of technology and are comfortable with it, many others still do not use much technology and are not comfortable using it when they must do so. For those who are not amenable to change and who find it difficult to adapt, there are often a variety of responses or results. One type of response is called technostress (Gaither Shepherd, 2010).

Technostress contributes to increasing discomfort and illness at the worksite, especially for those who work at the computer, and can be labelled as a stress immobility syndrome. This syndrome occurs when someone works for many hours while stressed, stationary and functionally immobilised with little awareness that this contributes to illness (Peper & Harvey, 2008).

Brod (1984) headed some of the earliest research on human reactions toward computer technology and identified a modern disease of adaptation caused by an inability to cope with new computer technologies in a healthy manner, which manifests itself in two distinct and related ways, namely in the struggle to accept computer technology, and in the more specialised form of over-identification with computer technology. Brod (1984) referred to this condition as technostress.

According to Rosen and Weil (1997a), technostress is any negative impact on attitudes, thoughts, behaviours or body physiology that are caused either directly or indirectly by computer technology. Furthermore, Rosen and Weil (1997b) state that technostress is a multidimensional phenomenon, consisting of three separate yet overlapping psychological dimensions, namely anxiety about present or future interactions with computers or computer-related technology; negative thoughts or self-critical internal dialogues during actual

computer interaction or when contemplating future computer interaction; negative attitudes towards computers, their operation, or their societal impact (Tiemo & Ofua, 2010).

Ragu-Nathan et al. (2008) reported that computer users react toward technostress in two distinct yet related behavioural patterns: a) technophobia, the struggle to accept computer technology; and b) technophilia, the over-identification with computer technology. Expanding on these reactions, Tiemo and Ofua (2010) classified technostress as comprising three categories, namely: a) anxious technophobes who exhibit the classic signs of an anxiety reaction when using technology: sweaty palms, heart palpitations, and headaches; b) cognitive technophobes who on the surface appear calm and relaxed, but internally teem with negative thoughts, such as "Everybody but me knows how to do this", and "I'll press the wrong key and ruin this machine"; and c) uncomfortable users who may be slightly anxious or use some negative statements, but are generally not in need of one-on-one counselling.

During five corporate field studies, Rosen and Weil (2000) found that people react to computer technology in a characteristic fashion, based on the level of technostress they experience. Rosen and Weil (2000) further established computer-related technostress to be the best predictor of computer technology adoption in the workplace; compared to other predictors such as supervisory role, company size, education, gender, job position, marital status and ethnic background.

In summary, no study could be found extending the TAM to account for computer-related technostress; however, from the results obtained by Rosen and Weil (2000) mentioned above, it appears that research in this regard is called for.

For the purpose of this study, it should be conceded that computer technology, although being a job resource, places job demands on the user to cope with the continued infusion of new technologies, devices and applications (Falaleeva & Johnson, 2002). The most common of such technology-related job demands that users need to cope with are multitasking; information overload; role conflicts; a constant interim; time compression; cognitive labour; abstraction; and diffused boundaries (Erasmus, 2001).

From the above exposition of technology adoption (or the lack thereof), it seems clear that the TAM is a theoretically sound, operationalised and well-researched index for determining the

influence of system characteristics on computer-related technology acceptance, which could, however, be extended to include both the psychological attachment and technostress constructs. Furthermore, little or no research has been done on the extended TAM and, specifically no research in a South African context could be found on any of the constructs under discussion.

Based on the conclusions drawn above, it thus seems that an extended model of computer-related technology adoption based on the TAM, including external variables, psychological attachment, and technostress could be proposed. Also, that such a comprehensive model could contribute significantly to the promotion and enhancement of computer-related technology adoption in a South African context. Figure 2 depicts such a proposed research model.

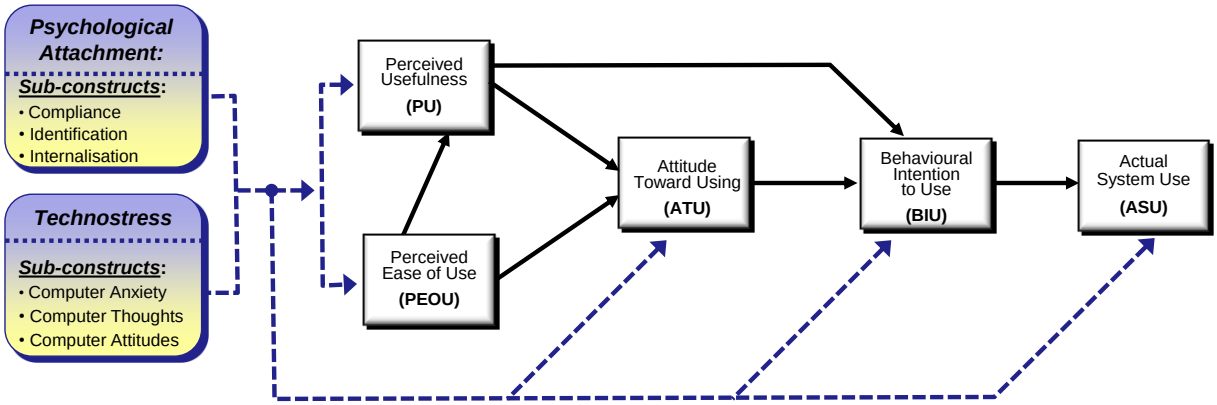

Figure 2. Extended TAM to include psychological attachment and technostress (adapted from Davis, Bagozzi, & Warshaw, 1989).

1.2 PROBLEM STATEMENT

The following general research question is formulated:

What is the relationship between technology acceptance, psychological attachment and technostress amongst users of the SAP ERP system in a South African corporate environment?

The specific research questions include the following:

- In literature, can the relationships between technology acceptance, psychological attachment and technostress be validated?

- Is technology acceptance as a construct relevant to SAP ERP users within a South African corporate environment?
- What role does psychological attachment play in the acceptance of technology process among SAP ERP users within a South African corporate environment?
- What role does technostress play in the acceptance of technology process among SAP ERP users within a South African corporate environment?

This research will make the following contributions to Psychology as science:

- It will result in an extended TAM accounting for psychological attachment and computer-related technostress, permitting further opportunities for research with practical operational relevance.
- It will result in a South African validated extended TAM prompting the potential to create new valid antecedent models through further extensions and research within a local context.
- A pivotal occupational model of technology acceptance will exist which could be used to predict computer technology adoption amongst employees.

1.3 AIM OF THE RESEARCH

1.3.1 General Aim

The general aim of this research is to validate the TAM and extend it to include psychological attachment and technostress; and to determine whether this comprehensive research model can be instrumental in predicting the level of commitment of SAP ERP end users in accepting, using and exploiting the SAP ERP system.

1.3.2 Specific Objectives

The specific objectives of this research are to:

- conceptualise from literature, the distinctive nature of a technology acceptance model (TAM), psychological attachment and technostress;
- validate the technology acceptance model (TAM) within a South African SAP ERP user environment;

- study the relationship between technology acceptance and psychological attachment; and
- study the relationship between technology acceptance and technostress.

1.4 RESEARCH METHOD

1.4.1 Research Design

A cross-sectional survey design whereby a sample is drawn from a population at one time was used.According to Yang and Land (2008), this design is best suited for addressing the descriptive and predictive functions associated with correlational design, whereby relationships between variables are examined. Given the cross-sectional nature of the data, other competing models were also tested with selected path coefficients between variables constrained to zero. The fit indices Chi χ^2, RMSEA, SRMR, *df*, TLI, CFI, AIC and BIC were compared to obtain the best fitting and most parsimonious structural model.

1.4.2 Participants and Procedure

This study was conducted at a South African steel manufacturer as part of their SAP ERP Consolidation Project, with the intent to determine user acceptance of the new consolidated system. The research sample was drawn from the SAP ERP users group consisting of system users and technical specialists over a 16-month period from September 2010 to December 2011. The battery of questionnaires, as compiled by the researcher, together with a manual pertaining to the completion requirements for all questionnaires as well as the contact details of the researcher from whom further information could be sourced were placed on the organisation's Information Portal by their systems administrator, where participants could complete and submit it electronically. Prior to placing the questions and manual online, some hardcopies of questionnaires and manual were distributed and collected by the SAP basis technical department from users working on projects outside the reach of the portal. The systems administrator extracted the completed questionnaire data from the Information Portal database and made all data, together with the hardcopies, available to the researcher. This data was verified and collated by the researcher into a single database for statistical analyses. Only complete questionnaires were included whilst questionnaires containing missing data were discarded.

1.4.3 Data Collection: Measuring Instruments

In this research, data will be obtained by means of the following measuring instruments:

- The *Technology Acceptance Model Questionnaire (TAM)* with 23 items (compiled by Davis, 1986, 1989, and validated by Malhotra and Galletta, 1999) is used for gathering data about the various constructs depicted in the core of the technology acceptance model, namely perceived usefulness (6 items), perceived ease of use (6 items), behavioural intention to use (4 items), attitude towards using (4 items), and actual system use (3 items).
- The *Psychological Attachment Questionnaire (PAQ)* contains scales to measure the various sub-constructs of psychological attachment, namely compliance (4 items), identification (3 items), and internalisation (3 items). This ten-item questionnaire was compiled and validated by Malhotra and Galletta (1999).
- The 20-item *Computer Thoughts Survey (CTS-C),* as compiled and validated by Rosen and Weil (1992), is used to determine negative computer thoughts concerning the SAP ERP system. From the 20 items, only 11 items were found to be relevant to the work environment and subsequently only items 1, 3, 6, 7, 9, 12, 13, 15, 17, 19 and 20 are utilised.

1.4.4 Data Analysis

The data is analysed for descriptive statistics using the SPSS (SPSS Inc., 2013) program. Descriptive statistics (e.g. means and standard deviations) will be used to analyse the data. Latent variable correlation coefficients will be computed to determine the relationships between latent variables. A cut-off point of $p \leq 0.05$ was set for the statistical significance of the results (Steyn, 1999).

Structural equation modelling using the AMOS (Arbuckle, 2013) and Mplus version 7.12 (Muthén & Muthén, 1998-2013) programs are used to assess the factorial validity of all measuring instruments. Items of all questionnaires are defined as being continuous and the maximum likelihood (ML) estimator will be used. The following indexes produced by AMOS and Mplus are used in this study: a) absolute fit indices, including the Chi-square statistic which is the test of absolute fit of the model, the Standardised Root Mean Residual (SRMR),

and the Root-Means-Square Error of Approximation (RMSEA); b) incremental fit indices, including the Tucker-Lewis Index (TLI) and the Comparative Fit Index (Hair, Black, Babin, & Andersen, 2010). TLI and CFI values higher than 0.90, are considered acceptable. RMSEA values lower than 0.08 and a SRMR lower than 0.08 indicate a close fit between the model and the data.

1.5 ETHICAL CONSIDERATIONS

The manager of the SAP Centre of Excellence in the Information Management section at a South African steel manufacturer will be approached and asked for permission to conduct this study. Permission in the form of a letter of consent will be obtained with the precondition that all research findings will be made available to the SAP CoE manager. This letter of consent together with the research proposal will be submitted to the Ethics Committee of the North-West University (NWU FH-SB-2012-008) for ethical approval. Participants will be informed in the preamble to the questionnaire, that: a) data is captured by the researchers and not their organisation; b) data will solely be used for academic research purposes and not for any job performance or merit objectives; c) participation is voluntary; and d) participants will remain anonymous.

1.6 CHAPTER LAYOUT

Chapter 1: Introduction

Chapter 2: Article 1: Computer-related technology acceptance, psychological attachment and technostress: Towards a theoretical model

Chapter 3: Article 2: A structural model of technology acceptance

Chapter 4: Article 3: The role of psychological attachment in technology acceptance

Chapter 5: Article 4: The role of technostress in technology acceptance

Chapter 6: Conclusions, limitations and recommendations

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CHAPTER 2

ARTICLE 1

COMPUTER-RELATED TECHNOLOGY ACCEPTANCE, PSYCHOLOGICAL ATTACHMENT AND TECHNOSTRESS: TOWARDS A THEORETICAL MODEL

ABSTRACT

The objective of this literature-based study was to determine whether the basis of commitment for using or not using the SAP AG enterprise resource planning system (SAP ERP), was founded on the system itself, on social relationships or on inherent psychological stress. This objective was reached by conceptualising a model for computer technological acceptance, which integrates technology acceptance, psychological attachment and technostress. The literature review confirmed that although the technology acceptance model was the most parsimonious, powerful and widely applied theoretical model, it was constrained due to the omission of social influence (psychological attachment) as a contributing factor in the processes of behavioural change towards technology acceptance. Furthermore, it was found that technostress lowers employee efficiency and creates dissonance in the work environment resulting in acceptance, hesitance or resistance towards the technology in question The empirical results forthcoming from this study will contribute to an understanding of change management and to training interventions required prior and during SAP ERP system renewal and upgrades, to best secure optimal usage.

Key terms: Technological acceptance, enterprise resource planning, psychological attachment, technostress, information system

Of all the new up-and-coming technologies, the computer has been identified as the most important (Kahhat & Williams, 2009; Manzano, 1999), most complex (Peper, 2008; Weil & Rosen, 1997), and fastest (Ayyagari, Grover, & Purvis, 2011; Bellis, 2001). In order for businesses to compete and survive within the business world, they are compelled to adopt new computer technologies (Al-Khaldi & Al-Jabri, 1998; Kahhat & Williams, 2009). However, if computers are not accepted and used by employees, a business's operations cannot be improved (Ayyagari, 2007; Davis, Bagozzi, & Warsaw, 1989); therefore organisations need techniques to steer resource allocation with the intention to ensure the successful acceptance and development of the latest and emerging computer technologies (Ayyagari, 2007; Davis & Venkatesh, 1995).

SAP AG is the world's leading (SAP AG Fact Sheet, October 2011; SAP SA, 2011; Yahoo Answers, 2011) and most popular (W3mentor, 2011) supplier of business software, focussing on specific industrial Enterprise Resource Planning (ERP) outcomes and has in the excess of 170 000 customers in more than 120 countries (SAP AG Fact Sheet, October 2011). SAP ERP is SAP AG's business-wide information system designed to synchronise resources, information, and activities needed to complete all business processes (SAP AG Fact Sheet, October 2011). SAP ERP provides complete business solutions by integrating various business processes such as sales, purchasing and production (Amoako-Gyampah & Salam, 2004). SAP ERP also incorporates information from one business process into another business process; thereby speeding up overall business turnaround time. Furthermore, SAP ERP is widely used in various industries because, while it rapidly updates and processes important data, it can automate business processes and provide real-time solutions for organisations (SAP SA, 2011; W3mentor, 2011).

Several thousand South African employees work with SAP ERP on a daily basis. Although it might be referred to as a standard software package, companies cannot expect to simply install it on their computer network and be ready to use it. First the software has to be accustomed to the structure and the processes of the business in question. This customising process may take years to be completed (Hurtienne, Prümper, & Linz, 2002; SAP ERP, 2011). During the customising phase, information technology (IT) which by implication includes information systems (IS) frequently undergoes extensive modifications within short periods of time (Ayyagari, 2007; Davis & Venkatesh, 1995). During such changes, people vary in their orientation towards using new technologies. Some organisations face workforce

resistance or a lack of confidence in new computer systems technologies, which consequently affects their investment in information systems detrimentally and prevents or impairs performance improvements (Alrafi, 1998).

Measuring information system success has been a concern since its inception due to its complexity and consequent difficulty to measure. Traditionally researchers attempted to do so through measurements aimed at delivering a functional information system product, within certain monetary and time constraints. Despite this predisposition there is evidence to suggest that a more accurate measure of success may lie within the field of system use. This evidence is based on the logic that a system first needs to be accepted by the end user before it is to be utilised; therefore, ensuring user acceptance should increase the probability of system success (Behrens, Jamieson, Jones, & Cranston, 2005). Consequently, computer usage became one of the more widely used research measures of computer system success (Alavi & Henderson, 1981; Nickerson, 1981; Swanson, 1988).

Many companies that have implemented SAP ERP do not reap the intended benefits of the potential inherent in this system despite their exorbitant implementation costs. The reasons for this are numerous (Beyleveld & Schurink, 2005). Firstly, an emerging information system cannot deliver improved organisational effectiveness if it is not accepted by potential users. One tool for assessing and predicting user acceptance of emerging information systems which has gained popularity in recent years is the technology acceptance model (TAM) (Ayyagari, 2007; Davis & Venkatesh, 1995). Secondly, users should, after accepting an information system, also be of the intention to continuously use it as a job requirement. Psychological attachment is the suppression of the influence of social influences on a user's behavioural intentions to use and attitude toward using the technology (Malhotra & Galletta, 1999). Kelman (1958) maintained that it is not sufficient to know that there has been a significant change in an individual's behaviour and attitude towards computer technology, but also whether the change is devious and temporary, or forthright and long-lasting, manifested in systems usage behaviour and integrated in the person's values (Kelman, 1958; Malhotra & Galletta, 2005). Psychological attachment processes assist in predicting whether the individual's behaviour to use technology is due to internalisation and identification of, or compliance with such behaviour (Kelman, 1958; Malhotra & Galletta, 1999). Thirdly, not only do users need to accept and continuously use information technology such as SAP ERP; they also need to be able to cope while using it, otherwise, psychological stress known as

technostress develops and prevents the optimal use of this system. Technostress, coined by Brod (1984), is defined as a modern disease of adaptation caused by an inability to cope with computer technologies in a healthy manner. Rosen and Weil (1992, 1997) extended this definition to distinguish technostress as a multidimensional phenomenon, consisting of three distinct but coinciding psychological dimensions, namely anxiety, negative thoughts and negative attitudes about the computer technology in question, and these dimensions are indicators of end-user coping levels.

Taking these three possible reasons for computer technology evasion as a premise of departure, this study aims to determine the conceptual congruence, if any, between the sub-constructs of the TAM (perceived ease of use, perceived usefulness, attitude and behavioural intention), psychological attachment (compliance, identification and internalisation), and technostress (computer anxiety, computer attitudes and computer thoughts). This study will contribute to an understanding of the change management and training interventions required prior and during SAP ERP system renewal and upgrades, as well as preparing prospective users to secure optimal usage.

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) has emerged as one of the most popular (Ayyagari, 2007; Chuttur, 2009; Davis & Venkatesh, 1995), well researched (Saadé & Kira, 2006), accepted (Behrens et al., 2005; Sharma & Yetton, 2001), used (Alrafi, 1998; Lee, Kozar, & Larsen, 2003; Saadé & Kira, 2006), and powerful yet parsimonious (Taylor & Todd, 1995) academic models on IS acceptance and usage, and represents an important theoretical contribution towards understanding IS acceptance behaviour (Chuttur, 2009; Davis, 1986, 1989; Lee et al., 2003; Ma, 2003; Robey, 1996).

The TAM was proposed by Fred Davis (1986) at the MIT Sloan School of Management, Cambridge. Davis developed the TAM to explain computer-usage behaviour (Davis, 1986). The goal of the TAM was to rationalise the general causal determinants of computer acceptance which can explain user behaviour across a broad range of end-user computer technologies and user populations, while at the same time being theoretically justified (Davis et al., 1989).

Inception of the TAM

In this section reference is be made to the original publications of Ajzen and Fishbein (1980) and Fishbein and Ajzen (1975) who were the founders of the Theory of Reasoned Action (TRA) as well as that of Davis (1989) and Davis et al. (1989) who were the founders of the TAM.

The TAM is founded on an adaptation of Fishbein and Ajzen's Theory of Reasoned Action (Alrafi, 1998; Davis et al., 1989; Davis & Venkatesh, 1995; Malhotra & Galletta, 1999). The TRA is an extensively studied model from social psychology which is concerned with the causes of intentional behaviours (Alrafi, 1998; Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975; Malhotra & Galletta, 1999). According to the TRA, a person's behaviour is decided by his or her behavioural intention (BI) to perform the behaviour, and BI is jointly decided by the person's attitude (A) and subjective norm (SN) concerning that behaviour (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). The TRA is depicted in Figure 1 below:

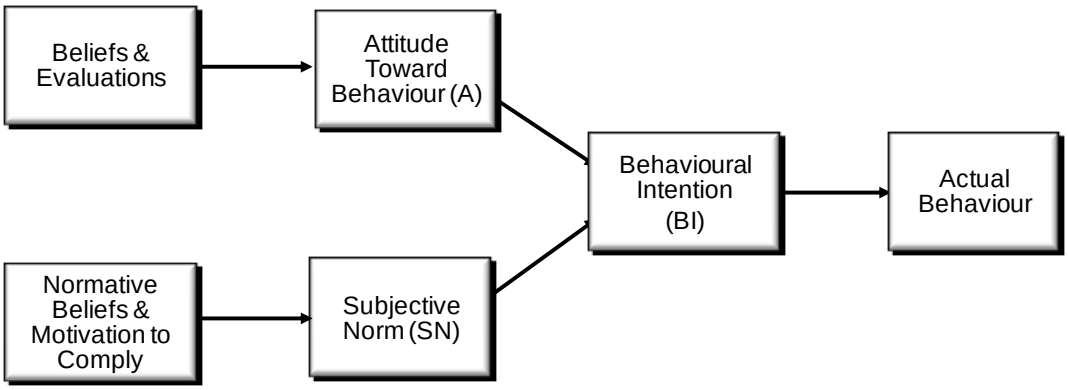

Figure 1. Theory of reasoned action (Fishbein & Ajzen, 1975)

Behavioural intention is a measure of the strength of a person's intention to perform a specified behaviour and is typically estimated by the stimuli regression: BI = A + SN.

Attitude toward behaviour is defined as an individual's positive or negative feeling (evaluative affect) about performing the intended behaviour, and is predicted by his or her salient beliefs about consequences of performing the behaviour multiplied by the evaluation of those consequences.

Beliefs are defined as the individual's subjective probability that performing the target behaviour will result in consequence. The evaluation term refers to "an implicit evaluative response" to the consequence (Fishbein & Ajzen, 1975, p. 29). Attitude toward behaviour in principle represents an information-processing view of attitude formation and change, which hypothesises that external stimuli influence attitudes only indirectly through changes in the person's belief structure (Ajzen & Fishbein, 1980; Davis et al., 1989).

Subjective norm refers to a person's perception that most people who are important to him/her think he or she should or should not perform the behaviour in question. The TRA theorises that an individual's subjective norm is determined by a multiplication function of his or her normative beliefs, perceived expectations of specific referent individuals or groups, and his or her motivation to comply with such expectations (Fishbein & Ajzen, 1975).

The TRA is a general model and as such, it does not specify the beliefs that are operational for a particular behaviour. Researchers using the TRA must first identify the beliefs that are relevant for subjects regarding the behaviour under investigation (Ajzen & Fishbein, 1980; Davis et al., 1989; Fishbein & Ajzen, 1975). Ajzen and Fishbein (1975) and Fishbein and Ajzen (1980) recommend using tendency relevant beliefs for a population, obtained by taking beliefs most frequently elicited from a representative sample of the population.

A particularly supportive aspect of the TRA from an information system perspective is its assertion that any other factors that influence behaviour do so indirectly by influencing A, SN or their relative stimuli. Thus, variables such as system design characteristics, user characteristics, task characteristics, nature of the development or implementation process, political influences, organisational structure and so on, would fall into this category which Fishbein and Ajzen (1975) refer to as external variables (Davis et al., 1989).

Structure of the TAM

The TAM uses the TRA as a theoretical basis for specifying causal relationships between two key sets of constructs: (1) Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) which are unique to the TAM, and (2) the TRA constructs of user's attitude (A), behavioural intentions (BI), and actual computer usage behaviour as depicted in Figure 2 below:

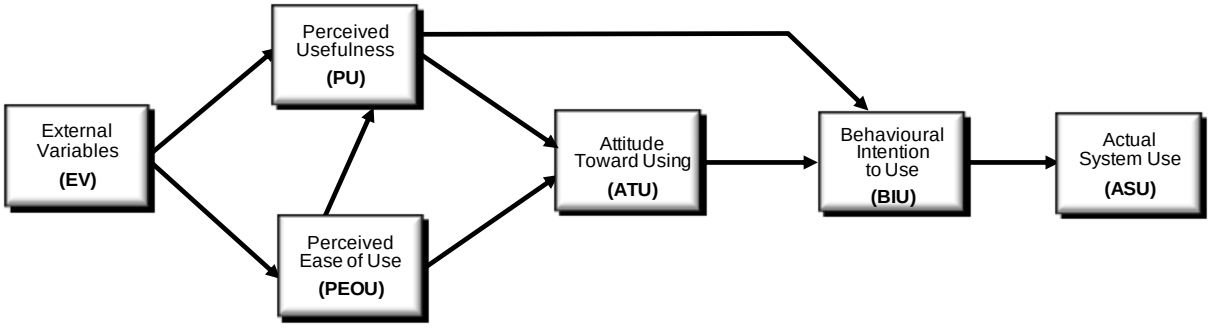

Figure 2. Technology acceptance model (TAM) (Davis, 1989)

PU is defined as the extent to which a person believes that using a particular computer technology will improve their work performance. Users tend to use or not use a computer application to the amount they believe it will assist them in doing a better job. PU explains the user's perception of the amount that the technology will improve his/her work output (Davis et al., 1989; Malhotra & Galletta, 1999). This means the user has a perception of how useful the technology is in performing his/her work tasks. This includes decreasing the time for doing the work, more efficiency and accuracy (Alrafi, 1998).

PEOU refers to the extent to which a user believes that the use a particular technology will be effortless. Users believe that a given application is useful, but they may at the same time believe that the technology is too problematic to use, and that its performance benefits are overshadowed by the effort of using the application (Davis, 1989). PEOU explains the user's perception of the amount of effort required to utilise the system, or the extent to which a user believes that using a particular technology will be effortless (Davis et al., 1989; Malhotra & Galletta, 1999).

Since the main objective of the TAM is to provide an explanation of the determining motives that ensure computer acceptance, a logical key goal is therefore to provide a foundation to pursue the impact of EV on internal beliefs (PU and PEOU), attitudes (A), and behavioural intentions (BI) of computer system users (Davis et al., 1989). Numerous external variables had been incorporated in the TAM, since Davis et al. (1989) recommended some external factors to be investigated in future research, such as system features, user characteristics, situational constraints, and managerially controllable interventions. Amongst others, variables such as demographics, end-user background, system characteristics (Algahtani & King,

1999); beliefs in the benefits of the ERP system, project communication, and training (Amoako-Gyampah & Salam, 2004); individual, organisational and task characteristics (Lee et al., 2003); age, education, income and race (Porter & Donthu, 2006); as well as organisational job category, system experience and computer experience, were incorporated in the TAM with significant results.

Research Application of the TAM

A variety of information systems classified into the following four major categories were investigated by previous research studies: communication systems, general-purpose systems, office systems, and specialised business systems. Table 1 below depicts some examples of such systems, the researchers and their key findings:

Table 1

Key Findings of Previous Information Systems Research Using the TAM

COMMUNICATION SYSTEMS
E-mail and V-mail (Karahanna & Straub, 1999) Actual use was influenced by perceptions of the usefulness of the E-mail system. Usefulness, in turn, was influenced by (a) perceptions of the system's ease-of-use; (b) the level of social influence exercised by supervisors; and (c) perceptions of the social acceptance of the medium. Ease-of-use was, in turn, influenced by the ease of system access. Supplementary conditions such as the availability of training and support for the use of information technology had no impact on perceptions of ease-of-use or usefulness of E-mail.
Dial-up Systems (Subramanian, 1994) Perceived usefulness and not ease of use was a determinant of predicted future usage.
Cellular (Kwon & Chidambaram, 2000) Users' perceptions were significantly associated with their motivation to use cellular phones. Perceived ease of use was found to have significant effects on users' extrinsic and intrinsic motivations. Apprehensiveness about cellular technology had a negative effect on intrinsic motivations.
GENERAL PURPOSE SYSTEMS
Computer Resource Centre (Taylor & Todd, 1995) Weighted least squares estimation revealed that all three models, TAM, TRA (Theory of Reasoned Action), and TPB (Theory of Planned Behaviour) performed well in terms of fit, and were roughly equivalent in terms of their ability to explain behaviour. Results indicate that the decomposed TPB provided a fuller understanding of behavioural intention, by focusing on the factors that were likely to influence systems use through the application of both design and implementation strategies.
Windows (Karahanna & Straub, 1999) The adoption and use of Microsoft Windows was determined by perceptions of its usefulness, which were subsequently influenced by: (a) opinions of the ease-of-use; (b) the level of social influence; and (c) opinions of the social appeal of the system. Accessibility of the medium influences opinions of the ease-of-use; while facilitating conditions such as the training and support had no impact on opinions of ease-of-use or usefulness.

Table 1 (continued)
Key Findings of Previous Information Systems Research Using the TAM

Groupware (Lou, Luo, & Strong, 2000; Malhotra & Galletta, 1999)
The perceived critical mass had the largest total effect (direct and indirect) on intention to use groupware. The researchers determined that it was essential to create a critical mass of users in the early stages of groupware implementation. Hence, the key emphasis of adoption initiatives was found to be on developing user attitudes that were conducive to effective utilisation and acceptance behaviours. A failure to develop such psychological attachment among potential users may require the organisation to bear the increased costs associated with more sophisticated control systems, and/or diminishing performance returns on increasing information technology investments.

OFFICE SYSTEMS

Word Processor (Chuttur, 2009; Hubona & Geitz, 1997)
The results confirmed that the influence of external variables on usage behaviour was not fully arbitrated by the belief constructs. To secure effective use of up-and-coming information technologies, a definite fit between technology and task, as well as between individual characteristics and technology need to be established.

Beliefs and attitudes were contributory in promoting user acceptance of emerging information technologies. External variables, individual and organisational, indirect and direct, were also important considerations.

Spread Sheet (Methieson, 1991; Venkatesh & Davis, 1996)
Both the TAM and the TPB were compared. Both models provided good predictions of individuals' intentions to use spread sheets, although the TAM slightly outperformed TPB. The TAM was easier to use, while TPB provided more information about the factors users consider when making their choices.

An extended TAM was strongly supported during four organisational studies at three points of measurement, accounting for 40%-60% of the variance in usefulness perceptions and 34-52% of the variance in usage intentions. Both social influence processes and cognitive instrumental processes significantly influenced user acceptance.

SPECIALISED BUSINESS SYSTEMS

Web-based Learning (Brown, 2002)
It was found that self-efficacy, computer anxiety, website characteristics, ease of finding and ease of understanding considerably influenced perceived ease of use. It was furthermore corroborated that in a developing country, perceived usefulness might not predict adoption, thus amplifying the role of perceived ease of use as a foremost predictor of both usage and perceived usefulness.

Table 1 (continued)

Key Findings of Previous Information Systems Research Using the TAM

Executive Information Systems (EIS) (Averweg, 2008)
Low Cronbach correlation coefficients were calculated between PU and Intended Use, as well as for PEOU and Intended Use constructs. The correlation for usefulness was lower than for ease of use; and therefore not consistent with Davis' findings. However, Averweg's results (1) partly support Venkatesh's (1999) conclusions that PEOU can be a stronger catalyst (over PU) in promoting IT acceptance; (2) support Brown's (2002) conclusions that the PEOU-Use-TAM relationship was superior to that of PU-Use; and (3) indicate there is no uniformity in the frequency of use of EIS. Brown (2002) reports that PEOU takes on increased importance, as it influences both use and PU. Averweg concluded by corroborating that the TAM was a useful model, but had to be integrated into a broader one which will include variables related to both human and social change processes, and to the adoption of the innovation model.

Internet Banking (Lai & Chau, 2010)
Both DOI (Diffusion of Innovation) and the TAM were found to be useful models for explaining internet banking acceptance. An integrated model was also found to be useful in explaining direct and indirect variances in internet banking acceptance. The integrated model explained 71% variance, while the TAM and DOI explained 67% and 60% variances respectively.

Mobile Phone (Phan & Daim, 2010)
Results confirmed that ease of use and usefulness were the most dominant predictors of the adoption of mobile services. In addition, technology improvement affected the attitude toward using a mobile service. Users require technology that is easy and free of effort to use. Ease of use is enabled through service quality, speed, and simplicity.

Internet (Wahid, 2007)
This research investigated differences between men and women regarding Internet usage along the following three criteria:

Internet adoption: Men accepted the Internet more readily than women.
Factors affecting Internet adoption: Amongst women, Internet acceptance was determined by perceived ease of use rather than perceived usefulness whereas Internet acceptance amongst men were determined by perceived usefulness rather than perceived ease of use. Men were found to have a more flexible Internet access approach compared to women.

From the preceding exposition of results, it is evident that researchers explored end-user technology acceptance by concentrating on a variety of stand-alone information systems. Yet, in the current information systems milieu, since the arrival of ERP, an integrated research approach became mandatory as a result of ERP's integration of stand-alone communication, general-purpose, office and specialised business systems into a single integrated business suite (Gartner, 2012). Moreover, no significant research study could be found using the TAM

as platform to determine technology acceptance within a South African ERP environment, which therefore confirms the relevance of this research study.

Design Limitation of the TAM

The potential scope of the TAM was limited by the omission of the TRA construct SN (Davis, 1986); thus, ignoring the social influence of perceived important people on a potential user, to either accept and utilise or reject the technology in question (Algahtani & King, 1999; Malhotra & Galletta, 1999). This omission was deliberate due to theoretical ambiguity and psychometric uncertainty around the construct of SN at that time (Lou, Luo, & Strong, 2000); seeing that it was difficult to distinguish whether usage behaviour was caused by the influence of significant others on one's intention, or by one's own attitude (Davis, 1986; Davis et al., 1989). Davis (1986) and Davis et al. (1989) agreed that the TAM was incomplete due to the omission of the TRA's subjective norm (SN); thus, ignoring the role of social influence during the process of behavioural change leading to the acceptance of new technology. This omission prevented the TAM from being applied to its full potential (Malhotra & Galletta, 1999).

In attempts to overcome this obstruction of omitting social influence, several researchers extended their TAM research models to account for it (Algahtani & King, 1999; Lee, et al., 2003; Malhotra & Galletta, 1999; Taylor & Todd, 1995; Venkatesh & Davis, 2000; Venkatesh & Morris, 2003). The most significant research findings from these studies were the following: Measured at four different organisations (two involving voluntary use and two mandatory use), on four different systems at three points in time (pre-implementation, one month post-implementation and three month post-implementation), social influence proved to be the main predictor of variances in usefulness perceptions as well as of variances in system usage intention under mandatory conditions, and it weakened over time (Venkatesh & Davis, 2000).

Comparing the TAM and two variations of the TRA model using 786 potential users at a computer resource centre during 3 780 visits to the centre, all three models proved to be roughly equal in explaining behaviour. However, social influence via the TRA models was a better behavioural intention predictor of system use for inexperienced system users during both system design and system application (Taylor & Todd, 1995).

The findings indicate that although system use is affected by perceptions of the medium's usefulness, which in turn are affected by perceptions of the ease-of-use of the medium, the degree of social influence exerted by supervisors and perceptions of the social presence of the medium plays a more significant predicting role, especially during the early stages of system development (Karahanna & Straub, 1998; Lee et al., 2003; Venkatesh & Davis, 2000; Venkatesh & Morris, 2003).

In order to overcome the shortcoming of the TAM, an alternative theoretical basis for conceptualising SN was needed and according to Davis (1986) and Davis et al. (1989), Kelman's (1958, 1961) conceptualised processes of social influence address this shortcoming (Davis, 1986; Davis et al., 1989). Kelman's theory of social influences argues that psychological attachment to specific usage behaviours is the construct of relevance (Kelman, 1958, 1961; Malhotra, 2005) to determine an IS user's level of commitment towards such behaviours (Malhotra, 2005; O'Reilly & Chatman, 1986). Therefore, social influence (subjective norm) is operationalised in terms of technology acceptance by means of psychological attachment (Malhotra & Galletta, 1999).

Psychological attachment is a construct defined as the degree of commitment by the IS user toward using a system, based on the effect of social influences on his or her behaviour. Psychological attachment is measured in terms of the three processes of social influence, as distinguished by Kelman (1958, 1961), namely compliance, identification and internalisation. According to Kelman (1958), it is not enough to know that there has been a measurable change in an individual's behaviour and attitude, but also to know whether the change is insincere and momentary or whether it is a lasting change, observable in the level of systems usage behaviour and the level of integration into the person's value system. While compliance implies public conformity without private approval of the behaviour, identification and internalisation imply public conformity along with increasing intensity of private approval. Thus, meaningful predictions of systems usage behaviour depend upon knowing the nature and depth of change of those behaviours that are reflected in subsequent actions. Acknowledging different levels of psychological attachment to specific behaviours provide the basis for developing specific assumptions about the conditions for predicting future behavioural changes (Kelman, 1958, 1961; Malhotra & Galletta, 2005).

Kelman (1958) argued that changes in behaviours produced by social influence may occur at different levels of intensity, and that these differences in the nature or level correspond to differences in the process whereby the individual accepts influence. Based upon this reasoning, Kelman (1958) attributed the extent of difference in behavioural commitment of the individual to the above mentioned three processes, namely identification, internalisation, and compliance. These three processes of commitment represent distinctly qualitative ways of accepting influence that determine the likely durability of the adopted behaviour to use the systems in question. Each of these three processes is characterised by a distinctive set of antecedent conditions, corresponding to a characteristic pattern of internal responses, such as thoughts and feelings in which the individual engages while adopting the induced behaviour. Similarly, each of the three processes is characterised by a distinctive set of resulting conditions, involving a particular qualitative variation in the subsequent history of the induced response (Kelman, 1958). The attachment processes are described as follows:

Internalisation operates through the individual's attitudinal system (Davis, 1986; Gagnon, 2012; Petty, 2011; Warshaw, 1980) and refers to the process by which, when one perceives that an important person thinks one should perform a behaviour, one incorporates that person's beliefs into one's own belief structures (Angst, Agarwal, & Magni, 2004; Goodman & Jinks, 2008; Kelman, 1958; Venkatesh & Davis, 2000; Warshaw, 1980). Thus, internalisation is when an individual accepts influence because it is congruent with his or her value system. Behaviour adopted through internalisation is integrated with the user's own values and becomes a part of his or her personal norms. The resulting behaviour induced through internalisation tends to be performed under conditions of the relevance of the issue, regardless of observation or prominence (Malhotra & Galletta, 1999, 2005).

Identification also operates through the individual's attitudinal system (Davis, 1986; Gagnon, 2012; Petty, 2011; Warshaw 1980). Individuals often respond to social influences to establish or maintain a favourable image within a reference group and this is referred to as identification (Angst et al., 2004; Goodman & Jinks, 2008; Kelman, 1958; Venkatesh & Davis, 2000). Identification is when an individual accepts influence because he or she wants to establish or maintain a satisfying self-defining relationship with another person or group. The resulting behaviour induced through identification is performed only under conditions of the prominence of the individual's relationship with the influencing person (Malhotra & Galletta, 1999, 2005).

Compliance refers to situations where the individual performs a behaviour which is inconsistent with his or her attitude in order to gain rewards or avoid punishment from important people, and is associated with a sense of pressure (Davis, 1986; Gagnon, 2012; Petty, 2011; Warshaw 1980). Compliance operates whenever an individual perceives that a socially influencing person wants him or her to perform a specific behaviour and this socially influencing person has the ability to reward the behaviour or punish non-behaviour (Angst et al., 2004; Goodman & Jinks, 2008; Kelman, 1958; Venkatesh & Davis, 2000; Warshaw, 1980). The resulting conditions for behaviour induced through compliance are that the behaviour tends to be performed under surveillance by the influencing person. In this case, induced behaviour is neither based on content of the behaviour nor on the importance of relationships (Malhotra & Galletta, 1999, 2005).

Psychological attachment was introduced above as a theoretical extension of the TAM, to represent the social influence variables that were omitted in the original TAM. It is the opinion of the researcher that the construct of technostress is another contributing factor to be considered in understanding people's technology acceptance levels.

Technostress

Brod (1984), a clinical psychologist, was the first to define the concept of technostress as being a disease of adaptation caused by an inability to cope with the contemporary computer technologies in a healthy way. It reveals itself in two distinct and related ways: an inability to accept computer technology and an over-identification with computer technology. Although supporting Brod's description, Rosen and Weil (1997a), also clinical psychologists, expanded on the definition by defining technostress as any negative impact on attitudes, thoughts, behaviours or body physiology that is caused either directly or indirectly by technology. Furthermore, Rosen and Weil (1997a, p. 18) identified an additional middle level of technostress manifestation in between Brod's two levels of under identification and over identification, namely that of an undecided group that they refer to as hesitant "Prove Its".

According to Fisher (1999), much of the research about the concept of computer anxiety has been directed at attempting to define the concept itself, hence encouraging the use of a variety of terms synonymous with technostress. He refers to Nykodym, Simonetti, and Christen (1988), and Rosen, Sears, and Weil (1987), who use terms such as computer anxiety,

compustress, cyber phobia, computer phobia, technophobia and technostress as interchangeable terms.

Technostress has been researched by several researchers in a variety of research environments. Table 2 represents some of the most significant findings of such studies.

Table 2

Key Findings of Previous Technostress Research

Technological Sophistication and Technophobia
Based on data collected from 3 392 students at 38 universities in 23 countries, Rosen and Weil (1992) found meaningful dimensional differences between computer technology acceptance (experience) and technostress (technophobia): Firstly, both dimensions were partially explained by the availability of technology. The lack of availability provoked discomfort of the unknown and the abundance of technology provoked discomfort of the known. Secondly, characteristics of the culture itself lead to the students' reactions to technology. Thirdly, the political structure of the country inhibited or encouraged the use of technology through its allocation of funds. Fourthly, the way and manner in which technology was introduced into the educational system, influenced students' reactions to technology.
Information Superhighway
Rosen and Weil (1994) found that the USA population were not ready to readily accept the coming Information Superhighway until their overall uneasiness with computer technology was lessened or eradicated. Results confirmed that having a calm, tranquil, jargon-free instructor introducing new technology by offering a personal motive, was critical to future wellbeing and acceptance.
Online Users and Non-users
Results obtained by Rosen and Weil (1995), dramatically demonstrated that people were vastly overestimating online usage. Despite the only 10% to 15% that were actually online, the remaining 85%-90% of the population felt that everybody was online and they were the last on the block to get hooked up to the superhighway. Feelings like this prompted people to feel insufficient, anxious and misplaced, and had either compelled people to make decisions about the use of technology that might not have been well thought through or had commanded stronger resistant responses. Worst yet, there appeared to have been a fragment of the population who was even more at risk for these negative feelings. Instead of being technologically disadvantaged, these people were becoming technologically oblivious.

Table 2 (continued)

Key Findings of Previous Technostress Research

Preparation for year 2000 (Y2K)
Rosen and Weil (1999) identified significant changes across a seven-month period from two research samples (n = 1071) and (n = 917) respectively: • Apprehension about potential technology problems decreased from around 66% of the population to 50% or less. • Apprehension about problems with personal computers, electronic mail and services decreased much less. • Technologies that produced the most distress were personal computers, government computers, credit cards and banking systems. • Attitudes toward technology in general had also changed, with more of the population cautious toward technology and fewer either keen or opposing. • Male "baby boomers" who were more highly educated and who were eager adopters of technology, knew more about Y2K. • Male adults age 50 and younger, who had children and who were eager adopters, understood more about information superhighway. • Male young adults were more concerned about potential Y2K problems than older adults.
Corporate Organisations
Rosen and Weil (2000) found that over a 49-month period, that clerical/support staff and managers/executives had become more cautious towards technology, while increasing their technology use both in the workplace and after standard work hours: • Clerical/support staff and managers/executives both demonstrated an increase in the use of all technologies over the 49-month period of which e-mail and the Internet were the most prominent. • Use of less complex devices was predicted by a variety of demographic factors, while use of more complex devices was predicted by psychological reactions to technology. More positive responses led to more usage of computers, e-mail, the Internet and fax machines. • Clerical/support staff and managers/executives indicated increased usage of all technologies after working hours with the computer, Internet and e-mail being the most prominent. • Computer training was average at best for the majority of all staff, with five out of six having received training. • Both clerical/support staff and managers/executives increased their average hours per month online over the 49-month period, with managers/executives spending the most time. • Both clerical/support staff and managers/executives increased their understanding of information superhighway across the 49-month period, with managers/executives showing highest comprehension.

Table 2 (continued)
Key Findings of Previous Technostress Research

Electronic Workplace
The following costs of technostress in business had been substantiated from research by Tangri (2003): • 19 % of absenteeism • 40% of people turnover • 55% of EAP (employee assistance program) program costs • 30% of short-term and long-term disability costs • 10% of drug plan costs • 60% total cost of workplace accidents Tangri (2003) also reported the following technostress-related statistics: • Employees were interrupted at least three times an hour by electronic technology • One in four computers had been physically assaulted. • Computer processing power doubled every 18 months. • Office automation packages changed every two years. • 85% of the population felt uncomfortable with technology.
Reference Library
Kupersmith (2003) reported the results of an electronic survey (n = 92) on technostress (computer-related stress) among academic library staff members taken in August 2003 as follows: • 59% of survey participants said their level of technostress has increased over the last 5 years, • 34% felt it was unchanged, and only 4% believed there was a decrease. • 65% of participants reported that technostress was a fairly serious problem whereas 8% said it was extremely serious problem, while • 27% felt it was not serious at all.
Corporate Organisations
Sanderlin (2004) found that technostress could reduce employee productivity and create dissonance in the work environment, costing employers time and money. Technostress levels could be decreased by developing and implementing effective training and wellness programmes, resulting in an enhanced sense of technological mastery and personal value. The lack of such programmes ultimately caused job dissatisfaction, dissonance, stress and anger.

Table 2 (continued)

Key Findings of Previous Technostress Research

Sources and Dimensions of Computer Anxiety
Roslan and Mun (2005) found significant relationships between the level of anxiety and sources of anxiety. The relationship between task anxiety and computer anxiety levels was the strongest; therefore, leading to the conclusion that task anxiety was the best predictive factor of computer anxiety.
Computer Science (CS) Degree Students
Research done on a sample of 163 participants, comprising 32 female and 131 male computer science degree students from all four years of the CS degree at Trinity College. The objective of this study was to determine the relationship between computer anxiety, low self-efficacy and computer experience. Results obtained by Doyle, Stamouli, and Huggard (2005) revealed that: • All students suffered from higher than expected intensities of computer anxiety. • First and fourth year students generally displayed low self-efficacy levels. • The relationship between computer anxiety and experience was observed as being negative, confirming that as computer experience increased, the student's level of anxiety decreased. • The relationship between experience and self-efficacy rendered a positive correlation, which signified that when the former increased, the latter also increased.
Technostress Antecedents and Implications
Ayyagari (2007) used a survey design methodology and structural equation modelling to test a proposed research model, comprising of field data from 692 working specialists at the market research firm Zoomerang®. The results suggested that: • Technostress was widespread and significantly predicted of general job strain. • Work overload and job role vagueness were found to be the foremost two stressors. Intrusive technologies were found to be the foremost predictors of stressors. • Relations between technology use and stressors were all significant (βs ranging from 0.09 to 0.21, all significant at 5% of probability at least). • Individuals became more dependent on technologies and consequently experienced higher levels of stress.

From the preceding account of results, it is evident that researchers explored the effects of technostress on end users in a variety of computer environments. However, in the current information systems setting, since the arrival of ERP, an integrated research approach became mandatory as a result of ERP's integration of stand-alone communication, general-purpose, office, and specialised business systems into a single integrated business suite (Gartner, 2012). Although research has been done to determine the effects of technostress within the ERP environment by researchers such as Gunson and de Blasis (2002); Hayashi (2011); Ragu-Nathan, Tarafdar, Ragu-Nathan, and Tu (2008); Shu and Wang (2008); and Tarafdar,

Tu, Ragu-Nathan, and Ragu-Nathan (2007), no significant research study could be found within a South African ERP environment, which therefore confirms the relevance of this research study.

Research, therefore, showed that technostress is a multidimensional phenomenon (Rosen & Weil, 1997b), consisting of three separate but overlapping psychological dimensions (Brillhart, 2004; Rosen & Weil, 1992; Tangri, 2003), namely anxiety about present or future interactions with computers or computer-related technology; negative thoughts or self-critical internal dialogues during actual computer interaction or when contemplating future computer interaction; and negative attitudes about computers, their operation, or their societal impact. Should an individual display one or more of the above psychological dimensions, he or she is seen to suffer from technostress (Rosen & Weil, 1992).

The environmental factor perceived and appraised by an individual which causes him/her to stress, is referred to as the 'stressor' (Strümpfer, 1986, p. 536). Research identified the most common corporate technostressors as organisational factors, information overload, role conflicts, multitasking, constant ad hoc (interim) feeling, time compression, cognitive labour, abstraction, diffused boundaries, constant learning and change, increased time spent in sedentary work, and difficulty separating from work (Erasmus, 2001).

Accordingly, such environmental factors bring about technostress, in turn inducing negative symptomatic behaviours known as technostrain in system users which negatively, directly and/or indirectly impact on their attitudes, thoughts, behaviours and body physiology (Weil & Rosen, 1997a); preventing information systems from succeeding (Rosen & Weil, 1998).

Technostrain

Perceived stress. Technostress also leads to physiological, psychological and behavioural changes (Ayyagari, 2007; Tiemo & Ofua, 2010). The most common *physical consequences* are found to be headaches, perspiring hand palms, heart tremors, unsettled stomach (Rosen & Weil, 1997b), moodiness, headaches and bad dreams (Brod, 1984). Mental effects largely involve irritation and moods of being overwhelmed and uncontrollable (Bland, 1999; Czaja, Charness, Fisk, Hertzog, Nair, Rogers, & Sharit, 2006; Roslan & Mun, 2005). Such mental outcomes often involve self-critical declarations and thoughts regarding the use of a computer

(Rosen & Weil, 1997b), future job permanency, capacity to perform, reimbursement, position, reputation and work relations (Ayyagari, 2007; Czaja et al., 2006; Pendlebury, Grouard, & Meston, 1998). Mental outcomes may also be observed as a defiance to learn about the computer or a complete rejection of the technology (Brod, 1984).

Brod (1984) identified two primary behavioural consequences, namely technocentred behaviour of over-identifying with computers and techno-anxious behaviour of being fearful of computers.

Technocentred people are people who are not intimidated by computer technology and see it as favourable and subsequently over-identify with it. Such individuals are highly inspired by and keen to adjust to contemporary technologies and adopt a mental state that mirrors that of the computer itself (Brod, 1984). Rosen and Weil refer to this category of individuals as Eager Adopters (Rosen & Weil, 1997). Eager Adopters score on the no-technostress level on all measures and are considered to have no technostress (Rosen & Weil, 1992; Tangri, 2003). Eager Adopters adore computer technology and are usually the first to buy new technological devices, view technology as amusing and stimulating and enjoy frolicking and fiddling with it (Rosen & Weil, 1997a).

Techno-anxious people, on the other hand, perceive computer technology to be intimidating. They are hesitant towards, unenthusiastic about and afraid of computers, and struggle to accept such technologies (Brod, 1984; Kupersmith, 2003; Roslan & Mun, 2005). Rosen and Weil have categorised the two subcategories in this techno-anxious group as Hesitant Prove-Its and Resisters. Hesitant Prove-Its score low on technostress measure and are considered to have low technostress (Rosen & Weil, 1992). They do not think computer technology is pleasant and rather wait until the significance of a new technology has been proved before trying it; and even then they hesitate to use it, wanting first to be persuaded that they really need it (Rosen & Weil, 1997a). Resisters score moderate/high on technostress measures and are considered to possess moderate or high technostress (Rosen & Weil, 1992). Resisters reject and/or avoid technology and can be identified by the following feelings/emotions: frustration, nervousness, awkwardness, uncertainty, amazement, dumbness, being overwhelmed, being upset, uncomfortable, and hesitant (Rosen & Weil, 1997a).

DISCUSSION

The objective of this study was to conceptualise a theoretical model for technology acceptance, which accommodates psychological attachment and technostress as external influences to the TAM. This would, if accomplished, assist in understanding whether the adoption of a technological system such as ERP is based on the system itself, social relationships amongst users, psychological stress inherent to a user or a combination thereof.

In the preceding literature review it became clear that the TAM, introduced by Fred Davis (1986), is the most appropriate theoretical and resource framework to examine user acceptance of computer technology for the following reasons: a) it continues to be the most widely applied theoretical model in the information systems community (Lee et al., 2003); b) it is deemed to be the most parsimonious and powerful approach (Venkatesh & Davis, 2000); c) it is the most widely published model with more than 698 journal citations in the Social Science Citation Index (SSCI); and d) it has successfully been applied to a variety of technologies (e.g. word processors, e-mail, WWW, GSS, Hospital Information Systems) under different situations (e.g. time and culture) with different control influences (e.g. gender, organisational type and size) and different research populations (e.g. undergraduate students, MBA students, and knowledge workers); lending further prominence to its robustness (Lee et al., 2003).

Although being a suitable framework, the TAM is constrained due to the omission of social influence as a contributing factor in the processes of behavioural change towards technology acceptance (Davis, 1986; Davis et al., 1989). This limitation prevents the TAM from being applied to its full potential (Malhotra, 1999). The findings of Venkatesh and Davis (2000) that social influence proved to be the major predictor of variances in perceptions about and intentions to use computer technology, especially during the early stages of system development, are evident of the need to address this constraint (Karahanna & Straub, 1998; Lee et al., 2003; Venkatesh & Davis, 2000; Venkatesh & Morris, 2003). Furthermore, by distinguishing between the three processes of commitment (internalisation, identification and compliance), one can assume that personal norms and values based on psychological attachment through internalisation of and identification with a management information system such as SAP ERP, could play a significant moderating role towards the sustained utilisation and optimisation thereof (Malhotra & Galletta, 2005).

Furthermore, technostress lowers employee efficiency and creates dissonance in the work environment, subsequently costing organisations time and money (Sanderlin, 2004). Rosen and Weil (1997a) found technostress to manifest in three distinct ways amongst computer users, namely: a) acceptance; b) hesitance; and c) resistance towards the system in question. These manifestations are relevant to clerical and support staff as well as managers and executives (Rosen & Weil, 2000). Therefore, technostress can, due to its link with both technology use and psychological stress (Ayyagari, 2007), affect a user's productivity level and cause dissonance in the workplace, resulting in loss of time and money for organisations (Sanderlin, 2004); and subsequently lowering the user's level of self-efficacy, leading to heightened anxiety levels (Brillhart, 2004; Doyle, Stamouli, & Huggard, 2005). Likewise, the findings of Gunson and de Blasis (2002) indicate that technostress also has a negative influence on the implementation, exploitation and preservation of an ERP system.

With the preceding discussion in mind, it makes sense to employ the TAM as research platform to measure user adoption levels of a computer technology such as ERP, and simultaneously consider the mediating/moderating influences of both psychological attachment and technostress as external variables to this process.

RECOMMENDATIONS

In the absence of research concerning the inclusion of both psychological attachment and technostress into one research model to determine technology acceptance, it seems appropriate to propose an extended model of computer-related technology adoption, based on the technology acceptance model (TAM), psychological attachment and technostress. In doing so, a significant contribution can be made towards the promotion and enhancement of computer-related technology adoption by users in the South African SAP ERP setting. Figure 3 below portrays such a proposed extended research model:

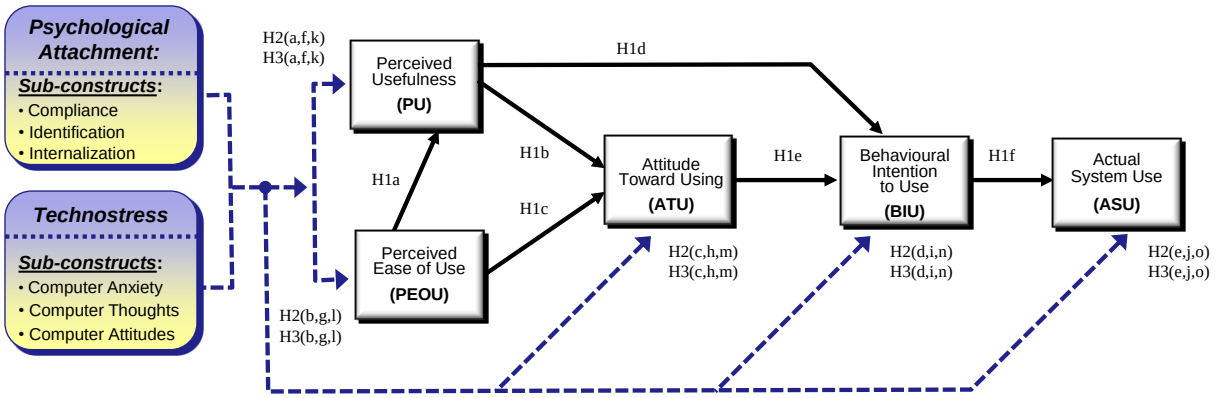

Figure 3. Extended TAM to include technostress and psychological attachment

It is furthermore recommended that this extended model be validated in three stages:

Stage one: The TAM

The TAM should first be validated to serve as platform to investigate the mediating role of psychological attachment and technostress in the process of technological acceptance.

Stage two: Psychological Attachment

Psychological attachment should be validated against the TAM to determine the role of social influence in terms of compliance, identification and internalisation on the acceptance or rejection of SAP ERP as a computer technology.

Stage three: Technostress

Thirdly, technostress should be validated against the TAM to determine the role of computer-related stress in terms of computer anxiety, computer thoughts and computer attitudes on the acceptance or rejection of SAP ERP as a computer technology.

With these impending findings (from the TAM, psychological attachment and technostress) as premise of departure, possible psychological intervention programmes can be established to enhance the adoption of new computer technologies such as SAP ERP from project to maintenance stages and subsequently ensuring organisational return on investment (ROI).

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CHAPTER 3

ARTICLE 2

A STRUCTURAL MODEL OF TECHNOLOGY ACCEPTANCE

ABSTRACT

The optimal utilisation of management information systems such as SAP ERP is paramount for organisational return on investment, which in turn is not dependent on the system alone, but also on the acceptance and ownership of its users. The aim of this study was to test the technology acceptance model within a South African SAP ERP user environment. A cross-sectional survey design was used. The 23-item Technology Acceptance Model Questionnaire of Malhotra and Galletta (1999) was deployed amongst SAP ERP users (N=241). The results confirmed significant paths from perceived usefulness of the information system to attitudes towards and behavioural intentions to use it. Furthermore, behavioural intention to use the system predicted actual use thereof. Perceived ease of use indirectly affected attitudes towards and behavioural intentions to use via perceived usefulness of the information system.

Key terms: Technological acceptance, perceived usefulness, perceived ease of use, attitude behavioural intention, actual system use.

Business organisations are constantly looking for ways to gain advantage over their competitors (Beyleveld & Schurink, 2005; Davenport, 1999). Historically, organisations focused on generating as much turnover as possible without taking into consideration what the precise demand is (Gumaer, 1996), but recently businesses embarked upon finding more efficient ways to deal with large turnovers (Umble, Haft, & Umble, 2003). One way to achieve this is to employ an Enterprise Resource Planning (ERP) system. An ERP system is an integrated, customised, packaged software based system that handles most of the system requirements in all business operational functions such as finance, human resources, manufacturing, sales and marketing (Watson & Schneider, 1998), and is widely used amongst businesses universally (Basoglu, Daim, & Kerimoglu, 2007). Although expectations from ERP systems are high, ERP systems have not always led to significant organisational enhancement (Soh, Kien, & Tay-Yap, 2000) and most ERP projects turn out to be over budget, not on time and do not succeed (Abugabah & Sanzogni, 2010; Hong & Kim, 2002; Kumar, Maheshwari, & Kumar, 2003).

Previous studies indicated that ERP projects failed as a result of poor project communication (Somers & Nelson, 2004), absence of support by senior managers (Al-Mashari, Al-Mudimigh, & Zairi, 2003), presence of ethnic differences (Yusuf, Gunasekaran, & Abthorpe, 2004), low user acceptance (Amoako-Gyampah & Salam, 2004; Shih & Huang, 2009), ineffective integration of systems (Al-Mashari et al., 2003), user dissatisfaction (Beyleveld & Schurink, 2005; Davis & Venkatesh, 1995), and inadequate system training (Amoako-Gyampah & Salam, 2004). The continued increase in ERP systems failures steered researchers to find new solutions (Gumussoy, Calisir, & Bayram, 2007), resulting in a growing body of academic research examining the predictors of information technology acceptance and utilisation among ERP users (Chau & Hu, 2002; Esteves-Sousa & Pastor-Collado, 2000; Holland & Light,1999; Nah & Lau, 2001; Taylor & Todd, 1995).

The foundation of these studies is a theory on the adoption and diffusion of innovation, where individuals' perceptions about using such innovations influence adoption behaviours (Moore & Benbasat, 1991; Rogers, 1995). Other theoretical models have also been used in an attempt to explain the relationship between user attitudes, perceptions, beliefs and ultimate system use. These models include the theory of reasoned action (Ajzen & Fishbein, 1975), the theory of planned behaviour (Ajzen & Madden, 1986), and the technology acceptance model (Davis, 1986).

No study has been found where the technology acceptance model was evaluated in the South African context. This study will contribute to scientific knowledge regarding the influence of individuals' perceptions of information system usage on their attitudes, behavioural intentions and actual use of such a system. The technology acceptance model, a variation of the theory of reasoned action (Davis, 1986), proved to be the most extensively used by information system researchers in their attempts to determine the predictors of system usage behaviour, perhaps because of its farsightedness and of its immensity of empirical support (Taylor & Todd, 1995). It is an influential, robust and universally employed model for forecasting and clarifying user behaviour towards information system usage (Davis, 1986; Davis, 1989; Hong, Thong, Wong, & Tam, 2002; Legris, Ingham, & Collerette, 2003).

The Technology Acceptance Model

The technology acceptance model consists of six distinct, yet causally-related constructs, namely external variables, perceived ease of use (PEOU), perceived usefulness (PU), attitude towards using (ATU), behavioural intention to use (BIU) and actual system use (ASU) (Davis, 1986; Davis, Bagozzi, & Warsaw, 1989).

In the technology acceptance model, perceived ease of use and perceived usefulness determine an individual's information system acceptance (Davis, 1989; Lee, Kozar, & Larsen, 2003), by determining his/her attitude towards using and subsequent behavioural intention to use, culminating in actual system use (Wu & Wang, 2005). Perceived usefulness is used as both a dependent and independent variable since it is predicted by perceived ease of use; and in turn predicts attitude towards using and behavioural intention to use at the same time (Davis, 1986; Davis et al., 1989; Lee et al., 2003). The perceived ease of use, attitude towards using and behavioural intention to use components represent the core functions of the technology acceptance model; whereas external variables and actual system use serve merely as input to and output from the model respectively. Figure 1 demonstrates the technology acceptance model as theoretical framework and its internal construct associations.

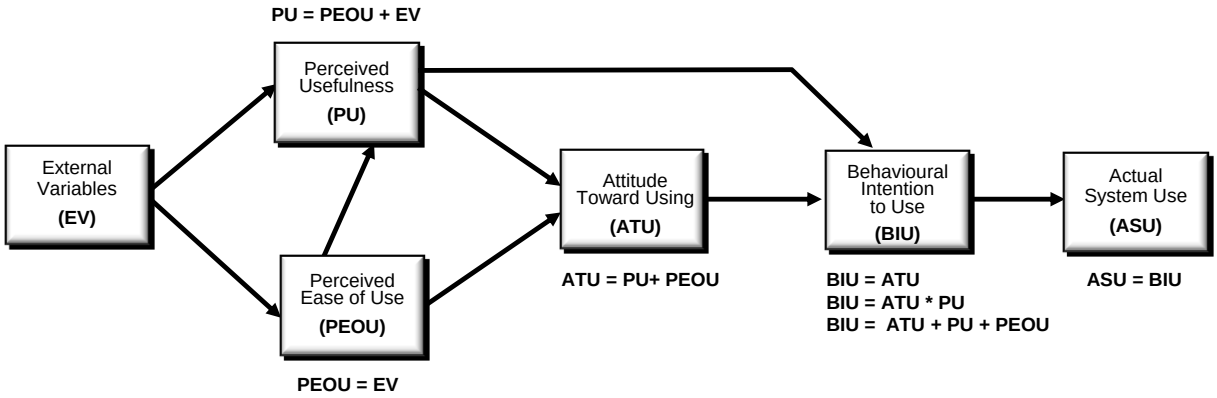

Figure 1. Technology acceptance model (adapted from Davis, Bagozzi, & Warshaw, 1989)

The rationale of the technology acceptance model commences with the supposition that the influence of external variables on technology acceptance behaviour is mediated by user beliefs and attitudes. Beliefs represent a degree of instrumentality tied to action; attitudes being purely affective. Beliefs relate to an individual's personal (subjective) estimation that performing a specific behaviour will result in a predictable consequence; whereas attitudes relate to an individual's positive or negative emotional feelings about performing that behaviour (Hubona & Geitz, 1997).

Both perceived ease of use and perceived usefulness are belief constructs which are indirectly influenced by external variables in reinforcing a user's belief that using a particular system could improve his or her performance; and furthermore, through his or her belief that using a particular system (by implication ERP) will be free of effort (Brown, 2002; Davis 1989; Saade & Bahli, 2005). External variables are therefore a link between inner beliefs, attitudes and intentions represented in the technology acceptance model and various individual dissimilarities, circumstantial restrictions, and organisational mediations imposing on behaviour (Davis et al., 1989). Identifying external variables and recognising their impact enable system developers to manipulate these variables, and in so doing have better control over user attitude towards using and on behavioural intention to use, and the subsequent enhanced actual system use (Hong et al., 2002). Previous researchers have identified two main types of external variables, namely personal differences and system features as identified by Lee et al. (2003), depicted in Tables 1 and 2.

Table 1

Summary of External Person Variables Used in Technology Acceptance Research

Variable	Description	Researchers
Image	The degree to which use of an innovation is perceived to enhance one's image or status in one's social system	Karahanna and Straub (1999); Venkatesh and Davis (2000)
Self-efficacy	The belief that one has the capability to perform a particular behaviour	Fenech (1998); Venkatesh and Speier (2000)
Personal Innovativeness	The individual trait reflecting a willingness to try out any new technology	Agarwal and Prasad (1998); Agarwal and Karahanna (2000)
Social Presence	The degree to which a medium permits users to experience others as being psychologically present	Karahanna and Straub (1999); Karahanna and Limayem (2000)
Subjective Norms/ Social Influence	Person's perception that most people who are important to him/her think he or she should or should not perform the behaviour in question	Malhotra and Galletta (1999); Venkatesh and Morris (2000)
Job Relevance	The capabilities of a system to enhance an individual's job performance	Venkatesh and Davis (2000); Thompson, Higgins, and Howellet (1991)
Computer Attitude	The degree to which a person likes or dislikes the object	Chau (2001)
Computer Anxiety	An individual's apprehension, or even fear, when he or she is faced with the possibility of using computers	Montazemi, Cameron, and Gupta (1996); Gopal, Miranda, Robichaux, and Bostrom (1994)
Perceived Enjoyment	The extent to which the activity of using a specific system is perceived to be enjoyable in its own right, aside from any performance consequences resulting from system usage	Chin and Gopal (1995); Teo, Lim, and Lai (1999)
Prior Experience	Experience gained while using a system strongly indicates a user's behavioural intention	Jackson, Chow, and Leitch (1997); Dishaw and Strong (1999)

Table 2

Summary of External System Variables Used in Technology Acceptance Research

Variable	Description	Researchers
Voluntariness	The degree to which use of the innovation is perceived as being voluntary, or of free will	Barki and Hartwick (1994); Venkatesh and Davis (2000)
Relative Advantage	The degree to which an innovation is perceived as being better than its precursor	Moore and Benbasat (1991); Premkumar and Potter (1995)
Compatibility	The degree to which an innovation is perceived as being consistent with the existing values, needs and past experiences of potential adopters	Chin and Gopal (1995); Xia and Lee (2000)
Complexity	The degree to which an innovation is perceived as being difficult to use	Premkumar and Potter (1995); Igbaria, Parasuraman, and Baroudi (1996)
Observability	The degree to which the results of an innovation are observable to others	Moore and Benbasat (1991)
Trialability	The degree to which an innovation may be experimented with before adoption	Moore and Benbasat(1991); Karahanna et al., (1999)
End User Support	High levels of support that promote more favourable beliefs about the system among users as well as MIS staff	Igbaria, Parasuraman, and Baroudi (1996); Karahanna and Limayem (2000)
Objective Usability	A construct that allows for a comparison of systems on the actual level of effect relating to completion of specific tasks	Venkatesh and Davis (1996); Venkatesh (2000)
Computer Playfulness	The degree of cognitive spontaneity in microcomputer interactions	Moon and Kim (2001); Agarwal and Karahanna (2000)
Visibility	The degree to which the innovation is visible in the organisation	Xia and Lee (2000); Karahanna and Straub (1999)
Accessibility	Physical accessibility: the extent to which someone has physical access to the hardware needed to use the system Information accessibility: the ability to retrieve the desired information from the system	Karahanna and Straub (1999) Karahanna and Limayem (2000)

Table 2 (continued)

Summary of External System Variables Used in Technology Acceptance Research

Variable	Description	Researchers
Result Demonstrability	The degree to which the results of adopting/using the IS innovation are observable and communicable to others	Karahanna and Straub (1999); Venkatesh and Davis (2000)
Management Support	The degree of support from managers to ensure sufficient allocation of resources and to act as a change agent to create a more conducive environment for IS success	Igbaria, Zinatelli, Cragg, and Cavaye (1997); Liao and Landry (2000)
System (Output or Information) Quality	The perception of how well the system performs tasks that match with job goals	Lucas and Spitler (2000); Lederer, Maupin, Sena, and Zhuang (2000)
Facilitating Conditions	The control beliefs relating to resource factors such as time and money and IT compatibility issues that may constrain usage	Taylor and Todd (1995b); Karahanna and Straub (1999)

Davis et al. (1989) found that although perceived usefulness and perceived ease of use are distinct dimensions, an enhanced perceived ease of use contributes to better performance; thus, having a direct influence on perceived usefulness.

Research has further revealed that there is a contributory relationship between perceived usefulness and attitude towards using, as well as between perceived ease of use and attitude towards using (Agarwal & Prasad, 1999; Davis et al., 1989; Gefen & Straub, 1997; Gumussoy et al., 2007; Moon & Kim, 2001). Attitude toward using involves judgment on whether a behaviour is good or bad and whether the user is in favour of or against performing it (Leonard, Cronan, & Kreie, 2004), and has a direct effect on the intention to use IS/ERP systems in the future (Davis et al., 1989; Liao, Shao, Wang, & Chen, 1999). According to the technology acceptance model, attitude towards using is mutually motivated by perceived ease of use and perceived usefulness (Davis et al., 1989).

The technology acceptance model further proposes that computer usage is ensured by behavioural intention to use, which predicts a user's intention in performing an intentional act, such as deciding to accept and use an information system. Behavioural intention to use has

also been found to correctly forecast the actual use of a computer information system (Davis et al., 1989; Recker, Rosemann, Green, & Indulska, 2006; Venkatesh & Davis, 1996). Behavioural intention to use, in turn, is influenced by attitude towards using and perceived usefulness (Chau & Hu, 2002; Davis et al., 1989).

Historically, technology acceptance model research has been done covering traditional and relatively simple, yet important, environments, such as personal computing, e-mail systems, word processing, and spread-sheet software (Hong et al., 2002). However, with the introduction and acceptance of complex information systems, such as ERP that works across functional and organisational boundaries, continuous business process re-engineering during implementation became mandatory. It therefore became clear that there is an increased need to study and extend the technology acceptance model in such complex information system settings (Lucas & Spitler, 1999). Several researchers have responded to this need and conducted research on the more complex information systems environment of ERP, of which the results are depicted by Table 3.

Table 3

Examples of TAM Research in the ERP Environment

Researchers	Results
Amoako-Gyampah and Salam (2004)	Managerial interventions such as training and communication influence the acceptance of ERP technology.
Gumussoy, Calisir, and Bayram (2007)	Subjective norms, perceived usefulness and education level are determinants for behavioural intention to use the ERP system.
Legris, Ingham, and Collerette (2003)	TAM explains only about 40% of ERP system use due to significant factors not included, such as human and social change processes and adoption of the innovation model variables.
Seymour, Makanya, and Berrangé (2007)	Factors, such as performance expectancy, effort expectancy, project communication, training, and shared beliefs were all found to be antecedents to symbolic adoption; and age was found to have a moderating influence on the relationships between symbolic adoption and: • effort expectancy; • training; • shared belief; and • project communication.
Shih and Huang (2009)	Structural equation modelling demonstrated that top management support strongly and positively affects computer self-efficacy (CSE), perceived usefulness (PU), and perceived ease of use (PEOU). CSE had an insignificant effect on PU, but was found to directly influence PEOU. PU influenced behavioural intention, but did not significantly affect actual system usage (ASU). PEOU was found to directly affect behavioural intention to use (BIU). Finally, BIU positively and directly affects actual usage (ASU).

Apart from the study done by Seymour, Makanya, and Berrangé (2007) within an academic environment, using a hybrid version of the technology acceptance model, namely the UTAUT (Unified Theory of Acceptance and Use of Technology), no South African research study could be found using the technology acceptance model as foundation to examine the mediating influence of shared beliefs in the benefits of the ERP system, on end user acceptance, and usage within a corporate environment.

Purpose and Hypotheses

The purpose of this study was to determine, within a South African corporate ERP environment, the internal relationships between technology acceptance model constructs and their mediating/moderating influence towards actual system use. Based on this objective, the following hypotheses were proposed as depicted by Figure 2:

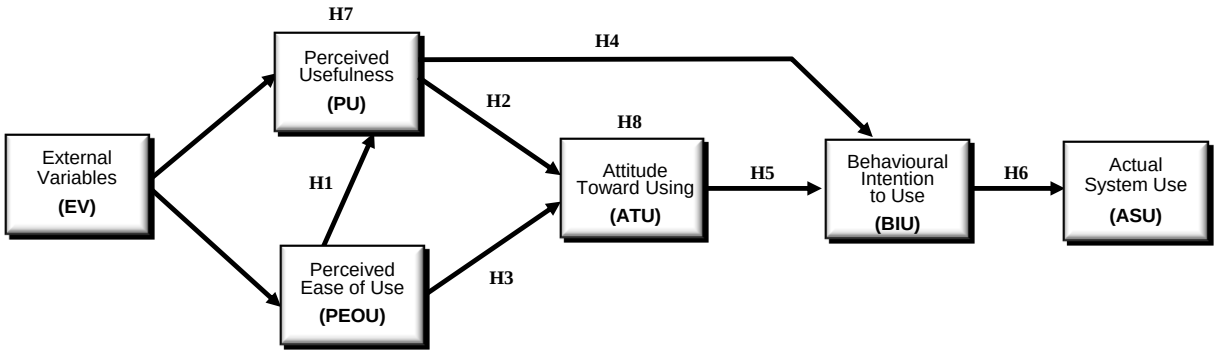

Figure 2. Internal relationships between technology acceptance constructs

Hypothesis 1: Perceived ease of use is positively related to perceived usefulness of an information system.

Hypothesis 2: Perceived usefulness is positively related to attitude toward using an information system.

Hypothesis 3: Perceived ease of use is positively related to attitude toward using an information system.

Hypothesis 4: Perceived usefulness is positively related to behavioural intention to use an information system.

Hypothesis 5: Attitude toward using is positively related to behavioural intention to use an information system.

Hypothesis 6: Behavioural intention to use an information system is positively related to actual system use.

Hypothesis 7: Perceived ease of use affects attitudes towards and behavioural intention to use an information system indirectly via perceived usefulness.

Hypothesis 8: Perceived usefulness affects actual information system use indirectly via a behavioural intention to use it.

METHOD

Research Design

A cross-sectional survey design whereby a sample is drawn from a population at one time was used. According to Yang and Land (2008), this design is best suited for addressing the descriptive and predictive functions associated with correlational design whereby relationships between variables are examined.

Participants

The entire ERP user population of 720 employees within a steel manufacturing organisation in Gauteng was targeted for this research, but a response rate of only 33.5% (241 participants) was obtained. The characteristics of the study population are detailed in Table 4. The majority of participants were white (75.5%), male (64.7%) and between the ages of 29 to 55 years of age holding a diploma or degree (43.6%). This sample was mainly non- managerial employees (66.8%) from the administration/services (38.6%) and engineering (28.6%) domains, having had between five to ten years ERP experience (42.0%).

Table 4

Characteristics of Participants (N=241)

Item	Category	Frequency	Percentage
Gender	Male	156	64.7
	Female	85	35.3
	Total	241	100.0
Culture	Asian	12	5.0
	Black	38	15.8
	Coloured	9	3.7
	White	182	75.5
	Total	241	100.0
Age	below 22	2	0.8
	23 – 28	24	10.0
	29 –39	73	30.3
	40 – 45	45	18.6
	46 –55	73	30.3
	over 55	24	10.0
	Total	241	100.0
Education	below Grade 12	11	4.6
	Grade 12	89	36.9
	Diploma/Degree	105	43.6
	Post Diploma/Degree	36	14.9
	Total	241	100.0
Domain	Manufacturing	15	6.2
	Engineering	69	28.6
	Financial	38	15.8
	Information Technology	26	10.8
	Administration/Services	93	38.6
	Total	241	100.0
Status	Senior Management	12	5.0
	Middle Management	68	28.2
	Non-managerial	161	66.8
	Total	241	100.0
ERP years	Less than 1	16	6.6
	1 – 2	16	6.6
	3 – 5	53	22.0
	6 – 10	101	42.0
	More than 10	55	22.8
	Total	241	100.0

Measuring Instrument

The TAM questionnaire with 23 items compiled by Malhotra and Galletta (1999), was used for gathering data about the various constructs depicted in the core of the technology acceptance model, namely perceived usefulness, perceived ease of use, behavioural intention to use, attitude towards using and actual system use. These scales were adapted from prior studies, many of which had already established reliability and validity. The Cronbach Alpha reliability scores for the core technology acceptance model constructs were found to range from 0.68 to 0.97 for perceived ease of use, 0.71 to 0.96 for perceived usefulness (Amoako-Gyampah & Salam, 2004; Chau & Hu, 2002; Davis, 1989; Davis et al., 1989; Malhotra & Galletta, 1999; Mathieson, 1991; Taylor & Todd, 1995), also 0.69 to 0.92 for attitude towards using (Amoako-Gyampah & Salam, 2004; Chau & Hu, 2002; Mathieson, 1991; Taylor & Todd, 1995), and 0.62 to 0.96 for behavioural intention to use (Amoako-Gyampah & Salam, 2004; Chau & Hu, 2002; Mathieson, 1991).

Malhotra and Galletta (1999) established convergent validity and discriminant validity of all pre-existing technology acceptance model measures by observing the correlations between the items on the various scales. Factor analyses provided evidence of distinct loadings of various factors and convergent and discriminant validity based on inter-item correlations. All pre-existing constructs used in the technology acceptance model met the criteria of validity and reliability.

A *Biographical questionnaire*, compiled by the researcher, was used to obtain descriptive information about the research participants as depicted in Table 3 before.

Data Analysis

The data was statistically analysed with the SPSS (SPSS Inc., 2003) and AMOS (Arbuckle, 2012) programs. Descriptive statistics (e.g. means and standard deviations) were used to analyse the data. Pearson correlation coefficients were computed to determine the relationships between variables. A cut-off point of $p \leq 0.05$ was set for the statistical significance of the results. Effect sizes (Cohen, 1988) were used to decide on the practical significance of the findings. A cut-off point of 0.30 (medium effect, Cohen, 1988) was set for the practical significance of correlation coefficients.

Structural equation modelling was used to assess the factorial validity of the measuring instruments perceived usefulness, perceived ease of use, attitude towards using, behavioural intention to use and actual system use. Among the fit indices produced by the AMOS program is the Chi-square statistic (χ^2), which is the test of absolute fit of the model. However, the χ^2 value is sensitive to sample size. Therefore, additional best-fit indices, such as the Root Means Square Error of Approximation (RMSEA), Standardised Root Mean Residual (SRMR) and Degrees of Freedom (*df*), Tucker-Lewis Index (TLI), Comparative Fit Index (CFI), Akaike Information Criterion (AIC) and the Bayes Information Criterion (BIC), were used in this study.

Due to the inefficiency of Cronbach's alpha for calculating scale reliability when using structured equation modelling, an alternative method is applied as proposed by Wang and Wang (2012), allowing for latent variables underlying a set of observed indicators which are not tau-equivalent or parallel measures. This method is based on utilising the unstandardised factor loadings (λ) and unstandardised variance of errors (θ), whilst incorporating the correlation of errors. When the results of a standardised solution are applied, the following formulas are applicable:

a) With no measurement errors correlated:

$$\rho = \frac{(\sum_i \lambda_i)^2}{(\sum_i \lambda_i)^2 + (\sum_i \theta_i)}$$

b) With measurement errors correlated:

$$\rho = \frac{(\sum_i \lambda_i)^2}{(\sum_i \lambda_i)^2 + \sum_i \theta_i + 2 \sum_i \sum_j \theta_{ij}}$$

Procedure

This study was conducted at a South African steel manufacturer as part of their SAP ERP Consolidation Project, with the intent to determine user acceptance of the new consolidated system. The research sample was drawn from the SAP ERP users group comprising system

users and technical specialists over a 16-month period from September 2010 to December 2011. The battery of questionnaires, as compiled by the researcher, together with a manual pertaining to the completion requirements for all questionnaires as well as the contact details of the researcher from whom further information could be sourced, were placed on the organisation's Information Portal by their systems administrator, where participants could complete and submit it online. Prior to placing the questions online and manual, some hardcopies of questionnaires and manual were distributed and collected by the SAP basis technical department from users working on project outside the reach of the portal. The systems administrator extracted the completed questionnaire data from the Information Portal database and made all data together with the hardcopies available to the researcher. This data was verified and collated by the researcher into a single database for statistical analyses. Only complete questionnaires were included whilst questionnaires containing missing data were discarded.

Ethical Aspects

The manager of the SAP Centre of Excellence in the Information Management section at a South African steel manufacturer was approached and asked for permission to conduct this study. Permission in the form of a letter of approval was obtained, with the precondition that all research findings will be made available to the SAP CoE manager. No permission was necessary from SAP AG seeing that this study investigated the effect of a real-time, fully integrated system (of which SAP was the steel manufacturer's choice of system) on the wellbeing of users and not investigating the effectiveness, efficiency or performance of SAP ERP as system. The Ethics Committee of the North-West University (NWU) approved the study. Participants were informed in the preamble to the questionnaire, that: a) data is captured by the researchers and not their organisation; b) data will solely be used for academic research purposes and not for any job performance or merit objectives; c) participation is voluntary; and d) participants will remain anonymous.

RESULTS

Testing the Measurement Model

By way of confirmatory factor analysis (CFA) alternative measurement models were tested to assess whether the items loaded significantly onto the scales with which they were related. Using structural equation modelling (SEM) methods, as implemented by AMOS (Arbuckle, 1999), six measurement models were tested. Model 1 was the TAM as proposed and validated by Davis (1986), and Malhotra and Galletta (1999), which consisted of five latent variables, namely a) perceived ease of use (measured by six observed variables); b) perceived usefulness (measured by six observed variables); c) attitude toward using (measured by four observed variables); d) behavioural intention to use (measured by four observed variables); and e) actual system use (measured by three observed variables). All the latent variables in model 1 were allowed to correlate.

Models 2, 3, 4, 5 and 6 followed the same template: model 2 was specified with perceived ease of use and perceived usefulness merged into a general-perception latent variable; model 3 was specified with perceived usefulness and attitude toward using merged into a useful-attitude latent variable; model 4 was specified with perceived ease of use and attitude toward using merged into an ease-attitude latent variable; model 5 was specified with perceived usefulness, perceived ease of use and attitude toward using merged into a perceptual-attitude latent variable; and model 6 was specified with attitude toward using and behavioural intention to use merged into a motivation-attitude latent variable. Table 5 presents fit statistics for the test of the various models.

Table 5

Fit Statistics of Competing Measurement Models

Model	χ^2	RMSEA	SRMR	*df*	TLI	CFI	AIC	BIC
Model 1	617.99	0.09	0.05	220	0.89	0.91	729.98	925.13
Model 2	1436.34	0.15	0.11	224	0.68	0.72	1540.34	1721.55
Model 3	834.49	0.11	0.07	224	0.84	0.86	938.49	1119.69
Model 4	956.38	0.12	0.12	224	0.81	0.83	1060.382	1241.59
Model 5	1642.15	0.16	0.12	227	0.63	0.67	1740.15	1910.90
Model 6	819.29	0.11	0.07	224	0.84	0.86	923.29	1104.50
Model 7	549.81	0.08	0.05	219	0.91	0.92	663.81	862.450

df = degrees of freedom; TLI = Tucker-Lewis Index; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardised Root Mean Square Residual; AIC = Akaike Information Criterion; BIC = Bayes Information Criterion.

A χ^2 value of 617.99 (*df* = 220) was obtained for the hypothesised measurement model 1. The fit statistics on two fit indices were acceptable: CFI = 0.91 and SRMR = 0.05. The fit statistics on the remaining two indices were near acceptable: TLI = 0.89 and RMSEA = 0.09. Two additional fit statistics, namely the AIC and BIC were used to compare alternative measurement models. The AIC, which is a comparative measure of fit, is meaningful when different models are estimated. The lowest AIC is the best fitting model. The BIC provides an indication of model parsimony. On these additional fit statistics, model 1 rendered an AIC = 729.98 and BIC = 925.13. Comparison of the fit indices indicates that model 1 fitted the data best.

Analyses continued in an exploratory manner to improve the fit of the selected model. The modification index (MI = 60.34) for item 14 ("I intend to use SAP for capturing ALL my work-related reports") and item 15 ("I intend to use SAP to generate all my work-related reports"), related to behavioural intention to use (BIU), indicated that the model fit could be improved by correlating the errors of these items. The fit statistics for the revised model (model 7) showed that the model fit improved significantly when the errors of the items were allowed to correlate. A χ^2 value of 549.81 (*df* = 219) was obtained for the hypothesised measurement model. The fit statistics on the six fit indices were acceptable: TLI = 0.91, CFI = 0.92, RMSEA = 0.08, SRMR = 0.05, AIC = 663.81, and BIC = 862.45.

Testing the Structural Model

Table 6 shows the descriptive statistics, reliability coefficients and inter-item correlation coefficients of the technology acceptance model measuring instruments i.e., perceived usefulness (PU), perceived ease of use (PEOU), attitude towards using (ATU), behavioural intention to use (BIU) and actual system (ASU) use:

Table 6

Descriptive Statistics, Reliability Coefficients and Correlation Means Coefficients and Inter-item Correlation Coefficients of the TAM Measuring Instruments (N=241)

Measure	Mean	*SD*	Skewness	Kurtosis	Inter-item r	ρ
PEOU	31.07	6.89	-0.93	1.25	0.41	0.99
PU	31.77	6.92	-0.73	0.92	0.57	0.99
ATU	21.05	4.74	-0.86	1.13	0.56	0.96
BIU	23.74	4.22	-1.23	1.75	0.44	0.96
ASU	16.91	4.66	-1.07	0.19	0.43	0.98

Scores on three of the dimensions, perceived ease of use, attitude towards using, and behavioural intention to use, seem to be leptokurtic by peaking high with a kurtosis of greater than 1, confirming their frequency distributions to be concentrated around the centre. The remaining two, perceived usefulness and actual system use, seem to be platykurtic by peaking low with a kurtosis of smaller than 1 with their frequency distribution concentrated widely around the distribution tail ends. All five dimensions are negatively skewed which is indicative of most values being distributed to the right of the mean. A multivariate kurtosis score for the data of 280.55 with a critical ratio score of 64.22 was reported by Amos (Arbuckle, 2012), which is indicative of severe non-normality.

Scale reliability obtained using the method as proposed by Wang and Wang (2012), rendered a reliability statistic ranging between $\rho = 0.96$ and $\rho = 0.99$ for the scales used in this study. This score surpassed the 0.70 cut-off point that Nunnally and Bernstein (1994) proposed and is therefore acceptable.

The correlation coefficients between perceived ease of use, perceived usefulness, attitude towards using, behavioural intention to use and ASU for employees working in a SAP ERP environment are reported in Table 7.

Table 7

Correlation Coefficients Between Perceived Ease of Use, Perceived Usefulness, Attitude Toward Using, Behavioural Intention to Use and Actual System Use (N=241)

Variable	1	2	3	4	5
1. PEOU	-	-	-	-	-
2. PU	0.48*$^{+}$	-	-	-	-
3. ATU	0.49*$^{+}$	0.75*$^{++}$	-	-	-
4. BIU	0.35*$^{+}$	0.55*$^{++}$	0.48*$^{+}$	-	-
5. ASU	0.32*$^{+}$	0.49*$^{+}$	0.52*$^{++}$	0.37*$^{+}$	-

* Statistically significant $p < 0.01$
$^{+}$ Correlation is practically significant $r \geq 0.30$ (medium effect)
$^{++}$ Correlation is practically significant $r \geq 0.50$ (large effect)

All correlation coefficients obtained were significant. Practically significant positive correlations of medium effect were obtained between perceived ease of use and perceived usefulness, as well as between perceived usefulness and attitude towards using, demonstrating higher user perceived usefulness and higher attitude toward using as a result of an increase in user perceived ease of use. Practically significant positive correlations of large effect were obtained between perceived usefulness and attitude towards using, as well as between perceived usefulness and behavioural intention to use; confirming that higher levels of perceived usefulness are associated with higher levels of end user attitude towards using, as well as end user behavioural intention to use the SAP ERP system. Practically significant positive correlations of medium effect were obtained between attitude towards using and behavioural intention to use, as well as between behavioural intention to use and actual system use; demonstrating that higher attitude toward using positively enhances behavioural intention to use which in turn leads to higher actual system use.

The structural model (model 8) was tested, based on the measurement model (model 7). Model 8 that emerged as an over-identified structural model, having 276 unique covariance terms and 53 parameters, was tested rendering the following fit results: $\chi^2 = 562.53$ ($df = 223$; $p = 0.00$); RMSEA = 0.08; SRMR = 0.06; TLI = 0.91; CFI = 0.92; AIC = 668.53; and BIC = 853.22. Figure 3 shows the standardised path coefficients estimated by AMOS (Arbuckle, 1997).

Given the cross-sectional nature of the data, two competing models, models 8a and 8b were also tested to determine possible redundancies among path coefficients. In model 8a, the relationship between perceived ease of use and perceived usefulness was annulled by constraining the path coefficient to zero. Results indicated a poor fit to the data: χ^2 (224, N = 241) = 625.56; $p < 0.001$; TLI = 0.89; CFI = 0.91; RMSEA = 0.09; SRMR = 0.19; AIC = 729.56; and BIC = 910.77. A path coefficient in the remaining competing model 8b was also constrained to zero between perceived usefulness and attitude toward using. Model 8b rendered the following fit statistics: χ^2 (224, N = 241) = 608.64; TLI = 0.90; CFI = 0.91; RMSEA = 0.09; SRMR = 0.11; AIC = 712.64; and BIC = 893.85. Table 8 presents fit statistics for the various structural models.

Table 8

Fit Statistics of Competing Structural Models

Model	χ^2	RMSEA	SRMR	*df*	TLI	CFI	AIC	BIC
Model 8	562.53	0.08	0.06	223	0.91	0.92	668.53	853.22
Model 8a	625.56	0.09	0.19	224	0,89	0.91	729.56	910.77
Model 8b	608.64	0.09	0.11	224	0,90	0.91	712.64	893.85

df = degrees of freedom; TLI = Tucker-Lewis Index; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardised Root Mean Square Residual; AIC = Akaike Information Criterion; BIC = Bayes Information Criterion.

Upon inspection of Table 8, model 8 emerged as the best fitting and most parsimonious structural model revealing the lowest χ^2 (562.53), *df* (223), and AIC (668.53) values. Furthermore, all other fit statistics, RMSEA (0.08), SRMR (0.06), TLI (0.91), and CFI (0.92) were within acceptable bounds. The following changes in chi-square ($\Delta\chi^2$) were found: Models 8 and 8a ($\Delta\chi^2 = 63.03$, $\Delta df = 1$, $p < 0.01$), models 8 and 8b ($\Delta\chi^2 = 46.11$, $\Delta df = 1$, $p < 0.01$). The AIC and BIC values of model 8 were also substantially lower than the values for

models 8a through 8b. Therefore, model 8 will be discussed with reference to the hypotheses of this study by referring to the relevant standardised regression weights as per Figure 3.

Hypothesis 1

Inspection of the standardised regression weights revealed a positive relationship (β = 0.51) between perceived ease of use and perceived usefulness toward using SAP ERP. The ML-estimated equation accounted for a large proportion of the variance in perceived usefulness (R^2 = 0.26). Hypothesis 1 is accepted.

Hypothesis 2

The standardised regression weight obtained for the relationship between perceived usefulness and attitude toward using SAP ERP was also positive (β = 0.51). The ML-estimated equation accounted for a large proportion of the variance in attitude toward using (R^2 = 0.35). Hypothesis 2 is accepted.

Hypothesis 3

The standardised regression weights for the relationship between perceived ease of use and attitude toward using SAP ERP were positive (β = 0.13), but the effect size was small.

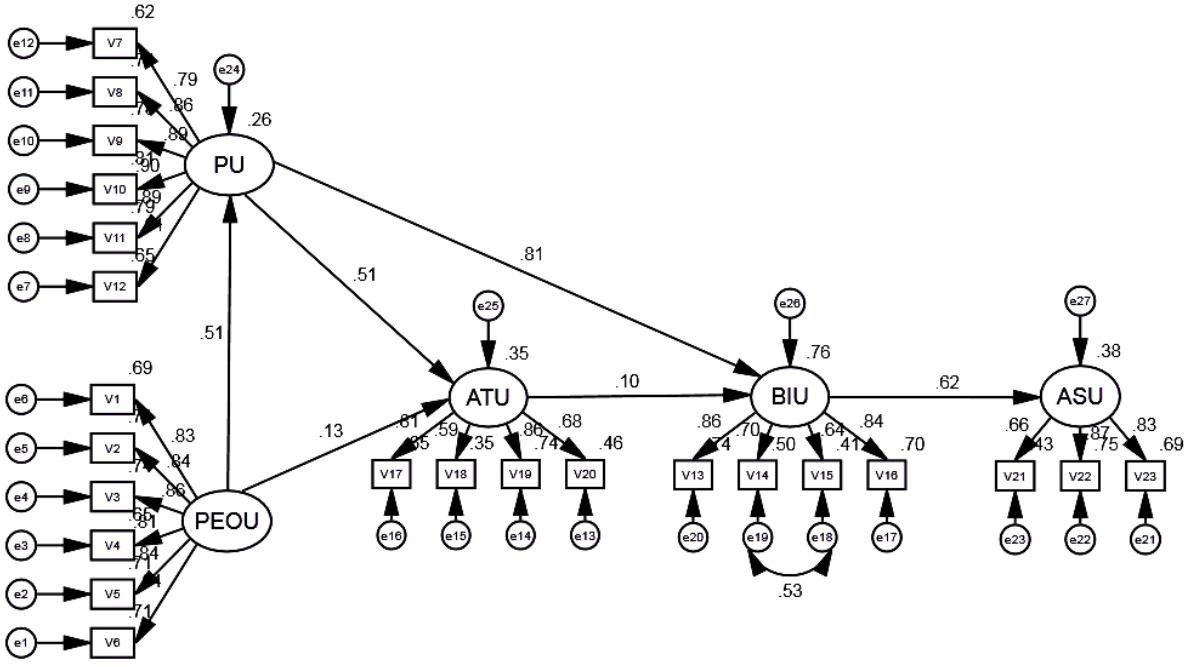

Figure 3. Structural model of technology acceptance

Hypotheses 4 and 5

The standardised regression weight obtained for the relationship between perceived usefulness and behavioural intention to use SAP ERP was positive (β = 0.81).

The standardised regression weight for the relationship between attitude toward using and behavioural intention to use SAP ERP was positive (β= 0.10). Although the ML-estimated equation accounted for a large proportion of the variance in behavioural intention to use (R^2 = 0.76), attitude towards using had a small effect; while perceived usefulness had a large effect. Hypotheses 4 and 5 are accepted.

Hypothesis 6

The standardised regression weight obtained for the relationship between behavioural intention to use SAP ERP and actual system use was positive (β = 0.62). The ML-estimated equation accounted for a large proportion of the variance in actual system use (R^2 = 0.38). Hypothesis 6 is accepted.

Hypothesis 7

To determine whether perceived ease of use indirectly affected behavioural intention to use via attitude toward using, the procedure as explained by Hayes (2009) was used. Two-sided bias-corrected 95% confidence intervals were constructed, using bootstrapping so as to evaluate indirect effects and proved not to include zero. The obtained lower CIs (LCIs) and upper CIs (UCIs) are reported in Table 9. Perceived ease of use affected behavioural intention to use SAP ERP indirectly via attitude toward using. Hypothesis 7 is accepted.

Hypothesis 8

Again two-sided bias-corrected 95% confidence intervals were, as suggested by Hayes (2009), constructed using bootstrapping in order to assess indirect effects. The relevant lower CIs (LCIs) and upper CIs (UCIs) are reported in Table 9. The 95% CIs for the indirect effect of perceived usefulness on behavioural intention to use (via attitude towards use) did not include zero. The 95% CIs of perceived usefulness on actual system use (via behavioural intention to use) did not include zero. Therefore, perceived usefulness affected actual information system use indirectly via the behavioural intention to use it. Hypothesis 8 is accepted.

Table 9

Indirect Effects of Perceived Ease of Use (PEOU) and Perceived Usefulness (PU)

Variable	Estimate	SE	95% BC CI
PEOU to BIU	0.45	0.07	[0.31, 0.60]
PEOU to ATU	0.26	0.06	[0.16, 0.41]
PU to ASU	0.53	0.06	[0.41, 0.65]
PU to BIU	0.50	0.05	[-0.03, 0.16]

SE = standard error; 95% BC CI = 95% bias-corrected confidence interval

DISCUSSION

The aim of this study was to test the technology acceptance model within a South African SAP ERP user environment. Results acquired through structural equation modelling confirmed that positive inter-construct relationships exist between all TAM constructs. Actual system use, which is the measurement for technology acceptance, was directly affected by behavioural intention to use and indirectly by perceived usefulness. In turn, behavioural intention to use was directly affected by perceived usefulness, attitude toward using, and indirectly by perceived ease of use. Attitude toward using was directly affected by perceived ease of use and perceived usefulness. Perceived usefulness was directly affected by perceived ease of use.

Structural equation modelling rendered a best fit model which confirmed a positive statistically significant relationship path leading from perceived ease of use through perceived usefulness and behavioural intention to use to actual system use. This path commences with a meaningful correlation between perceived ease of use and perceived usefulness (explaining 26% of the variance). This finding is consistent with findings reported by Amoako-Gyampah and Salam (2004), Averweg (2008), Chau and Hu (2002), Davis (1986), Davis et al. (1989), and Venkatesh and Davis (2000).

As expected, perceived usefulness of the information system was strongly associated with the behavioural intention to use it (76% of the variance explained). This finding is consistent with that reported by Davis (1986), Malhotra and Galletta (1999), and Taylor and Todd (1995), but inconsistent with findings of Gumussoy et al. (2007), who reported it to be of medium

practical effect. This discrepancy may be attributed to the fact that the Gumussoy et al. (2007) study focused on potential ERP users and not on existing users. Potential users will obviously not have any experience with ERP; therefore, they will not have a well-founded sense of usefulness. Amoako-Gyampah and Salam (2004) reported this relationship to be non-significant. The Amoako-Gyampah and Salam (2004) research was done during an ERP implementation amidst prospective users with no or little system experience. Their study focused primarily on three external project related variables, namely a) project communication related to the ERP system; b) shared belief in the benefits of the ERP system; and c) training on the ERP system. Obviously these participants had no sense of usefulness and were unable to formulate an intention toward using the system.

The behavioural intention to use the system was strongly related to actual system use (38% of the variance shared). This finding is consistent with that reported by Davis (1986); Malhotra and Galletta (1999); but inconsistent with Shih and Huang (2009) who reported it as being of medium effect. Shih and Huang (2009) conducted their research prior to an ERP implementation incorporating additional behavioural constructs, such as: a) top management support; b) computer self-efficacy; and c) computer anxiety. This finding of Shih and Huang (2009) could possibly be attributed to a lack of hands-on experience; thus, potential users were unable to formulate a behavioural intention to use the system.

The significance of identifying the relationship path to system use as indicated above is that organisations can focus on appropriate interventions prior to system upgrades and modifications, in order to secure the optimal use of their ERP system amongst existing users. Therefore, during such ERP renewal projects, change management endeavours could focus on influencing the users' perceptions regarding the ease of use together with usefulness of the adapted system. Subsequently, through emphasising the benefits of these adaptations, users' intentions to use the modified system can positively be influenced.

The results of this study confirm the important role of perceived ease of use and perceived usefulness of technology in the acceptance thereof. Perceived ease of use strongly affected perceived usefulness, while perceived usefulness strongly affected attitudes towards system use as well as the behavioural intention to use it. The findings confirmed that perceived ease of use indirectly affected individuals' attitudes towards use (via perceived usefulness). Moreover, perceived ease of use also indirectly affected the behavioural intention to use the system (via perceived usefulness). Perceived usefulness of the information system seems to

play a pivotal role in the model: it affected attitudes towards system use, but also the behavioural intention to use the system.

Attitude towards system use did not play an important role in affecting behavioural intentions to use it and/or the actual use thereof in this study. Although perceived usefulness of the information system strongly affected attitudes toward using it, the relationship of attitudes with behavioural intention to use was non-significant. One reason for this finding could be a possible overlap between the constructs of perceived usefulness and attitudes towards use. However, an evaluation of the measurement models showed that these constructs could be modelled independently. This observation corresponds with the model of Gumussoy et al. (2007), but differs from that of Amoako-Gyampah and Salam (2004) who found the strength of the relationship between attitude towards using and behavioural intention to use highly significant with $r = 0.75$. This inconsistency could be attributed to differences in user cultures in South Africa and the United States of America and/or the period of user exposure to ERP. The South African study was conducted amongst existing ERP users; whereas Amoako-Gyampah and Salam (2004) focused on potential ERP users prior to an ERP implementation.

This study had several limitations. Firstly, the sample size has a limitation, specifically the distribution of cultural groups, age generations and gender. This limitation could be ratified by a stratified random sampling approach of larger samples, and securing adequate representation of participants in each of these categories. Another limitation was that the measurement of the TAM variables was based upon self-reports. According to Schaufeli, Enzmann, and Girault (1993), the exclusive use of self-report measures increases the likelihood that at least part of the shared variance between measures can be attributed to method variance. Thirdly, the study population was very homogeneous since; from a sample of 241 respondents, 64.7% were male and 75.5% white. South Africa's multicultural society demands studying the constructs of technology acceptance from different cultural group perspectives, by ensuring construct equivalence in the absence of item bias for these groups. Stratified random sampling might amend this inadequacy.

This study validated the technology acceptance model within a South African context and it paved the way for future researchers to reconstruct and improve the technology acceptance model at the hand of South African-tailored measures. Practically, this study implies the possible determining of SAP ERP end user acceptance of new functional additions, due to

system upgrades and functional add-ons. Furthermore, corporate leadership could select and recruit super users by means of the model and measures used in this study, and in so doing, work towards higher levels of returns on their information technology investment.

RECOMMENDATIONS

Based on the findings of this study, it is recommended that future studies should include larger sample sizes obtained from stratified random sampling to secure adequate representation in all sample categories, in order to prevent a homogeneous sample model. Future studies could also follow a longitudinal design where causal inferences can be made prior to SAP ERP system upgrades or functional enhancements. This will promote an understanding of the motivational impact such changes have on end users. Lastly, future research should consider including the generational theory solely to determine the aptitude and consequent acceptance of new IT technologies. This will enable corporate leadership to successfully interact with each generation during system changes and developments, to ensure higher levels of acceptance.

Furthermore, based on the research problem, it is recommended that future studies within South Africa be done using other relevant external variables as suggested by previous researchers, namely project communication (Somers & Nelson, 2004), senior management support (Al-Mashari, Al-Mudimigh, & Zairi, 2003), ethnic differences (Yusuf, Gunasekaran, & Abthorpe, 2004), effective systems integration (Al-Mashari et al., 2003), and system training (Amoako-Gyampah & Salam, 2004).

Considering ERP renewal projects, it is recommended that future studies focus on the practical composition of change management user interventions, in order to secure acceptance of the renewed system by way of utilising the findings of this study. A typical intervention rationale could be: Firstly, to build user confidence by indicating the ease of use of the renewed system; secondly, reiterating the usefulness and future added value to the user's job and career of employing the system in question; thirdly, through relevant education, training and guidance initiatives, motivate users to use the system; and lastly, ensure on-going user support.

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CHAPTER 4

ARTICLE 3

THE ROLE OF PSYCHOLOGICAL ATTACHMENT IN TECHNOLOGY ACCEPTANCE

ABSTRACT

The objective of this study was to examine the relationship between psychological attachment and technology acceptance amongst SAP ERP end users within a South African context. A cross-sectional survey design was used. The Technology Acceptance Model Questionnaire and the Psychological Attachment Questionnaire were administered to SAP ERP users (N = 241). The results confirmed that individuals use the system when they perceive it as useful and easy to use. Identification (using the system because it allows possible recognition and approval by prominent people) was positively associated with its perceived usefulness. Compliance was not related to system use, although it had an effect on the attitude towards use. Identification had a strong direct effect on internalisation (using the system because it is in line with the individual's value system), which in turn affected actual system use indirectly via the behavioural intention to use it.

Key terms: Technological acceptance, perceived usefulness, perceived ease of use, attitude toward use, behavioural intention to use, actual system use, psychological attachment

Organisations are increasingly investing in and utilising information systems. Reasons for increased use of information systems include demands to decrease costs and/or to, without increasing costs, produce more, simply to improve and maintain the quality of services and products in order to stay in business (Legris, Ingham, & Collerette, 2003); and to maintain an advantage over competitors (Beyleveld & Schurink, 2005; Davenport, 1999). Traditionally, information systems were used to enforce compliance with completing and achieving specific business goals (Malhotra & Galetta, 2005). Consequently, measuring effectiveness was based upon delivering an operational information system product, within certain financial and time-based restrictions (Behrens, Jamieson, Jones, & Cranston, 2005). Yet, despite on-going measuring and improvement attempts, Legris et al. (2003) report that only 26% of all management information systems (e.g. enterprise resource planning projects) are completed in time and within budget, with all prerequisites fulfilled. Furthermore, in excess of 46% of projects were over budget, overdue and with less features and functions than originally specified, and close to one third of the projects (28%) were terminated. Subsequently, based on the reasoning that the probability of system success is most likely determined by the level of user acceptance of such a system, researchers began considering system use as a more accurate measure of information systems success (Behrens et al., 2005).

The most popular theoretical framework for predicting information systems usage based upon user acceptance is Davis's (1986) technology acceptance model (TAM) (Chuttur, 2009; Davis & Venkatesh, 1995). The TAM is derived from Fishbein and Ajzen's (1975) general theory of reasoned action (TRA) which aims to explain computer use in terms of the attitude toward using information systems, rather than the attitude toward information systems itself (Averweg, 2008). Therefore, as a user-centred methodology , the TAM has been recognised as a measure of technology acceptance by suggesting that when users are confronted by information system innovations, they are influenced by two factors as to how and when they will use it, namely perceived usefulness (PU) and perceived ease of use (PEOU) of the particular system (Behrens et al., 2005; Davis, Bagozzi, & Warshaw, 1989). The TAM defines perceived usefulness as the extent to which a person believes that the use of a system would improve his or her performance; whereas perceived ease of use refers to the extent to which a person believes that using a particular system would be effortless (Davis, 1986; Davis et al., 1989; Karahanna & Straub, 1998; Malhotra & Galletta, 1999).

The TAM has proved to hold good predictive validity for the use of a variety of information technologies (Karahanna & Straub, 1998), however, its prediction capacity is limited by the exclusion of the TRA construct known as subjective norm. This limitation is justified therein that the underlying processes in which an individual engages when he or she adopts an induced behaviour may be different; even though the resulting behaviour may appear the same (Orlikowski, 1991). Subjective norm refers to a person's conviction that most of his or her important acquaintances think he or she should (or should not) perform the behaviour in question (Ajzen & Fishbein, 1980). Therefore, subjective norm refers to the social influencing process by which, when an information systems user perceives that an important person such as the user's manager believes that he or she should use this new computer technology, the user will absorb this person's beliefs into his/her own belief structure (Alrafi, 1998). Davis (1986) and Davis et al. (1989) corroborate that the TAM's research scope is inhibited by the omission of social influence as an important variable. They further suggested that this limitation may be surmounted by using an alternative theoretical foundation for conceptualising subjective norm as found in the processes of social influence, that is compliance, identification and internalisation as reported by Kelman (1958, 1961).

Although Kelman's social influence constructs (psychological attachment) have successfully been used as research platform in a variety of studies (see Table 1), only a limited number could be found which extended the TAM to include psychological attachment (see Table 2). The most prominent studies are those of Malhotra and Galletta (1999), and Venkatesh and Davis (2000). Malhotra and Galletta (1999) included psychological attachment as an external variable affecting attitude toward using and behavioural intention to use. This was done during the implementation of a Microsoft Soft Exchange enterprise wide communication, coordination and collaboration system. Venkatesh and Davis (2000) extended the TAM to include psychological attachment as one of several external variables affecting perceived usefulness and behavioural intention to use. Psychological attachment was jointly evaluated with other external variables such as self-image, job content, output quality and result confidence impacting on perceived usefulness only. This study was conducted within the following four research areas: a) implementing a manufacturing proprietary system; b) converting a financial mainframe system to a Windows environment; c) implementing a Windows-based customer accounting system; and d) implementing a domestic and international stock management system (Venkatesh & Davis, 2000).

Yet, no study could be found extending the TAM to include psychological attachment as external variable impacting all five TAM constructs (i.e. perceived ease of use – PEOU; perceived usefulness – PU; attitude toward using – ATU; behavioural intention to use – BIU; and actual system use - ASU). Also, no recent study could be found regarding a complex real-time, fully integrated user setting such as ERP.

Therefore, the research question for this study pertains to what predictive validity an extended TAM, allowing for psychological attachment, will have within a South African ERP user environment towards system acceptance, utilisation, and improvement. The contribution made by this study will be the validation of the predictive ability of technology acceptance within a more recent and complex South African ERP user environment by means of an extended TAM. This study will also pave the way for future similar studies in diverse settings and computer systems.

Psychological Attachment

Kelman (1958) claimed that it is not only essential to know that there has been a quantifiable change in an individual's attitude and behaviour, but also to know whether the change is artificial and short-lived or whether it is a long-lasting change, demonstrated in behaviour and incorporated in a person's value system. The process of compliance in social influence implies public conformity without private acceptance of the behaviour; whereas identification and internalisation imply public conformity that go together with increasing levels of private approval . Malhotra and Galletta (2005), in turn, affirmed that significant predictions of information system usage behaviour can be made, depending upon prior knowledge about the nature and extent of change in those behaviours that are reflected in subsequent actions. Psychological attachment is therefore introduced and defined by the authors as the level of commitment of the information system user toward system use, based on the effect of social influences on his or her behaviour and is subsequently measured in terms of Kelman's three processes of social influence, namely compliance, identification, and internalisation (Malhotra & Galletta, 2005).

Many researchers have confirmed the credibility of Kelman's psychological attachment model by employing it as theoretical foundation for conceptualising subjective norm as a

determinant of human behaviour in multiple settings. Table 1 below depicts the most notable of such research studies:

Table 1

Summary of Research Settings Using Psychological Attachment

Researchers	Research Environment
Kelman (1958)	Attitude change
Kelman (1961)	Opinion change
Becker, Randall, and Riegel (1995)	Organisational commitment
de Chernatony and Harris (2000)	Developing corporate brands
Barbuto (2002)	Sources of motivation
Hartenian (2004)	Power and compliance
Malhotra and Galletta (1999; 2005)	Volitional IS systems adoption and usage
Munduate and Medina (2005)	Power, authority and leadership
Jenewein and Mühlmeier (2008)	Brand-oriented leadership
Mazman, Usluel, and Çevik (2009)	Adoption and usage of innovation
Kelman (2010)	Conflict resolution and reconciliation
Rupp, Williams, and Aguilera (2011)	Increasing corporate social responsibility

Changes in behaviours produced due to social influence may occur at different levels, which are obvious from differences in the type or intensity of such changes (Petty, 2012; Rupp et al., 2011; Venkatesh & Davis, 2000). These differences correspond to the three distinct processes whereby an individual accepts influence, namely compliance, identification, and internalisation (Kelman, 1958).

Compliance, Identification, and Internalisation

Compliance refers to situations where the individual performs a behaviour which is inconsistent with his or her attitude, in order to gain rewards or avoid punishment from important people, and is associated with a sense of pressure (Davis, 1986; Warshaw 1980). Compliance manifests whenever an individual perceives that a socially influential person wants him or her to behave in a specific manner, and this socially influential person has the ability to compensate the behaviour or penalise lack of behaviour (Boros, 2008; Kelman, 1958; Petty, 2012; Rupp et al., 2011; Singh, Gupta, & Venugopal, 2008). Such induced

behaviour is neither based on content of the behaviour nor on the importance of relationships and is performed under surveillance of the influential person (Hsu & Lu, 2004; Malhotra & Galletta, 2005; Singh et al., 2008; Venkatesh & Davis, 2000); in order to receive a reward or avoid rejection and hostility (Hsu & Lu, 2004; Sun & Zhang, 2006). Therefore, compliance behaviour is created and strengthened through the enforcement of formal rules and norms and is encouraged via social fear and a threat of humiliation (Rupp et al., 2011), which negatively affect a person's level of commitment (Jenewein, 2008).

Identification operates through the individual's attitudinal system (Boros, 2008; Singh et al., 2008), when he or she responds towards social influences to establish or maintain a favourable image within a reference group (Petty, 2012; Rupp et al., 2011; Venkatesh & Davis, 2000). This type of behaviour is evident when an individual accepts influence because he or she wants to establish or maintain a satisfying self-defining relationship with another person or group. Such behaviour is performed only under conditions of the prominence of the individual's relationship with the influencing person or group (Boros, 2008; Hsu & Lu, 2004; Malhotra & Galletta, 2005; Petty, 2012; Rupp et al., 2011; Singh et al., 2008; Venkatesh & Davis, 2000). Thus, identification occurs when a user accepts an opinion held by others, because he or she is concerned about defining himself or herself favourably in relation to the group (Hsu & Lu, 2004; Sun & Zhang, 2006).

Internalisation occurs when people adopt external attitudes and behaviours, because the content thereof is congruent with that individual's own value system (Boros, 2008; Singh et al., 2008). Behaviour adopted through internalisation is integrated with the user's own values and becomes a part of his or her personal norms (Malhotra & Galletta, 2005). The resulting behaviour induced through internalisation tends to be performed under conditions of the importance of the issue, regardless of surveillance or acknowledgment (Boros, 2008; Hsu & Lu, 2004; Petty, 2012; Rupp et al., 2011; Singh et al., 2008; Venkatesh & Davis, 2000). Thus, internalisation occurs when an individual accepts influence, because it is consistent with his or her value system (Hsu & Lu, 2004; Sun & Zhang, 2006).

By distinguishing between the processes of psychological attachment (social influence), one could determine whether the behaviour to use a system is caused by the influence of an agent on one's intention , or by one's own attitude (Kelman, 1958, 2006; Malhotra & Galletta, 1999). Each of these processes is characterised by distinctive antecedent conditions,

corresponding to a distinctive structure of thoughts and feelings accompanying a person's acceptance of the induced behaviour (Kelman, 1958; Malhotra & Galletta, 1999). These antecedents are: a) the relative power of the influencing agent; b) the prominence of the induced response; and c) the relative significance of the expected effect (Kelman, 1958, 2006). Likewise, each of the three processes is characterised by a distinctive consequent condition, involving a particular qualitative variation in the ensuing history of the induced behaviour (Kelman, 1958; Malhotra & Galletta, 1999). For instance, behaviour induced through compliance tends to be performed under surveillance of the influencing agent. In contrast, behaviour induced through identification tends to be performed under prominence of one's relationship with the agent, and behaviour induced through internalisation tends to be performed under conditions of the relevance of the issue, regardless of surveillance or prominence (Kelman, 1958, 2006).

Compliance, identification, and internalisation represent varying levels of commitment, resulting from a desire to satisfy different personal objectives. Whereas compliance denotes public conformity without private acceptance of the behaviour, identification and internalisation indicate public conformity that is accompanied by increasing levels of private acceptance (Malhotra & Galletta, 2005). Furthermore, compliance has a negative influence on attitude; whereas internalisation and identification have a much stronger positive influence on a person's attitude (Malhotra & Galletta, 1999). Therefore, although the consequent behaviour of individuals may appear the same, the underlying processes in which they engage when adopting the behaviour may be different; which in turn has a bearing on the level and longevity of the behaviour/commitment (Kelman, 2006). Awareness of these different levels of users' psychological attachment to specific behaviours, provides the basis for developing specific hypotheses about the conditions of behaviour change. Adding empirical analysis to such hypotheses can enhance an understanding of the conditions that are conducive to lasting changes in information system usage behaviour, and how such changes are affected by personal and social norms (Malhotra & Galletta, 2005).

Since the acknowledgement of Davis (1986) and Davis et al. (1989) that the TAM was incomplete and limited due to the omission of social influence (subjective norm) as a regulating construct, several researchers had extended their TAM research to account for social influence (subjective norm). Table 2 is a summary of the foremost research studies and their findings.

Table 2

Summary of Research Findings Regarding the Extended TAM to Include Social Influence

Researchers	**Finding**
Taylor and Todd (1995)	TAM, modified to include subjective norms and perceived behavioural control, performed well in predicting technology acceptance for both experienced and inexperienced users.
Lucas and Spitler (1996)	Favourable norms and high ratings of quality were associated with favourable perceptions producing the following general forms of the regressions: Perceived ease of use = f (norms, quality) Perceived usability = f (norms, quality, perceived ease of use).
Malhotra and Galletta (1999)	When social influences generated a feeling of compliance, they seem to have had a negative influence on users' attitudes toward use of the new information system. However, when social influences generated a feeling of internalisation and identification on the part of the user, they had a positive influence on the attitude toward the acceptance and use of the new system. The findings also suggested that internalisation of the induced behaviour by the adopters of a new information system played a stronger role in shaping acceptance and usage behaviour than perceived usefulness (PU).
Karahanna and Straub (1999)	Social influence affected both user PU and PEOU, via the process of internalisation and produces the most enduring form of attitude change.
Venkatesh and Davis (2000)	In mandatory settings, constructs related to social influence were significant; whereas in the voluntary settings, they were not significant. Effect of social influence was via a four-way interaction: • with its role being more important in the context of mandatory use; • more so among women; • even more so among older women; and • even more significant in the early stages of individual experience of the technology.
Hsu and Lu (2004)	Social influences, including perceived critical mass and social norms, significantly and directly, but separately, affected attitudes and intentions.
Sun and Zhang (2006)	The effects of PU, PEOU and SN (subjective norm) on BIU differ between experienced and inexperienced users. PU remains a significant determinant of BIU over time.

A notable observation from the extended TAM studies referred to in Table 2, is that none considered the relation of psychological attachment (subjective norm) on the TAM in its entirety by including all of its components. Venkatesh and Davis (2000), Hsu and Lu (2004), and Sun and Zhang (2006) focused on perceived usefulness and behavioural intention to use; Malhotra and Galletta (1999) on attitude toward using and behavioural intention to use; Lucas and Spitler (1996) on perceived usefulness and perceived ease of use; Karahanna and Straub (1999) on perceived usefulness; and Taylor and Todd (1995) on behaviour intention to use.

Purpose and Hypotheses

None of the research studies listed in Table 2 endeavoured to determine the effect of social influence on the TAM in its entirety, but was rather done in relation to some distinctive components of the model. Furthermore, no South African study could be found that extends the TAM to include social influence as a construct in determining technology acceptance via the model. Therefore, this study focused on the role of social influence (subjective norm) operationalised in terms of psychological attachment on technology acceptance within a South African corporate ERP environment (Davis, 1986; Kelman, 1958; Malhotra & Galletta, 1999). The aim of this study is to examine the relationship between psychological attachment and technology acceptance. To achieve this aim, direct relationships are hypothesised between each sub dimension of psychological attachment (compliance, identification, and internalisation), and that of the TAM (perceived usefulness, perceived ease of use, attitude toward using, behavioural intention to use, and actual system use). Figure 1 shows the conceptual model of the study.

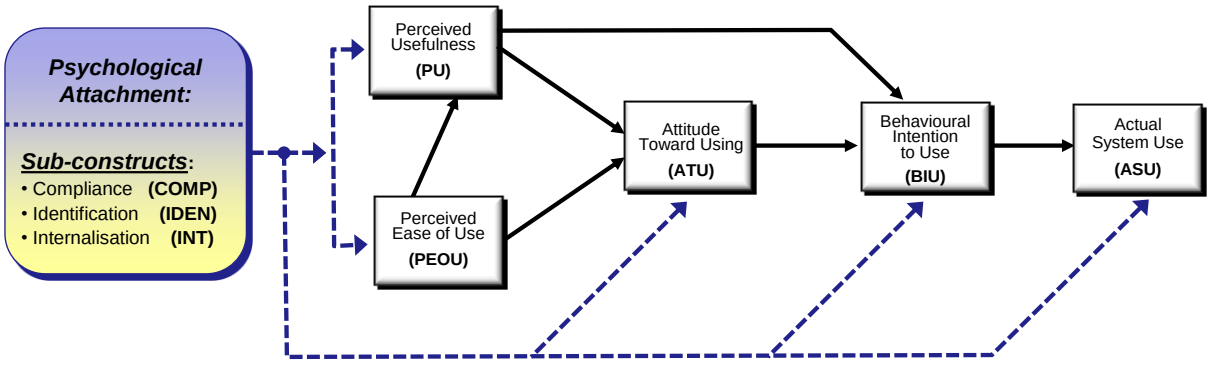

Figure 1. Extended technology acceptance model (TAM) to include psychological attachment

Psychological attachment distinguishes the degree of a user's commitment toward using a system, measured in three distinct aspects, namely compliance, identification, and internalisation; providing a basis for deducing specific hypotheses about the conditions for predicting future commitment changes (Kelman, 1958, 1961; Malhotra & Galletta, 1999, Taylor & Todd, 1995). Compliance commitment is initiated and strengthened by the enforcement of prescribed rules and norms and is empowered via social fear and the risk of humiliation. In turn, identification commitment is initiated and strengthened not by behavioural requirements, but by the initiation of role systems and is strengthened via the avoidance of guilt and shame or the promotion of pride and affiliation. Internalisation commitment is initiated and strengthened by shared social values and is strengthened via the avoidance of regret and self-disappointment or the promotion of self-integrity and the adherence to personal standards (Rupp et al., 2011). Therefore, in order to determine whether a commitment change is insincere and short-lived or whether it is a long-lasting change, its antecedent conditions (compliance, identification, and internalisation) should be known in order to develop specific assumptions for future commitment change interventions (Kelman, 1958, 1961; Lee, Kozar, & Larsen, 2003; Malhotra & Galletta, 2005).

Previous studies investigated the impact of psychological attachment on fractions of the TAM (see Table 2); this study endeavours to determine the impact thereof on the TAM in its entirety (i.e. perceived ease of use, perceived usefulness, attitude toward using, behavioural intention to use, and actual system use). With this in mind, relationships are hypothesised between all sub-constructs of psychological attachment and that of the TAM.

The following relationships are hypothesised with regard to compliance:
Hypothesis 1: Compliance is negatively associated with perceived usefulness.
Hypothesis 2: Compliance is negatively associated with perceived ease of use.
Hypothesis 3: Compliance is negatively associated with attitude toward using.
Hypothesis 4: Compliance is negatively associated with behavioural intention to use.
Hypothesis 5: Compliance is negatively associated with actual system use.

The following relationships are hypothesised with regard to identification:
Hypothesis 6: Identification is positively associated with perceived usefulness.
Hypothesis 7: Identification is positively associated with perceived ease of use.
Hypothesis 8: Identification is positively associated with attitude toward using.

Hypothesis 9: Identification is positively associated with behavioural intention to use.
Hypothesis 10: Identification is positively associated with actual system use.

With regard to internalisation, the following relationships are hypothesised:
Hypothesis 11: Internalisation is positively associated with perceived usefulness.
Hypothesis 12: Internalisation is positively associated with perceived ease of use.
Hypothesis 13: Internalisation is positively associated with attitude toward using.
Hypothesis 14: Internalisation is positively associated with behavioural intention to use.
Hypothesis 15: Internalisation is positively associated with actual system use.

The following hypotheses have been formulated for determining indirect antecedent effects:
Hypothesis 16: Internalisation affects actual system use indirectly via behavioural intention to use.
Hypothesis 17: Identification affects behavioural intention to use indirectly via perceived usefulness.
Hypothesis 18: Identification affects behavioural intention to use indirectly via internalisation.

METHOD

Research Design

A cross-sectional survey design whereby a sample is drawn from a population at one time was used. According to Yang and Land (2008), this design is best suited for addressing the descriptive and predictive functions associated with correlational design whereby relationships between variables are examined.

Participants

The entire ERP user population of 720 employees within a steel manufacturing organisation in Gauteng was targeted for this research, but a response rate of only 33.5% (241 participants) was obtained. The characteristics of the study population are detailed in Table 3. The majority of participants were white (75.5%), male (64.7%) between the ages of 29 to 55 years of age, while holding a diploma or degree (43.6%). These participants were mainly non-managerial

employees (66.8%) from the administration/services (38.6%) and engineering (28.6%) domains, having had between five to ten years ERP experience (42.0%).

Table 3

Characteristics of Participants (N=241)

Item	Category	Frequency	Percentage
Gender	Male	156	64.7
	Female	85	35.3
	Total	241	100.0
Culture	Asian	12	5.0
	Black	38	15.8
	Coloured	9	3.7
	White	182	75.5
	Total	241	100.0
Age	below 22 years	2	0.8
	23 – 28	24	10.0
	29 –39	73	30.3
	40 – 45	45	18.6
	46 – 55	73	30.3
	over 55	24	10.0
	Total	241	100.0
Education	below Grade 12	11	4.6
	Grade 12	89	36.9
	Diploma/Degree	105	43.6
	Post-Diploma/Degree	36	14.9
	Total	241	100.0
Domain	Manufacturing	15	6.2
	Engineering	69	28.6
	Financial	38	15.8
	Information Technology	26	10.8
	Administration/Services	93	38.6
	Total	241	100.0
Status	Senior Management	12	5.0
	Middle Management	68	28.2
	Non-Managerial	161	66.8
	Total	241	100.0
ERP years	Less than 1	16	6.6
	1 – 2	16	6.6
	3 – 5	53	22.0
	6 – 10	101	42.0
	More than 10	55	22.8
	Total	241	100.0

Measuring Instruments

The 23 item *Technology Acceptance Model Questionnaire* (TAM) as compiled by Malhotra and Galletta (1999) was used for gathering data about the various constructs depicted in the core of the technology acceptance model. These construct included perceived usefulness, perceived ease of use, behavioural intention to use, attitude towards using, and actual system use. These scales were adapted from prior studies, many of which had already established reliability and validity. The Cronbach alpha reliability scores for the core technology acceptance model constructs were found to range from 0.68 to 0.97 for perceived ease of use, and 0.71 to 0.96 for perceived usefulness (Amoako-Gyampah & Salam, 2004; Chau & Hu, 2002; Davis, 1989; Davis et al., 1989; Malhotra & Galletta, 1999; Mathieson, 1991; Taylor & Todd, 1995); also 0.69 to 0.92 for attitude towards using (Amoako-Gyampah & Salam, 2004; Chau & Hu, 2002; Mathieson, 1991; Taylor & Todd, 1995); and 0.62 to 0.96 for behavioural intention to use (Amoako-Gyampah & Salam, 2004; Chau & Hu, 2002; Mathieson, 1991).

Malhotra and Galletta (1999) established convergent validity and discriminant validity of all pre-existing TAM measures by observing the correlations between the items on the various scales. Factor analyses provided evidence of distinct loadings of various factors and convergent and discriminant validity based on inter-item correlations. All pre-existing constructs used in the TAM met the criteria of validity and reliability.

The Psychological Attachment Questionnaire (PAQ) that was used for gathering data, contained scales to measure the various sub-constructs of psychological attachment, namely compliance, identification, and internalisation. This ten-item questionnaire was compiled and verified by Malhotra and Galletta (1999). Malhotra and Galletta (1999) found the Cronbach alpha reliability measurement for these three constructs to be 0.70 for Compliance, 0.80 for Identification, and 0.72 for Internalisation, and for the questionnaire as a whole to be 0.81. Validity was established with a principal component analysis with varimax rotation for constructs of psychological attachment that yielded two distinct factors with eigenvalues greater than 1. All four items for Compliance loaded on a distinct factor, however, the three items of Identification and three items of Internalisation loaded together on another factor. The factor loadings for Compliance were found to be between 0.56 and 0.75, for Identification 0.71 and 0.84, and finally for Internalisation 0.67 and 0.83. Malhotra and Galletta (1999) determined these factor loadings to be high, based on the work of Nunnally

and Bernstein (1993) who reported that factor loadings for all variables, which represent the correlations between the variables and the respective factors, greater than 0.55 are considered high. Furthermore, convergent validity and discriminant validity of the measures were verified by observing the correlations between the variables of possibly overlapping components.

A *Biographical questionnaire*, compiled by the researcher, was used to obtain descriptive information about the research participants as depicted in Table 3 before.

Data Analysis

The data was statistically analysed with the SPSS (SPSS Inc., 2013) and the AMOS (Arbuckle, 2013) programs. Descriptive statistics (e.g. means and standard deviations) were used to analyse the data. Pearson correlation coefficients were computed to determine the relationships between latent variables. A cut-off point of $p \leq 0.05$ was set for the statistical significance of the results.

Structural equation modelling was used to assess the factorial validity of the measuring instruments, namely perceived usefulness, perceived ease of use, attitude towards using, behavioural intention to use, and actual system use. Among the fit indices produced by the AMOS program, are the Chi-square statistics (χ^2), which is the test of absolute fit of the model. However, the χ^2 value is sensitive to sample size. Therefore, additional best-fit indices, such as the Root Means Square Error of Approximation (RMSEA), Standardised Root Mean Residual (SRMR), Degrees of Freedom (*df*), Tucker-Lewis Index (TLI), Comparative Fit Index (CFI), Akaike Information Criterion (AIC), and the Bayes Information Criterion (BIC) were used in this study.

Due to the inefficiency of Cronbach's alpha for calculating scale or construct reliability when using structured equation modelling, an alternative method is applied as proposed by Wang and Wang (2012), allowing for latent variables underlying a set of observed indicators which are not tau-equivalent or parallel measures. This method is based on utilising the unstandardised factor loadings (λ) and unstandardised variance of errors (θ), whilst incorporating the correlation of errors.

Procedure

This study was conducted at a South African steel manufacturer as part of their SAP ERP Consolidation Project, with the intent to determine user acceptance of the new consolidated system. The research sample was drawn from the SAP ERP users group consisting of system users and technical specialists over a 16-month period from September 2010 to December 2011. The battery of questionnaires, as compiled by the researcher, together with a manual pertaining to the completion requirements for all questionnaires as well as the contact details of the researcher from whom further information could be sourced were placed on the organisation's Information Portal by their systems administrator, where participants could complete and submit it online. Prior to placing the questionnaires and manual online, some hardcopies of questionnaires and manual were distributed and collected by the SAP basis technical department from users working on project outside the reach of the portal. The systems administrator extracted the completed questionnaire data from the Information Portal database and made all data, together with the hardcopies, available to the researcher. This data was verified and collated by the researcher into a single database for statistical analyses. Only complete questionnaires were included whilst questionnaires containing missing data were discarded.

Ethical Aspects

The manager of the SAP Centre of Excellence in the Information Management section at a South African steel manufacturer was approached and asked for permission to conduct this study. Permission in the form of a letter of consent was obtained with the precondition that all research findings would be made available to the SAP CoE manager. No permission was necessary from SAP AG seeing that this study investigated the effect of a real-time, fully integrated system (of which SAP was the steel manufacturer's choice of system) on the wellbeing of users and not investigating the effectiveness, efficiency or performance of SAP ERP as system. This letter of consent was successfully submitted to the Ethics Committee of the North-West University (NWU FH-SB-2012-008) for approval. Participants were informed in the preamble to the questionnaire, that a) data is captured by the researchers and not their organisation; b) data will solely be used for academic research purposes and not for any job performance or merit objectives; c) participation is voluntary; and d) participants will remain anonymous.

RESULTS

Testing the Measurement Model

By way of confirmatory factor analysis (CFA), alternative measurement models were tested to assess whether items loaded significantly on to the scales with which they were related. Using structural equation modelling (SEM) methods, as implemented by AMOS (Arbuckle, 2012), five measurement models were tested. Model 1 consisted of an extended TAM which included psychological attachment. Model 1 consisted of eight latent variables which included the TAM variables of perceived ease of use, perceived usefulness, attitude toward using, behavioural intention to use, and actual system use together with the psychological attachment variables of compliance, identification, and internalisation. All latent variables in model 1 were allowed to correlate.

Models 2 to 5 followed the same template: Model 2 was specified with 6 observed variables (with compliance, identification, and internalisation merged as one variable); model 3 was specified with 7 observed variables (with internalisation omitted); model 4 was specified with 7 observed variables (with identification omitted); model 5 was specified with 7 observed variables (with compliance omitted). Table 4 presents fit statistics for the measurement models.

Table 4

Fit Statistics of Competing Measurement Models

Model	χ^2	RMSEA	SRMR	*df*	TLI	CFI	AIC	BIC
Model 1	1120.79	0.07	0.08	467	0.87	0.88	1308.79	1636.36
Model 2	1300.94	0.08	0.07	480	0.85	0.86	1462.94	1745.21
Model 3	1393.33	0.09	0.09	473	0.83	0.84	1567.33	1870.50
Model 4	1395.32	0.09	0.08	474	0.82	0.84	1569.32	1872.50
Model 5	1250.07	0.08	0.07	474	0.85	0.87	1424.07	1814.25
Model 6	1057.90	0.07	0.08	466	0.89	0.90	1247.90	1673.96
Model 7	1003.14	0.07	0.08	465	0.90	0.91	1195.14	1529.68
Model 8	956.13	0.07	0.08	464	0.90	0.91	1150.13	1488.15

df = degrees of freedom; TLI = Tucker-Lewis Index; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardised Root Mean Square Residual; AIC = Akaike Information Criterion; BIC = Bayes Information Criterion

Although theoretical model 1 yielded the most acceptable fit statistics, with χ^2 = 1120.79 (*df* = 467; p = 0.001); RMSEA = 0.07; SRMR = 0.08; TLI =0.87; CFI = 0.88; AIC = 1308.79 and BIC = 1636.36, it was not a good fit due to its TLI and CFI values being below the 0.90 limit. It was therefore evident that some modification in specification was needed to derive a model that better represents the sample data. Inspection of the modification indices (MI), revealed that some items might have been wrongly specified, thus loading on other factors instead of loading on the intended factor only. The AIC and BIC values of model 1 were also substantially lower than the values for models 2 to 5. The following changes (Δ) in AIC and BIC were found: models 1 and 2 (ΔAIC = 154.15 and ΔBIC = 108.85); models 1 and 3: (ΔAIC = 258.54 and ΔBIC = 234.14); models 1 and 4: (ΔAIC = 260.53 and ΔBIC = 236.14); models 1 and 5 (ΔAIC = 115.28 and ΔBIC = 177.89).

Analyses continued in an exploratory manner to improve the fit of the selected model. The modification index (MI = 54.93) for item 14 *("I intend to use SAP for capturing all my work related reports"*) and item 15 *("I intend to use SAP to generate all my work related reports"*), indicated that the model fit could be improved by correlating these items. The fit statistics for the revised model (model 6) revealed an improved fit rendering χ^2 value of 1057.90 (*df* = 466), TLI = 0.89, CFI = 0.90, RMSEA = 0.07, SRMR = 0.08, AIC = 1247.90 and BIC = 1673.96. In order to improve the TLI statistic to above the 0.90 threshold, a further re-

specified model 7 was developed by considering the modification index (MI = 48.21) for item 18 (*"All things considered, my using SAP in my job is a(n) Harmful/Beneficial idea"*) and item 20 (*All things considered, my using SAP in my job is a(n) Negative/Positive idea"*). This correlation can be accounted for by reason that harmful experiences are naturally viewed as negative and beneficial when positive, and are therefore measuring the same construct. Items 18 and 20 were allowed to correlate in model 7 which generated the following fit statistics: χ^2 = 1003.14 (*df* = 465), TLI = 0.90, CFI = 0.91, RMSEA = 0.07, SRMR = 0.08, AIC = 1195.14 and BIC = 1529.68. Because the TLI statistic of 0.90 was obtained by rounding-up, analyses continued to enhance it to above the threshold. This was done by considering the modification index (MI = 40.03) for item 31 (*"How hard I work on using SAP is directly linked to how much I am rewarded"*) and item 33 (*"In order for me to get rewarded in my job, it is necessary to use SAP"*). This correlation can be explained for by reason of both items measuring the same construct of rewards using the SAP system. Items 31 and 33 were allowed to correlate in model 8, which generated the following fit statistics: χ^2 = 956.13 (*df* = 464), TLI = 0.90, CFI = 0.92, RMSEA = 0.07, SRMR = 0.08, AIC = 1150.13, and BIC = 1488.15. Model 8 was found to be the best fitting and most parsimonious measurement model.

Testing the Structural Model

Table 5 shows descriptive statistics, reliability coefficients (ρ) and inter-item correlation coefficients of the TAM measuring constructs of the TAM, as well as of the psychological attachment measuring constructs internalisation, identification, and compliance.

Table 5

Descriptive Statistics, Cronbach Alpha Coefficients and Inter-item Correlation Coefficients of the TAM and Psychological Attachment Measuring Instruments (N=241)

Measure	Mean	*SD*	Skewness	Kurtosis	Inter-item r	ρ
PEOU	31.07	6.89	-0.93	1.25	0.41	0.99
PU	31.77	6.92	-0.73	0.92	0.57	0.99
ATU	21.05	4.74	-0.86	1.13	0.56	0.88
BIU	23.74	4.22	-1.23	1.75	0.44	0.93
ASU	16.91	4.66	-1.07	0.19	0.43	0.98
INT	39.16	16.87	0.90	0.28	0.66	0.97
IDEN	80.19	11.00	-0.64	0.37	0.73	0.98
COMP	65.57	10.35	-0.72	11.41	0.34	0.79

PEOU = perceived ease of use; PU = perceived usefulness; ATU = attitude toward using; BIU = behavioural intention to use; ASU = actual system use; INT = internalisation; IDEN = identification; COMP = compliance

Scores on four of the dimensions, namely perceived ease of use, attitude toward using, behavioural intention to use, and compliance seem to be leptokurtic by peaking high with a kurtosis of greater than 1; therefore, confirming their frequency distributions to be concentrated around the centre. The remaining four, namely perceived usefulness, actual system use, internalisation, and identification seem to be platykurtic by peaking low at a kurtosis of smaller than 1; with their frequencies distribution concentrated widely around the distribution tail ends. With the exception of internalisation, all dimensions are negatively skewed which is indicative of most values being distributed to the right of the mean. Internalisation is positively skewed with the majority of values distributed to the left of the mean. A multivariate kurtosis score for the data of 382.55, with a critical ratio score of 61.78, was reported by Amos (Arbuckle, 2012) which is indicative of non-normality.

Bivariate Pearson correlation coefficients between the TAM dimensions and psychological attachment dimensions for employees working in an SAP ERP environment as generated by using SPSS are reported in Table 6.

Table 6

Correlation Coefficients Between TAM and Psychological Attachment (N=241)

	1	2	3	4	5	6	7
1. PEOU	-	-	-	-	-	-	-
2. PU	0.48*$^{+}$	-	-	-	-	-	-
3. ATU	0.49*$^{+}$	0.75*$^{++}$	-	-	-	-	-
4. BIU	0.35*$^{+}$	0.55*$^{++}$	0.48*$^{+}$	-	-	-	-
5. ASU	0.32*$^{+}$	0.49*$^{+}$	0.52*$^{++}$	0.37*$^{+}$	-	-	-
6. INT	0.36*$^{+}$	0.46*$^{+}$	0.50*$^{++}$	0.43*$^{+}$	0.42*$^{+}$	-	-
7. IDEN	0.47*$^{+}$	0.68*$^{++}$	0.67*$^{++}$	0.48*$^{+}$	0.49*$^{+}$	0.68*$^{++}$	-
8. COMP	-0.03*	0.07	0.07	-0.09	0.09	0.50*$^{++}$	0.06

PEOU = perceived ease of use; PU = perceived usefulness; ATU = attitude toward using; BIU = behavioural intention to use; ASU = actual system use; INT = internalisation; IDEN = identification; COMP = compliance; * Statistically significant p = 0,01; + Correlation is practically significant r 0,30 (medium effect); ++ Correlation is practically significant r 0,50 (large effect)

All scales showed adequate reliabilities. Overall, users selected scores above the midpoint of the scale for all scales with the exception of identification and compliance. Their scores for identification were closer to midpoint than that of compliance.

The structural model (model 9) was tested, based on measurement model 8 with all non-significant relationships removed. Model 9 rendered the following fit statistics: χ^2 = 984.80 (*df* = 482; *p* = 0.001); RMSEA = 0.07; SRMR = 0.08; TLI = 0.91; CFI = 0.91; AIC = 1142.81; and BIC = 1418.11. In comparison with measurement model 8, structural model 9 revealed an increase in chi-square ($\Delta\chi^2$) of 21.72, and in degrees of freedom (Δdf) of 13. Calculating its chance probability, (Q) rendered a value of 0.0598 which represents an insignificant change and is therefore acceptable. Figure 2 shows the statistically significant standardised path coefficients estimated by AMOS (Arbuckle, 2013).

Considering the cross-sectional nature of the data, three competing models, namely 9a to 9c, were also tested to determine possible redundancies among path coefficients. In model 9a the path from identification to perceived ease of use was constrained to zero ($\beta = 0$), which rendered a lesser fit statistic of χ^2 (*df* = 470) = 968.37; $p < 0.001$; TLI = 0.90; CFI = 0.91; RMSEA = 0.07; SRMR = 0.16; AIC = 1150.37; and BIC = 1467.48. In model 9b, the path

between identification and perceived usefulness was constrained to zero (β = 0), which rendered the following lesser fit statistic: χ^2 (*df* = 470) = 983.88; *p* < 0.001; TLI = 0.90; CFI = 0.91; RMSEA = 0.07; SRMR = 0.08; AIC = 1165.88; and BIC = 1483.00. In model 9c, the path from internalisation to behavioural intention to use was constrained to zero (β = 0), which rendered a fit statistic of χ^2 (*df* = 483) = 997.34; *p* < 0.001; TLI = 0.90; CFI = 0.91; RMSEA = 0.07; SRMR = 0.09; AIC = 1153.34; and BIC = 1425.16. Table 7 presents fit statistics for the various competing structural models.

Table 7

Fit Statistics of Competing Structural Models

Model	χ^2	RMSEA	SRMR	*df*	TLI	CFI	AIC	BIC
Model 9	984.80	0.07	0.08	482	0.91	0.91	1142.81	1418.11
Model 9a	1050.32	0.07	0.16	483	0.89	0.90	1206.32	1478.13
Model 9b	1091.37	0.07	0.13	483	0.87	0.90	1247.37	1519.18
Model 9c	997.34	0.07	0.09	483	0.90	0.91	1153.34	1425.16

df = degrees of freedom; TLI = Tucker-Lewis Index; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardised Root Mean Square Residual; AIC = Akaike Information Criterion; BIC = Bayes Information Criterion

Upon inspection of Table 7, model 9 emerged as the best fitting and most parsimonious structural model, revealing the lowest χ^2 (984.80), *df* (482), AIC (1142.81), and BIC (1418.11) values. All other fit statistics, RMSEA (0.07), SRMR (0.08), TLI (0.91) and CFI (0.91), were acceptable. The following changes in chi-square ($\Delta\chi^2$) were found: Models 9 and 9a ($\Delta\chi^2$ = 5.28, Δdf = 1, *p* < 0.01), models 9 and 9b ($\Delta\chi^2$ = 20.79, Δdf = 1, *p* < 0.01), and between models 9 and 9c ($\Delta\chi^2$ = 3.24, Δdf = 1, *p* < 0.01). The AIC value of model 9 was also substantially lower compared to the other competing models, confirming best fit (Kline, 2010).

Next, the obtained relationships of the best fitting and most parsimonious structural model are discussed with reference to the hypotheses of this study.

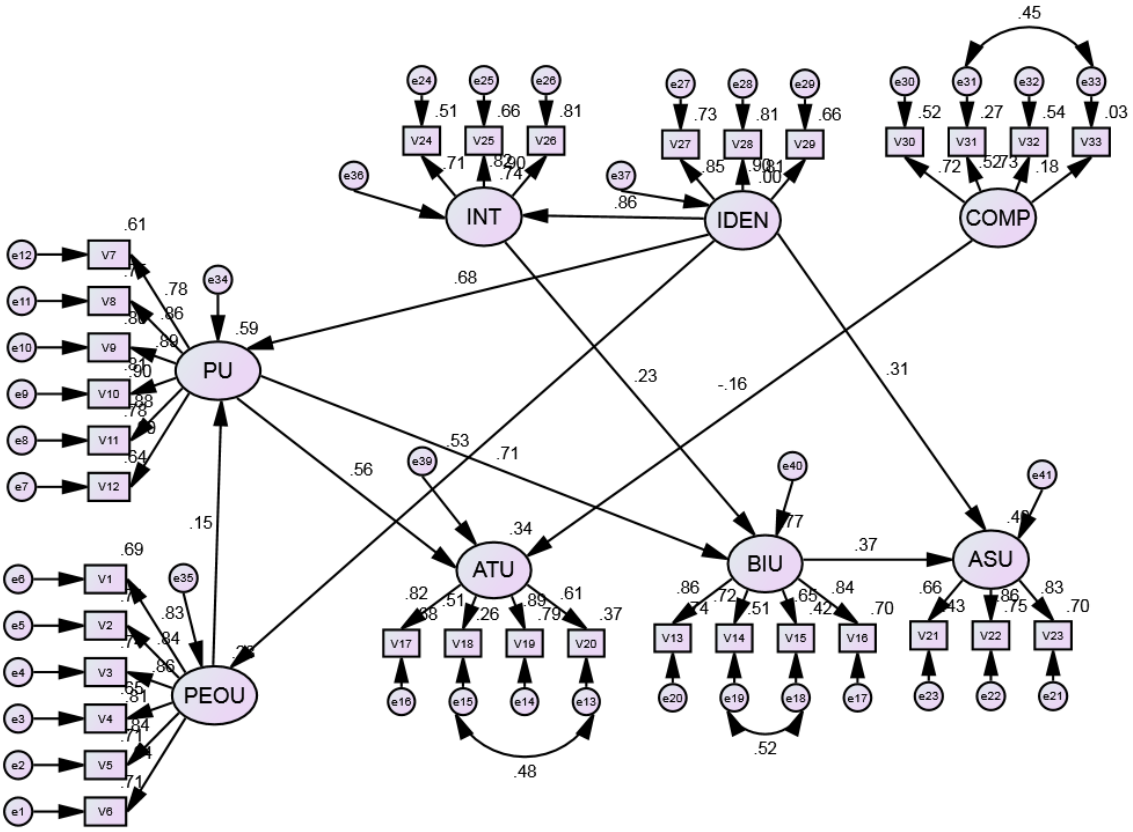

Figure 2. Structural model for the extended TAM to account for psychological attachment

Note: Only statistically significant paths are shown in the figure.

Compliance Hypotheses 1 to 5

Inspection of the standardised regression weights confirms hypotheses 1 to 4 to yield negative statistics and hypothesis 5 as a positive statistic. All five statistics are statistically non-significant. Hypotheses 1 to 4 are accepted and hypothesis 5 is rejected.

Identification Hypotheses 6 to 10

Inspection of the standardised regression weights revealed significant positive relationships between identification and perceived usefulness (β = 0.68; Lo = 0.53; Hi = 0.79), perceived ease of use (β = 0.53; Lo = 0.37; Hi = 0.67), attitude toward using (β = 0.20; Lo = -0.16; Hi = 0.54), and actual system use (β = 0.40; Lo = 0.04; Hi = 0.55). A non-significant positive relationship between identification and behavioural intention to use was reported. Hypotheses 6 to 10 are accepted.

Internalisation Hypotheses 11 to 15

Inspection of the standardised regression weights revealed positive relationships between internalisation and perceived usefulness (β = 0.08; Lo = -0.32; Hi = 0.42), perceived ease of

use (β = 0.19; Lo = -0.22; Hi = 0.61), attitude toward using (β = 0.15; Lo = -0.23; Hi = 0.56), behavioural intention to use (β = 0.23; Lo = 0.06; Hi = 0.39). Therefore, hypotheses 11 to 14 are accepted. Hypothesis 15 is rejected due to a non-significant negative relationship between internalisation and actual system use.

Using the procedure as explained by Hayes (2009), two-sided, bias-corrected, 95% confidence intervals were constructed using bootstrapping to prove indirect effects. The obtained lower CIs (LCIs) and upper CIs (UCIs) are reported in Table 8.

Table 8

Indirect Effects of Psychological Attachment on Technology Acceptance

Variable	Estimate	SE	95% BC CI
INT to ASU	0.09	0.05	[0.01, 0.21]
IDEN to BIU	0.74	0.04	[0.64, 0.81]
IDEN to PU	0.08	0.05	[0.01, 0.19]

INT = internalisation; IDEN = identification; ASU = actual system use; BIU = behavioural intention to use; PU = perceived usefulness; SE = standard error; 95% BC CI = 95% bias-corrected confidence intervals

Hypothesis 16

The 95% CIs of internalisation on actual system use did not include zero. Therefore, internalisation had indirect effects on actual system use via behavioural intention to use. Hypothesis 16 is accepted.

Hypothesis 17

The 95% CIs of identification on behavioural intention to use did not include zero. Therefore, identification had indirect effects on behavioural intention to use via perceived usefulness. Hypothesis 17 is accepted.

Hypothesis 18

Both 95% CIs of identification on perceived usefulness did not include zero. Therefore, identification had an indirect effect on behavioural intention to use via internalisation. Hypothesis 18 is accepted.

In summary, the model fit indices suggest that the relationships postulated in the model account for a substantial amount of the covariation in the data. The model accounts for the following variances: internalisation 74%, perceived usefulness 59%, perceived ease of use 28%, attitude toward using 39%, behavioural intention to use 77%, and actual system use 40%; thus, lending more empirical support for the model's fit.

DISCUSSION

The objective of this study was to determine the role of social influence (subjective norm) as operationalised in terms of Kelman's (1958) psychological attachment, recommended by Davis (1986) and verified by Malhotra and Galletta (1999), on all TAM constructs within a South African SAP ERP user environment. Results acquired from structural equation modelling confirmed that a positive technology acceptance relationship path existed, leading from perceived ease of use through perceived usefulness and behavioural intention to use to actual system use. Further, results corroborated that significant direct and indirect relationships existed between psychological attachment constructs and technology acceptance. Foremost of these relationships are: a) internalisation had a direct effect on behavioural intention to use, and an indirect effect on actual system use via behavioural intention to use; b) identification had significant direct effects on internalisation, perceived usefulness, and perceived ease of use, as well as indirect effects on behavioural intention to use via internalisation, plus perceived usefulness via perceived ease of use; and c) although identification had a direct effect on perceived usefulness, it had no indirect effect on behavioural intention to use via perceived usefulness.

Using the TAM as premise of departure, a best fit model obtained by way of structural equation modelling confirmed a positive technology acceptance relationship path leading from perceived ease of use through perceived usefulness and behavioural intention to use to actual system use. This path commences with a positive relationship between perceived ease of use and perceived usefulness, rendering a standardised regression value of $\beta = 0.15$ and explaining 59% of the variance. The significance of this relationship toward actual system use is consistent with findings reported by Amoako-Gyampah and Salam (2004); Averweg (2008); Chau and Hu (2002); Davis (1986); Davis et al. (1989); and Venkatesh and Davis (2000).

The path continues from perceived usefulness to behavioural intention to use reporting a standardised regression value of $\beta = 0.71$, explaining 77% of the variance. This finding is consistent with that reported by Davis (1986); Malhotra and Galletta (1999); and Taylor and Todd (1995); but inconsistent with findings of Gumussoy et al. (2007) who reported it to be of medium practical effect. This discrepancy may be attributed to the fact that the Gumussoy et al. (2007) study focused on potential ERP users and not existing users as in this study. Potential users will obviously not have any experience with ERP; therefore, not having a well-founded sense of usefulness. Amoako-Gyampah and Salam (2004) reported this relationship to be non-significant with practically low effect. The Amoako-Gyampah and Salam (2004) research was done during an ERP implementation amidst prospective users with no or little system experience. This study focused primarily on three external project related variables: a) project communication related to the ERP system; b) shared belief in the benefits of the ERP system; and c) training on the ERP system. Obviously, these participants had no sense of usefulness and were unable to formulate an intention toward using the system.

The path concludes with a positive relationship reporting a standardised regression value of $\beta = 0.37$ and explaining 40% of the variance between behavioural intention to use and actual system use. This finding is consistent with that reported by Davis (1986); Malhotra and Galletta (1999); but inconsistent with Shih and Huang (2009) who reported it as being of medium effect. Shih and Huang (2009) conducted their research prior to an ERP implementation, while incorporating additional behavioural constructs, such as: a) top management support; b) computer self-efficacy; and c) computer anxiety. This finding of Shih and Huang (2009) could possibly be attributed to a lack of hands-on experience; thus, potential users were unable to formulate a behavioural intention to use the system.

Previous research explored the relationship of psychological attachment with individual constructs such as user perceptions, attitudes and intentions. No other study could be found to measure the influence of psychological attachment on all TAM constructs culminating in actual system use. Therefore, the obtained relationship effects between psychological attachment constructs and TAM constructs in this study are discussed next.

Internalisation Effects

Internalisation occurs when a person adopts and performs behaviour, because its content is consistent with his or her own personal values (Kelman, 1958; Venkatesh & Davis, 2000; Warshaw, 1980); and is performed based on the relevance of the issue, regardless of

surveillance or recognition (Hsu & Lu, 2004; Kelman, 1958; Malhotra & Galletta, 1999; Malhotra & Galletta, 2005; Venkatesh & Davis, 2000; Warshaw 1980). Internalisation had a direct positive effect on behavioural intention to use ($\beta = 0.23$) and an indirect effect on actual system use via behavioural intention to use. Therefore, internalisation directly and positively affected SAP ERP users' motivation; resulting in an indirect long-lasting behavioural intention to use the system. Incorporating the direct effect identification has on internalisation ($\beta = 0.86$), a logical commitment path emerges wherein constant stimulation of user identification will sustain this spontaneous and long-lasting commitment to use SAP ERP. This finding is contrary to that of Karahanna and Straub (1999), who found that social influence (psychological attachment) affected both PU and PEOU via the process of internalisation. This discrepancy could be attributed to the fact that Karahanna and Straub (1999) gathered data from e-mail users who do not need technical insight of the working of the system other than its usefulness and ease of use. SAP ERP users, on the other hand, are technically informed and make their decision to use the system based on their conviction about the all-inclusive value added by the system.

Identification Effects

Identification occurs when a person adopts attitudes and behaviours to achieve a satisfying, self-defining relationship with another person or group. During identification, the content of the behaviour is irrelevant to the person and the behaviour is produced solely based on the prominence of the acquired relationship (Hsu & Lu, 2004; Sun & Zhang, 2006), and to establish or maintain a favourable image within a reference group (Kelman, 1958; Venkatesh & Davis, 2000). In this study identification had direct positive effects on internalisation ($\beta = 0.86$), perceived usefulness ($\beta = 0.68$), perceived ease of use ($\beta = 0.53$), and actual system use ($\beta = 0.31$). Indirect effects emerged between identification and a) behavioural intention to use via internalisation; and b) behavioural intention to use via perceived usefulness.

Identification also directly influenced actual use of the SAP ERP. Actual system use is an indication of how many times a person uses a technological system within a given time period (Averweg, 2008; Malhotra & Galletta, 1999; Venkatesh & Davis, 2000). In this relationship, actual system use is based on possible social rewards awarded in the form of relationships with important others and a likely favourable self-image and status. The danger of relying on this relationship of identification on actual system use is that, should the relationship and/or self-image terminate, so would actual use and upkeep of the system.

Identification directly influenced perceived usefulness explaining 59% of the variance. Perceived usefulness signifies the degree to which a person believes that using a particular technology will enhance his or her job performance (Hsu & Lu, 2004). People tend to use or not use a technology to the extent that they believe it will help them perform their job better. This belief is either positive or negative and is of fluctuating intensity (Alrafi, 1998; Davis, 1986). Furthermore, this finding corresponds with that made by Sun and Zhang (2006) to be true during mandatory tasks and projects. However, Sun and Zhang (2006) report further that although this relationship exists, it wears off over time and users tend to depend more on their own beliefs through internalisation. Perceived usefulness in turn directly affects behavioural intention to use, through a personal sense of system worth in career advancement. This enhancement of behavioural intention to use assists with prolonging the actual use of the system.

In order to prolong the use of the system, an organisation should endeavour to focus on users' behavioural intention to use. Behavioural intention is the measure of the strength of a user's intention to use the ERP system (Fishbein & Ajzen, 1975; Malhotra & Galletta, 1999). Identification indirectly affected behavioural intention to use (via internalisation and perceived usefulness), which subsequently leads to long-lasting use. Identification also affected perceived ease of use directly, which has a sustaining effect on perceived usefulness and in turn directly affected behavioural intention to use. Therefore, should an ERP system be installed, upgraded or revamped, an organisation can achieve immediate short term system use by advancing identification endeavours and also by sustaining such endeavours; growing internalised commitment of users which will naturally lead to spontaneous system use.

Compliance Effects

Compliance occurs when the person predominantly produces a behaviour or act to obtain rewards or avoid punishments. Such induced behaviours are based neither on content of the behaviour nor on the prominence of relationships (Malhotra & Galletta, 2005), and is performed under surveillance of the influential person (Hsu & Lu, 2004; Kelman, 1958; Malhotra & Galletta, 1999, 2005; Venkatesh & Davis, 2000; Warshaw 1980). In this study, compliance had negligible negative direct effects on all TAM constructs of which the most prominent was that on attitude toward using (β = -0.16). With the non-significant relation

between attitude toward using and behavioural intention to use, compliance appears not to contribute towards actual system use.

In summary, effective use of new and altered information technologies like SAP ERP is likely to require more than mere compliance. A failure to develop psychological attachment among potential users may require the organisation to endure the increased costs associated with more sophisticated control systems and/or fading performance returns on accumulating information technology investments. Having users that share the values underlying effective use of SAP ERP can ensure that users act instinctively to utilise the system in an effective way. Given the on-going trend toward end user computing and greater role of users' self-determination in interacting with increasingly flexible technologies in remote and virtual environments (Malhotra & Galletta, 1999), the theory of social influences (psychological attachment) seems to offer a rich understanding of user behaviour in the implementation and continuous use of a technology such as SAP ERP.

This study had several limitations. Firstly, the sample size has a limitation, specifically the distribution of cultural groups, age generations and gender. This limitation could be ratified by a stratified random sampling approach of larger samples, in securing adequate representation in each of these categories. Another limitation was that the measurement of this model's variables was solely based upon self-reports. According to Spector (2006), the exclusive use of self-report measures increases the likelihood that at least part of the shared variance between measures can be attributed to method variance. Thirdly, the study population was very homogeneous, since from a sample of 241 respondents, 64.7% were male, and 75.5% white. South Africa's multicultural society demands studying the constructs of technology acceptance from different cultural group perspectives, by ensuring construct equivalence in the absence of item bias for all these groups. Stratified random sampling might amend this inadequacy.

RECOMMENDATIONS

Based on the findings of this study, it is recommended that future studies include larger sample sizes obtained from stratified random sampling to secure adequate representation in all sample categories, and in doing so, prevent a homogeneous sample model. It would also be sensible that future studies follow a longitudinal design, where causal inferences can be identified prior to SAP ERP system implementations, upgrades or functional enhancements; subsequently revealing the acceptance progression of adapted technological functionality. This will enable an understanding as to the motivational impact such changes have on end users.

It is furthermore proposed for future research to consider including the generational theory categories in the sample population to determine the aptitude and consequent acceptance of new IT technologies. This will enable corporate leadership to most successfully interact with each generation during system changes and developments, and in doing so, ensure higher levels of acceptance which could secure system benefits. Lastly, it is recommended that future research be done to determine the reverse effect, if any, of the TAM constructs of perceived usefulness and perceived ease of use on psychological attachment constructs. It is further proposed that the redundancy of attitude toward using be investigated to confirm whether it is due to duplication of its content in perceived usefulness and/or perceived ease of use, or whether it is due to the technical expertise of the sample population.

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CHAPTER 5

ARTICLE 4

THE ROLE OF TECHNOSTRESS IN TECHNOLOGY ACCEPTANCE

ABSTRACT

The objective of this study was to examine the relationship between technostress and technology acceptance amongst SAP ERP end users within a South African context. A cross-sectional survey design was used. The Technology Acceptance Model (TAM) questionnaire and the Computer Thoughts Survey (CTS) were deployed amongst SAP ERP users (N = 241). The results confirmed that technostress had insignificant negative relationships with all TAM constructs and that the most probable area of impact on the progression of technology acceptance could be perceived ease of use and perceived usefulness.

Key terms: Technological acceptance, perceived usefulness, perceived ease of use, attitude toward use, behavioural intention to use, actual system use, technostress

Information systems (IS) technology, such as enterprise resource planning (ERP), is a key enabler for the effective transformation of data into useful information; hence allowing organisations to increase their competitive advantage over their rivals (Hayashi, 2011). The adoption and use of such a system has led to the redefinition of organisational structures and business processes and has changed the ways of collaboration between and among individuals and the organisation (Ragu-Nathan, Tarafdar, Ragu-Nathan, & Tu, 2008). Enterprise resource planning is a complex system, managing information from shared data sources such as sales, purchasing, and production (Amoako-Gyampah & Salam, 2004). Frequently, within short periods of time, ERP systems undergo extensive modifications regarding new peripheral technologies, devices, functionalities, workflows, and applications (Davis & Venkatesh, 1995; Ragu-Nathan et al., 2008); resulting in a challenge for users to cope with a continued infusion of modifications (Falaleeva & Johnson, 2002).

Inability to cope with such continuous technological changes in a healthy manner can initiate a disease of maladaptation defined as technostress (Achuonye & Ezekoka, 2011), which in literature is also often referred to as computer anxiety, compustress, cyber phobia, computer phobia, and technophobia (Fisher, 1999). This definition was further amended by labelling technostress not as a disease, but rather as phobic clinical symptoms exhibited by computer users as a learned form of resistance against an unhealthy organisational situation (Ragu-Nathan et al., 2008). Based on these two definitions, technostress (technophobia) was finally coined as any negative effect on attitudes, cognitions and actions or bodily processes, that is caused either directly or indirectly by any computerised technology (Brillhart, 2004).

Furthermore, technostress is viewed as a multidimensional phenomenon consisting of three separate, yet intersecting psychological dimensions, namely: a) anxiety about current or upcoming interactions with computers or computer-related technology; b) negative thoughts or self-deprecating internal dialogues during actual computer interaction or when contemplating future computer interaction; and c) negative attitudes towards computers, their operation, or their social impact (Tiemo & Ofua, 2010). Anxiety about interactions with computer-related technology and negative attitudes about computers and their impact, cause negative cognitions (thoughts) during actual computer usage (Ragu-Nathan et al., 2008). Such negative cognitions are self-deprecating internal dialogues during actual computer usage or when anticipating future interaction (Gilbert, Lee-Kelley, & Barton, 2003). Understanding how these negative cognitions affect users' satisfaction with and performance in computer

systems such as SAP ERP, is an important step in capturing development opportunities from current computer processing environments (Tarafdar, Tu, & Ragu-Nathan, 2010). Negative computer thoughts in this study are captured with the Computer Thoughts Survey (CTS) compiled and validated by Rosen and Weil (1992)

With regard to human reactions toward technostress, Ragu-Nathan et al. (2008) reported that computer users react in two distinct, yet related, behaviours: a) technophobia, the struggle to accept computer technology; and b) technophilia, the over-identification with computer technology. Expanding on these reactions, technostress was classified as three comprising categories, namely: a) anxious technophobes who exhibit the typical signs of an anxiety reaction when using technology, such as perspiring hand-palms, heart tremors, and headaches; b) cognitive technophobes who on the surface appear calm and relaxed, but internally teem with negative thoughts such as "Everybody but me knows how to do this" and "I'll press the wrong key and ruin this machine"; and c) uncomfortable users who may be slightly anxious or use some negative statements, but are generally not in need of personal counselling (Tiemo & Ofua, 2010).

The contribution made by this study will be the validation of the predictive ability of technology acceptance within a more recent and complex South African ERP user environment, by means of a technostress extended Technology Acceptance Model (TAM) of Davis (1986). Furthermore, this study will identify technostress's most likely points of influence during the technological acceptance process as portrayed by the TAM.

Technostress

Technostress has been encapsulated as negative thoughts (cognitions) resulting in the inability of a user to cope with the demands of organisational computer usage. Such negative thoughts are initiated by stressors in the computer technological environment (Tarafdar et al., 2010). In general, stressors are any environmental factors perceived and appraised by an individual (Strümpfer, 1986), such as events, demands, stimuli, or conditions (Ragu-Nathan et al., 2008) which cause him or her to stress and cause behavioural, psychological, and physiological outcomes known as strain (Cooper, Dewe, & O'Driscoll, 2001). Accordingly, similar environmental factors exist within the information systems environment causing technostress and are known as technostressors. Technostressors induce negative symptomatic behaviours (technostrain) which negatively, directly or indirectly, impact on a user's attitudes, thoughts,

behaviours and body physiology (Tarafdar et al., 2010); which in turn can prevent information system projects from succeeding (Hardy-Vallee, 2012).

Tarafdar et al. (2010) distinguished the five most prominent categories of technostressors, namely techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty.

Techno-overload describes situations where the use of information systems force users to work quicker and for long periods of time, which in turn leads to multitasking with several applications and accomplishing different information-processing tasks simultaneously (Clute, 1998). Excessive and on-going multitasking often leads to rushed and unproductive information processing (Ragu-Nathan et al., 2008), role conflicts (Erasmus, 2001), information overload and performance anxiety (Clute, 1998), communicating and receiving more information than is necessary and that can effectively be processed and used (Venkatesh & Davis, 2002; Fisher & Wesolkowski, 1999). Within the ERP environment, Hayashi (2011) reports further that because of techno-overload, more mistakes occur and consequently generate technostress amongst an organisation's system users; subsequently soiling the relationships between users, management and peers.

Techno-invasion describes the invasive effect of computer technology in terms of creating situations where users can potentially be reached at any time (Tarafdar et al., 2010). Employees feel the need to be constantly "signed on", leading to a distortion between work-related and personal environments (Erasmus, 2001), leaving end users with the feeling that they are never "free" of technology, that they are always under supervision or "on call", and that their private lives has been invaded (Hayashi, 2011; Tarafdar et al., 2010). This perceived loss of privacy due to this distortion of borders between the home and the work, leads to dissatisfaction with the applications they use (Brillhart, 2004).

Techno-complexity describes instances where the complexity associated with a computer system makes users feel incompetent regarding their current skills levels and compels them to spend time and energy in learning and comprehending various aspects of such a computer system (Ragu-Nathan et al., 2008). This obligatory constant learning and changing create a feeling of being in a constant transitory with users (Erasmus, 2001), lowering their self-

confidence and impairing their performance (Tarafdar et al., 2010), and are exacerbated by the demand to comply (Michie, 2002).

Techno-insecurity relates to situations in which users feel intimidated about losing their jobs either to automation resulting from new computer systems or about other people who have a better comprehension of the system in question (Sethi et al., 2004; Wang, Shu, & Tu, 2008). This sense of insecurity arises when users are unable to cope with needed learning requirements and work process modifications relating to the new and/or changing computer system (Hayashi, 2011; Tarafdar et al., 2010). Such users consequently experience low self-confidence and impaired work performance (Brillhart, 2004).

Techno-uncertainty refers to situations in which continued computer system modifications and improvements unsettle users and create uncertainty for them (Tarafdar et al., 2010), in that they worry about constantly learning and educating themselves about new computer systems (Erasmus, 2001). Due to the tendency that existing and recently acquired knowledge rapidly becomes obsolete (Tiemo & Ofua, 2010), this inevitably leads to dissatisfaction with the computer system in question (Brillhart, 2004), allowing stress to develop (Michie, 2002).

Technostressors instil anxiety and negative attitudes about computer technology in users, which in turn lead to negative cognitions during actual computer use (Ragu-Nathan et al., 2008). Consequently, such negative cognitions force computer users to react in characteristic ways when using computer technologies, namely as anxious technophobes, cognitive technophobes and uncomfortable users (Gilbert, Lee-Kelley, & Barton, 2003). Given the critical role of the user in organisational information processing as enabler of success, an understanding of how these cognitions affect users' satisfaction with and their performance in SAP ERP mediated tasks, is an important step in seizing benefits to secure optimal use and enable return on investment for an organisation (Tarafdar et al., 2010).

Technostress has been researched by several researchers in a variety of research environments and Table 1 below represents the most significant findings of some of these research studies:

Table 1

Key Findings of Previous Technostress Research

Reference Library (Kupersmith, 1992)
59% of survey participants said their level of computer-related stress had decreased in the past 5 years; 34% felt it had not changed much; and only 4% believed it has decreased; 65% of participants reported that this type of stress was a somewhat serious problem for them; 8% said it was very serious; while 27% felt it was not at all serious.
Technological Sophistication and Technophobia (Rosen & Weil, 1992)
Based on data collected from 3 392 students at 38 universities in 23 countries, vast differences were found in both (a) technological sophistication and (b) negative reactions to computers and technology and could be explained as follows: First, both dimensions may partially be explained by the availability of technology, namely either the lack of or abundance of available technology can inspire discomfort of the unknown and known, respectively. Second, characteristics of the culture itself may lead to students' reactions to technology. Third, the political structure of the country may inhibit or encourage the use of technology by its allocation of funds. Fourth, the way and manner in which technology is introduced into the educational system may influence students' reactions to technology.
Information Superhighway (Rosen & Weil, 1994)
Results suggested that the American public was not ready to eagerly embrace the approaching information superhighway until their general discomfort with technology was reduced or eliminated. Results suggest that having a calm, relaxed, jargon-free person introducing new technology by providing a personal motivation was critical for future comfort and acceptance.
Online Users and Non-users (Rosen & Weil, 1995)
The results demonstrated dramatically that people were vastly overestimating online usage. Since only approximately one in ten were actually online, this suggests that the remaining 85%-90% of the population were misperceiving technology usage by a factor of two (and nearly three). This led to a feeling by most people that "everybody is online and I am the last on the block to get hooked up to the superhighway". In general, feelings like these led people to feel inadequate, worried and lost and had either forced people to make decisions about technology utilisation that were not well thought through, or led to stronger resistant reactions (as perhaps seen in the rise in popularity of technology bashing books and a re-emergence of the Luddites). Even worse, there appeared to be a segment of the population that was even more at risk for these negative feelings. Instead of being "have nots", these people were becoming "know nots".

Table 1 (continued)

Key Findings of Previous Technostress Research

Preparation for Y2K (Rosen & Weil, 1999)

Significant changes identified across a seven-month period were as follow:

1. Concern about potential technology problems fell from around two-thirds of the population to one-half or less. However, concern about problems with personal computers, e-mail and utilities fell much less. Those technologies that were generating the most concern were personal computers, government computers, credit cards and banking.
2. Attitudes toward technology in general also changed with more of the population being hesitant toward technology, and fewer either eager or resisting.
3. Slightly more people were planning to stockpile food and money.
4. More people knew about the Y2K issue and they were getting more of their information from television and other media.
5. Demographic differences existed and indicated the following:
   – male baby boomers who were more highly educated and who were eager adopters know more about Y2K.
   – male adults 50 years and under, who had children and who were eager adopters, understood more about cyberspace.
   – male young adults were more concerned about potential Y2K problems than older adults.
   – females who were married and had children, were more likely to stockpile cash and all females were more likely to stockpile food.

Corporate Organisations (Rosen & Weil, 2000a)

Over a 49-month period, clerical/support staff and managers/executives became more hesitant toward technology, while increasing their technology use both in the workplace and after standard work hours. Specifically,

1. clerical/support staff and managers/executives both showed an increase in the use of all technologies over the 49-month period. The largest increase for both groups was in use of e-mail and the Internet, although clerical/support staff showed double digit percentage increases in the use of all tools, except pagers; and managers/executives showed double digit percentage increases of all tools. The latter showed substantially larger increases in usage than the former in Internet, e-mail, pagers and faxes;
2. use of less complex tools was predicted by a variety of demographic factors, while use of more complex tools was predicted by psychological reactions to technology. More positive reactions led to more usage of computers, e-mail, the Internet, and fax machines;
3. clerical/support staff and managers/executives indicated increased usage of all technologies after working hours, with the majority using their computer, the Internet and e-mail at least 1-2 hours after standard working hours;
4. computer training was basically only fair at best for the majority of clerical/support staff and managers/executives with one in six receiving no training at all;
5. both clerical/support staff and managers/executives increased their average hours per month online over the 49-month period, with managers/executives spending more time online in all samples; and

Table 1 (continued)

Key Findings of Previous Technostress Research

6. both clerical/support staff and managers/executives increased their understanding of cyberspace across the 49-month period, with the latter showing more understanding.

Electronic Workplace (Tangri, 2003)

Cost of technostress in business:

1. 19% absenteeism;
2. 40% turnover (Cost of which is 150-200% of the salary envelope for each position;
3. 55% of EAP (employee assistance program) costs;
4. 30% of short-term and long-term disability costs;
5. 10% of drug plan costs; and
6. 60% total cost of workplace accidents.

Technostress statistics:

- Employees were interrupted at least three times an hour by electronic technology.
- One in every four computers has been physically assaulted.
- Computer processing power doubled every 18 months.
- Office automation packages changed every two years.
- 85% of the population felt uncomfortable with technology.

Corporate Organisations (Sanderlin, 2004)

Technostress can reduce employee productivity and create dissonance in the work environment, costing employers time and money. Given the trend toward an increasingly faster-paced and more stressful work environment, it seems reasonable to develop effective training and wellness programs to decrease employees' stress levels and to enhance their sense of technological mastery and personal value. Failing to develop such programmes will ultimately cause job dissatisfaction, dissonance, stress, and anger.

Sources and Dimensions of Computer Anxiety (Roslan & Mun, 2005)

Significant relationships exist between anxiety levels and sources of anxiety. The relationship between task anxiety and computer anxiety level is the strongest. Task anxiety is, therefore, the best predictive factor of computer anxiety.

Computer Science (CS) Degree Students (Doyle, Stamouli, & Huggard, 2005)

This study investigated whether CS students in Trinity College suffer from computer anxiety and low self-efficacy. The computer experience of the students had also been examined since literature in this field indicated there was a relationship between these three factors. The study was conducted with CS students from all four years and the findings revealed that students suffered from higher than expected levels of computer anxiety. Low self-efficacy levels were commonly found among first and fourth year students. Based on these results, a negative relationship was observed between computer anxiety and experience which means, that as computer experience increases, the student's level of anxiety decreases. Also a statistically significant positive correlation was identified between experience and self-efficacy, which indicated that when the former increases, the students become more self-confident and their level of self-efficacy increases.

Table 1 (continued)

Key Findings of Previous Technostress Research

Technostress Antecedents and Implications (Ayyagari, 2007)
The links between technology usage and stressors are all significant (βs ranging from 0. 09 to 0. 21, all significant at 5% at least). The results indicated that, as individuals become more dependent on technologies (i.e. increasing technology usage), they experience higher levels of stressors.

More specifically, technostress was also researched within an ERP (enterprise resource planning) user environment of which Table 2 presents the most significant findings.

Table 2

Key Findings of Previous Technostress Research in an ERP Environment

Technostress Amongst ERP Users in Multinational Organisations (Gunson & de Blasis, 2002)
a) Five major factors were identified as generating technostress: o system problems; o computing errors; o learning time for getting used to new technologies, due to the fact that technologies said to be time-saving increased tasks more than they alleviated them; o difficulty following the fast evolving technologies; and o technology-aided employee scrutiny, which was the supplemental control exerted by employers in reading employees' files or e-mails. b) Technostress was increasingly affecting executives and managers.
Impact of Technostress on the Role Stress and Productivity of ERP Users (Tarafdar, Tu, Ragu-Nathan, & Ragu-Nathan, 2007)
Based on empirical survey data from ICT users in 223 organisations, the effects of stress created by information and computer technology (ICT) - that is "technostress"- on role stress and on individual productivity, were explored. Results confirmed that: (1) technostress was inversely related to individual productivity; (2) role stress was inversely related to individual productivity; and (3) technostress was directly related to role stress.
Technostress Amongst Enterprise Application (ERP) Users (Ragu-Nathan, Tarafdar, Ragu-Nathan, & Tu, 2008)
Based on structural equation modelling (SEM), results from 680 end users showed that technostress creators decreased job satisfaction, and led to decreased organisational and continuance commitment; while technostress inhibitors increased job satisfaction and organisational and continuance commitment. Age, gender, education, and computer confidence influenced technostress.
Technostress Amongst ERP and CRM (Customer Relationship Management) Users (Shu & Wang, 2008)
The moderating effects of perceived organisational support on the relationship between technostress and role conflict (and role overload) were investigated using data collected from 450 employees. Results indicated that: (1) technostress, perceived by employees, was positively related to role conflict (and role overload); (2) perceived organisational support moderated the relationship between technostress and role conflict, such that the relationship would be negative when perceived organisational support was higher; and (3) perceived organisational support did not significantly moderate the relationship between technostress and role overload.
Technostress Amongst Healthcare ERP Users (Hayashi, 2011)
Based on the literature review and user interviews of an enterprise resource planning system in the healthcare industry, it was found that management directly influenced work relationships, work overload, technical support, role ambiguity, and job security which affected the level of technostress experienced.

Purpose and Hypotheses of this Study

None of the research studies listed in Tables 1 and 2 attempted to determine the influence of technostress on the technology acceptance model (TAM). Furthermore, no South African study could be found that extended the TAM to include technostress as a moderating construct in determining technology acceptance via the TAM. Therefore, the objective of this study was to determine, within a South African corporate ERP environment, the role of technostress on technology acceptance. This study, furthermore, determined the role of technostress on all TAM constructs. Based on this objective, the following hypotheses were proposed as illustrated by Figure 1:

Hypothesis 1: Technostress is negatively associated with perceived usefulness.
Hypothesis 2: Technostress is negatively associated with perceived ease of use.
Hypothesis 3: Technostress is negatively associated with attitude toward using.
Hypothesis 4: Technostress is negatively associated with behavioural intention to use.
Hypothesis 5: Technostress is negatively associated with actual system use.

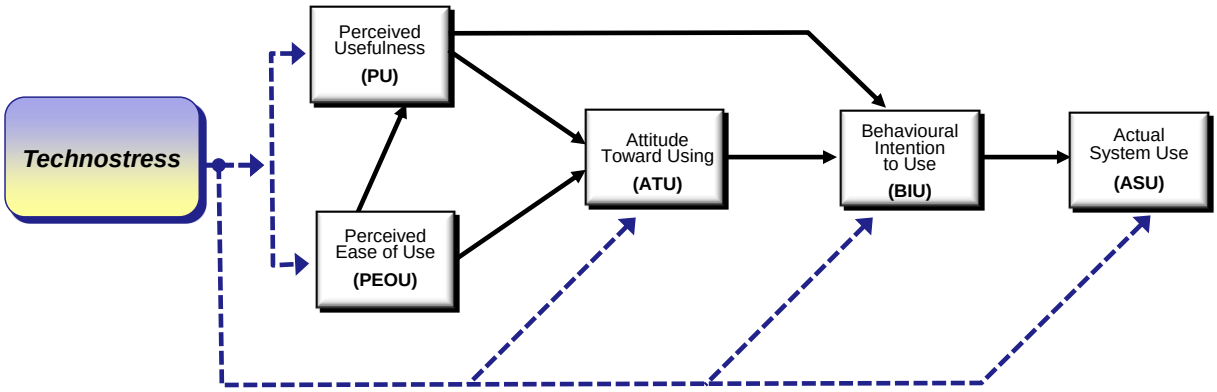

Figure 1. Extended technology acceptance model (TAM) to include technostress

METHOD

Research Design

A cross-sectional survey design whereby a sample is drawn from a population at one time was used.

According to Yang and Land (2008), this design is best suited for addressing the descriptive and predictive functions associated with correlational design whereby relationships between variables are examined.

Participants

The entire ERP user population of 720 employees within a steel manufacturing organisation in Gauteng was targeted for this research, but a response rate of only 33.5% (241 participants) was obtained. The characteristics of the study population are detailed in Table 3. The majority of participants were white (75.5%), male (64.7%), between the ages of 29 to 55 years of age, while holding a diploma or degree (43.6%). These participants were mainly non-managerial employees (66.8%) from the administration/services (38.6%) and engineering (28.6%) domains, having had between five to ten years ERP experience (42.0%).

Table 3

Characteristics of Participants (N=241)

Item	Category	Frequency	Percentage
Gender	Male	156	64.7
	Female	85	35.3
	Total	241	100.0
Culture	Asian	12	5.0
	Black	38	15.8
	Coloured	9	3.7
	White	182	75.5
	Total	241	100.0
Age	below 22 years	2	0.8
	23 – 28	24	10.0
	29 –39	73	30.3
	40 – 45	45	18.6
	46 – 55	73	30.3
	over 55	24	10.0
	Total	241	100.0
Education	Below Grade 12	11	4.6
	Grade 12	89	36.9
	Diploma/Degree	105	43.6
	Post Diploma/Degree	36	14.9
	Total	241	100.0
Domain	Manufacturing	15	6.2
	Engineering	69	28.6
	Financial	38	15.8
	Information Technology	26	10.8
	Administration/Services	93	38.6
	Total	241	100.0
Status	Senior Management	12	5.0
	Middle Management	68	28.2
	Non-managerial	161	66.8
	Total	241	100.0
ERP years	Less than 1	16	6.6
	1 – 2	16	6.6
	3 – 5	53	22.0
	6 – 10	101	42.0
	More than 10	55	22.8
	Total	241	100.0

Measuring Instruments

The Technology Acceptance Model Questionnaire (TAM) with 23 items, compiled by Malhotra and Galletta (1999), was used for gathering data about the various constructs depicted in the core of the technology acceptance model, namely perceived usefulness, perceived ease of use, behavioural intention to use, attitude towards using, and actual system use. These scales were adapted from prior studies, many of which had already established reliability and validity. The Cronbach alpha reliability scores for the core technology acceptance model constructs were found to range from 0.68 to 0.97 for perceived ease of use, and 0.71 to 0.96 for perceived usefulness (Amoako-Gyampah & Salam, 2004; Chau & Hu, 2002; Davis, 1989; Davis et al., 1989; Malhotra & Galletta, 1999; Mathieson, 1991; Taylor & Todd, 1995), also from 0.69 to 0.92 for attitude towards using (Amoako-Gyampah & Salam, 2004; Chau & Hu, 2002; Mathieson, 1991; Taylor & Todd, 1995), and 0.62 to 0.96 for behavioural intention to use (Amoako-Gyampah & Salam, 2004; Chau & Hu, 2002; Mathieson, 1991).

Malhotra and Galletta (1999) established convergent and discriminant validity of all pre-existing TAM measures by observing the correlations between the items on the various scales. Factor analyses provided evidence of distinct loadings of various factors and convergent and discriminant validity based on inter-item correlations. All pre-existing constructs used in TAM met the criteria of validity and reliability.

Rosen and Weil (1992) compiled and validated three questionnaires to determine the presence and intensity of technostress, namely the 20-item Computer Anxiety Rating Scale (CARS-C), 20-item Computer Thoughts Survey (CTS-C) and the 20-item General Attitudes Toward Computer Thoughts Scale (GATC-C). Scoring moderate to high on any one of these measures is indicative of the presence of technostress. Upon close scrutiny, the CARS-C and GATCS-C items has proven to be targeted as entry level users and not seasoned SAP ERP users like the participants in this study. The CTS-C however targets experienced users, therefore, for purposes of this study, only the CTS-C will be used as a measure of technostress.

Rosen and Weil (1992) compiled and validated a questionnaire to determine the presence and intensity of technostress, namely the 20-item Computer Thoughts Survey (CTS-C), measuring negative computer thoughts. After applying exploratory factor analysis, items 1, 3, 6, 7, 9, 12,

13, 15, 17, 19 and 20 were found to be relevant to the ERP area and were retained to test for negative computer thoughts leading to technostress.

The 11 above mentioned items of the Computer Thoughts Survey (CTS-C) was originally created by Rosen and Weil to yield assessment and diagnostic information necessary for a clinical treatment programme. This programme focused on a technophobe's cognitions and feelings about his/her abilities with technology rather than on their anxieties about computers and technological devices (Rosen & Weil, 1992). Rosen and Weil (1992) did eight studies to determine the reliability of the CTS-C which yielded Cronbach alpha coefficients of reliability ranging from 0.81 to 0.93, thus, confirming its reliability (Rosen & Weil, 1992). Validity testing yielded three distinct factors with eigen values greater than 1, namely Negative Cognitions About Computer Operation and Use with loadings between 0.53 and 0.77, explaining 38% of the variance; Positive Cognitions During Computer Interaction with loadings between 0.43 and 0.68, explaining 16% of the variance; and Feelings of Enjoyment and Fun While Using a Computer with loadings between 0.50 and 0.73, explaining 5% of the variance respectively.

A *Biographical questionnaire,* compiled by the researcher, was used to obtain descriptive information about the research participants as depicted in Table 3 before.

Data Analysis

The data was analysed using SPSS (SPSS Inc., 2003) and Mplus version 7.12 (Muthén & Muthén, 1998-2013). Items of all questionnaires were defined as being continuous and the maximum likelihood (ML) estimator was used. The following indexes produced by Mplus were used in this study: a) absolute fit indices, including the Chi-square statistic, which is the test of absolute fit of the model, the Standardised Root Mean Residual (SRMR), and the Root-Means-Square Error of Approximation (RMSEA); and b) incremental fit indices, including the Tucker-Lewis Index (TLI) and the Comparative Fit Index (Hair, Black, Babin, & Andersen, 2010). TLI and CFI values higher than 0.90, are considered acceptable. RMSEA values lower than 0.08 and a SRMR lower than 0.08 indicate a close fit between the model and the data.

Due to the inefficiency of Cronbach's alpha for calculating scale or construct reliability when using structured equation modelling, an alternative method is applied as proposed by Wang and Wang (2012), allowing for latent variables underlying a set of observed indicators which are not tau-equivalent or parallel measures. This method is based on utilising the unstandardised factor loadings (λ) and unstandardised variance of errors (θ), whilst incorporating the correlation of errors.

Procedure

This study was conducted at a South African steel manufacturer as part of its SAP ERP Consolidation Project, with the intent to determine user acceptance of the new consolidated system. The research sample was drawn from the SAP ERP users group comprising system users and technical specialists over a 16-month period from September 2010 to December 2011. The battery of questionnaires, as compiled by the researcher, together with a manual pertaining to the completion requirements for all questionnaires as well as the contact details of the researcher from whom further information could be sourced were placed on the organisation's Information Portal by their systems administrator, where participants could complete and submit it online. Prior to placing the questions and manual online, some hardcopies of questionnaires and manual were distributed and collected by the SAP basis technical department from users working on project outside the reach of the portal. The systems administrator extracted the completed questionnaire data from the Information Portal database and made all data, together with the hardcopies, available to the researcher. This data was verified and collated by the researcher into a single database for statistical analyses. Only complete questionnaires were included whilst questionnaires containing missing data were discarded.

Ethical Aspects

The manager of the SAP Centre of Excellence in the Information Management section at a South African steel manufacturer was approached and asked for permission to conduct this study. Permission in the form of a letter of consent was obtained with the precondition that all research findings would be made available to the SAP CoE manager. No permission was necessary from SAP AG seeing that this study investigated the effect of a real-time, fully integrated system (of which SAP was the steel manufacturer's choice of system) on the

wellbeing of users and not investigating the effectiveness, efficiency or performance of SAP ERP as system. This letter of consent as well as an application for ethical approval was successfully submitted to the Ethics Committee of the North-West University (NWU FH-SB-2012-008). Participants were informed in the preamble to the questionnaire, that a) data is captured by the researchers and not their organisation; b) data will solely be used for academic research purposes and not for any job performance or merit objectives; c) participation is voluntary; and d) participants will remain anonymous.

RESULTS

Testing the Measurement Model

By way of confirmatory factor analysis (CFA), alternative measurement models were tested to assess whether the items loaded significantly onto the scales with which they were related. Using structural equation modelling (SEM) methods, three measurement models were tested. Model 1 consisted of an extended TAM which included technostress, or specifically six latent variables which included the TAM variables of a) perceived ease of use; b) perceived usefulness; c) attitude toward using; d) behavioural intention to use; e) actual system use; and f) technostress. All latent variables in model 1 were allowed to correlate.

Models 2 and 3 followed the same template: Model 2 was specified, with 1 observed variable comprising TAM and technostress variables merged; model 3 was specified with 5 observed variables consisting of technostress (perceived ease of use and perceived usefulness merged), attitudes toward using, behavioural intention to use, and actual system use.

Table 4

Fit Statistics of Competing Measurement Models

Model	χ^2	RMSEA	SRMR	*df*	TLI	CFI	AIC	BIC
Model 1	1098.89	0.07	0.06	512	0.87	0.88	22520.64	22928.36
Model 2	1030.08	0.07	0.06	511	0.89	0.90	22453.83	22865.03
Model 3	973.66	0.06	0.06	510	0.90	0.91	22399.40	22814.09
Model 4	953.22	0.06	0.06	509	0.90	0.91	22380.97	22799.14

df = degrees of freedom; TLI = Tucker-Lewis Index; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardised Root Mean Square Residual; AIC = Akaike Information Criterion; BIC = Bayes Information Criterion.

A χ^2 value of 973.66 (*df* = 510) was obtained for the hypothesised measurement model 3. The fit statistics on four fit indices were acceptable: TLI = 0.90. CFI = 0.91, RMSEA = 0.06, SRMR = 0.06. Two additional fit statistics, namely the AIC and BIC were used to compare alternative measurement models. The AIC, which is a comparative measure of fit, is meaningful when different models are estimated. The lowest AIC is the best fitting model. The BIC provides an indication of model parsimony. On these additional fit statistics, model 3 rendered an AIC = 22399.40 and BIC = 22814.09. Comparison of the fit indices indicates that model 3 fitted the data best.

Analyses continued in an exploratory manner to improve the fit of the selected model. The modification indices confirmed that the model fit could be improved by correlating three pairs of items: behavioural intention item 14 ("I intend to use SAP for capturing ALL my work related reports") with behavioural intention item 15 ("I intend to use SAP to generate ALL my work related reports"); attitude toward using item 2 ("All things considered, my using SAP in my job is a(n) Harmful/Beneficial idea") with attitude toward using item 4 ("All things considered, my using SAP in my job is a(n) Negative/Positive idea"), as well as technostress item 19 ("I feel overwhelmed by how much I don't know") with technostress item 20 ("I won't be able to get the computer to do what I want). The fit statistics for the revised model (model 4) revealed an improved fit rendering χ^2 value of 953.22 (df = 509), TLI = 0.90, CFI = 0.91, RMSEA = 0.06, SRMR = 0.06, AIC = 22380.97, and BIC = 22799.14. Model 4 was found to be the best fitting and most parsimonious measurement model.

Testing the Structural Model

Table 5 shows the descriptive statistics and reliability coefficients of the technology acceptance model measuring instruments, i.e. perceived usefulness (PU), perceived ease of use (PEOU), attitude towards using (ATU), behavioural intention to use (BIU) and actual system use (ASU), together with technostress.

Table 5

Descriptive Statistics and Reliability Coefficients of the TAM and Technostress Measure (N=241)

Measure	Mean	*SD*	Skewness	Kurtosis	ρ
PEOU	31.07	6.89	-0.93	1.25	0.99
PU	31.77	6.92	-0.73	0.92	0.99
ATU	21.05	4.74	-0.86	1.13	0.88
BIU	23.74	4.22	-1.22	1.75	0.93
ASU	16.91	4.66	-1.07	0.19	0.98
TECHNO	80.19	1.00	-0.64	0.37	0.78

PEOU = perceived ease of use; PU = perceived usefulness; ATU = attitude toward using; BIU = behavioural intention to use; ASU = actual system use; TECHNO = technostress

Scores on three of the dimensions, perceived ease of use, attitude toward using, and behavioural intention to use seem to be leptokurtic by peaking high with a kurtosis of greater than 1; therefore, confirming their frequency distributions to be concentrated around the centre. The remaining three, perceived usefulness, actual system use, and technostress seem to be platykurtic by peaking low at a kurtosis of smaller than 1 with their frequency distribution concentrated widely around the distribution tail ends. All dimensions are negatively skewed, which is indicative of most values being distributed to the right of the mean.

Correlation coefficients between the TAM dimensions and technostress for employees working in an SAP ERP environment as generated by using SPSS, are reported in Table 6 below:

Table 6

Correlation Coefficients Between TAM and Technostress (TECH) Measuring Constructs (N=241)

	1	2	3	4	5
1. TECH	-	-	-	-	-
2. PEOU	-0.19	-	-	-	-
3. PU	-0.24	0.50	-	-	-
4. ATU	-0.06	0.38	0.56	-	-
5. BIU	-0.22	0.55	0.86	0.53	-
6. ASU	-0.07	0.35	0.56	0.59	0.43

TECH = technostress; PEOU = perceived ease of use;
PU = perceived usefulness; ATU = attitude toward using;
BIU = behavioural intention to use; ASU = actual system use

All scales showed adequate internal reliabilities. Overall, users selected scores above the midpoint of the scale for all scales, with the exception of identification and compliance.

The structural model (model 5) was tested based on the measurement model (model 4). Model 5 that emerged as an over-identified structural model, having 528 unique covariance terms and 32 parameters, was tested rendering the following fit results: χ^2 = 953.22 (*df* = 509; *p* = 0.00); RMSEA = 0.06; SRMR = 0.06; TLI = 0.90; CFI = 0.91, AIC = 22380.97, and BIC = 22799.14. Figure 2 shows the standardised path coefficients estimated by Mplus version 7.12 (Muthén & Muthén, 1998-2013).

Given the cross-sectional nature of the data, four competing models, models 5a to 5d, were also tested to determine possible redundancies among path coefficients. In model 5a, the relationship between technostress and attitude toward using was constrained to zero. Results indicated a lesser fit to the data: χ^2 (511, *N* = 241) = 960.10; *p* < 0.001; TLI = 0.90; CFI = 0.91; RMSEA = 0.06; SRMR = 0.06; AIC = 22383.85; and BIC = 22795.05. In model 5b, the relationship between technostress and behavioural intention to use was annulled by constraining the path coefficient to zero. Results indicated a lesser fit to the data: χ^2 (510, *N* = 241) = 953.22; *p* < 0.001; TLI = 0.90; CFI = 0.91; RMSEA = 0.06; SRMR = 0.06; AIC = 22378.97; and BIC = 22793.66. In model 5c, the relationships between technostress and both behavioural intention to use and actual system use were annulled by constraining the path

coefficients to zero. Results indicated a lesser fit to the data: χ^2 (511, N = 241) = 954.31; p < 0.001; TLI = 0.90; CFI = 0.91; RMSEA = 0.06; SRMR = 0.06; AIC = 22378.06; and BIC = 22789.27. In model 5d, the relationships between technostress and behavioural intention to use, actual system use, and perceived usefulness were annulled by constraining the path coefficients to zero. Results indicated a lesser fit to the data: χ^2 (512, N = 241) = 959.70; p < 0.001; TLI = 0.90; CFI = 0.91; RMSEA = 0.06; SRMR = 0.06; AIC = 22381.45; and BIC = 22789.17. Table 7 presents fit statistics for the various structural models.

Table 7

Fit Statistics of Competing Structural Models

Model	χ^2	RMSEA	SRMR	*df*	TLI	CFI	AIC	BIC
Model 5	953.22	0.06	0.06	509	0.90	0.91	22380.97	22799.14
Model 5a	960.10	0.06	0.06	511	0.90	0.91	22383.85	22795.05
Model 5b	953.22	0.06	0.06	510	0.90	0.91	22378.97	22793.66
Model 5c	954.31	0.06	0.06	511	0.90	0.91	22378.06	22789.27
Model 5d	959.70	0.06	0.06	512	0.90	0.91	22381.45	22789.17

df = degrees of freedom; TLI = Tucker-Lewis Index; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardised Root Mean Square Residual; AIC = Akaike Information Criterion; BIC = Bayes Information Criterion.

Upon inspection of Table 7, model 5 emerged as the best fitting and most parsimonious structural model revealing the lowest χ^2 (953.22), *df* (509), AIC (22380.97) and BIC (22799.14) values. All other fit statistics, RMSEA (0.06), SRMR (0.06), TLI (0.90), and CFI (0.91) were within acceptable bounds. The following changes in chi-square ($\Delta\chi^2$) were found: Models 5 and 5a ($\Delta\chi^2$ = 6.88, Δdf = 2, p < 0.01), models 5 and 5b ($\Delta\chi^2$ = 0.0, Δdf = 1, p < 0.01), between models 5 and 5c ($\Delta\chi^2$ = 1.09, Δdf = 2, p < 0.01), and models 5 and 5d ($\Delta\chi^2$ = 6.48, Δdf = 3, p < 0.01). Although model 5 rendered a higher AIC and BIC statistic than model 5b of ΔAIC = 2.00 and ΔBIC = 5.48, model 5 rendered a lower Δdf = 1. Figure 2 shows the standardised path coefficients estimated by Mplus for the hypothesised model.

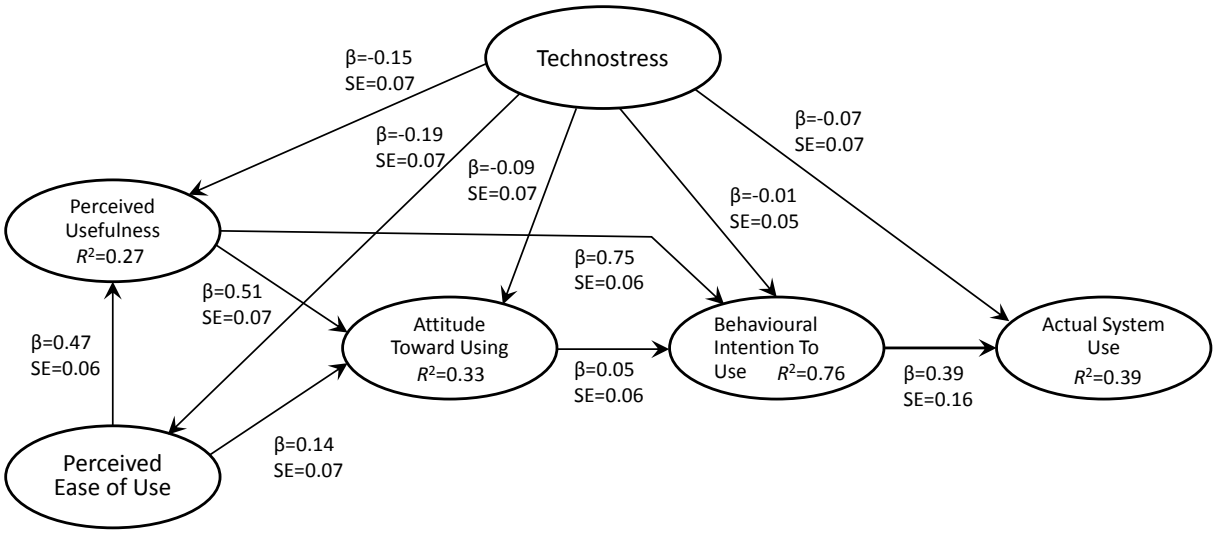

Figure 2. Structural model for the extended TAM to account for technostress
Note: Only statistically significant paths are shown in the figure.

Next, the obtained relationships of the best fitting and most parsimonious structural model are discussed with reference to the hypotheses of this study.

Hypothesis 1

Inspection of the standardised regression weights revealed a negative relationship (β = -0.15) between technostress and perceived usefulness. The ML-estimated equation accounted for a large proportion of the variance in perceived usefulness (R^2 = 0.27), accounting for 27% of the variance. Hypothesis 1 is accepted.

Hypothesis 2

The standardised regression weight between technostress and perceived ease of use revealed a negative relationship (β = -0.19). Hypothesis 2 is accepted.

Hypothesis 3

Inspection of the standardised regression weights revealed a negative relationship between technostress and attitude toward using (β = -0.09). The ML-estimated equation accounted for a large proportion of the variance in attitude toward using (R^2 = 0.33), accounting for 33% of the variance. Hypothesis 3 is accepted.

Hypothesis 4

The standardised regression weight between technostress and behavioural intention to use revealed a negative relationship (β = -0.01) The ML-estimated equation accounted for a large proportion of the variance in behavioural intention to use (R^2 = 0.76), accounting for 76% of the variance. Hypothesis 4 is accepted.

Hypothesis 5

Inspection of the standardised regression weights revealed a negative relationship between technostress and actual system use (β = -0.07). The ML-estimated equation accounted for a large proportion of the variance in behavioural intention to use (R^2 = 0.39), accounting for 39% of the variance. Hypothesis 5 is accepted.

Taken together, the model fit indices suggest that the relationships postulated in the model account for a substantial amount of the covariation in the data. The model accounts for the following variances: perceived usefulness 27%, attitude toward using 33%, behavioural intention to use 76%, and actual system use 38%; lending more empirical substantiation of the model's fit. The negative effects of technostress on the process of technology acceptance were small as confirmed by its relevant standardised regression statistics with a) perceived usefulness (β = -0.15); b) perceived ease of use (β = -0.19); c) attitude toward using (β = -0.09); d) behavioural intention to use (β = -0.01); and e) actual system use (β = -0.07). The most significant of these relationships are those with perceived ease of use and perceived usefulness.

DISCUSSION

The objective of this study was to determine the role of technostress, as operationalised in terms of Rosen and Weil's (1992) negative computer thoughts survey, on all TAM constructs within a South African SAP ERP user environment. Using the TAM as premise of departure, a best fit model obtained by way of structural equation modelling confirmed a positive technology acceptance relationship path leading from perceived ease of use through perceived usefulness and behavioural intention to use, to actual system use. This path commences at perceived ease of use with a positive relationship of reinforcement to perceived usefulness. The significance of this relationship toward actual system use is consistent with findings reported by Amoako-Gyampah and Salam (2004); Averweg (2008); Chau and Hu (2002); Davis (1986); Davis et al. (1989); and Venkatesh and Davis (2000).

This positive path resumes as hypothesised, from perceived usefulness to behavioural intention to use. This finding is consistent with that reported by Davis (1986); Malhotra and Galletta (1999); Taylor and Todd (1995); but inconsistent with findings of Gumussoy et al. (2007), who reported it to be of medium practical effect. This inconsistency may be attributed to the fact that the Gumussoy et al. (2007) study focused on potential ERP users and not existing users as in this study. Potential users will obviously not have any experience with ERP; therefore, they will not have a well-founded sense of usefulness. Amoako-Gyampah and Salam (2004) reported this relationship to be non-significant with practically low effect. The Amoako-Gyampah and Salam (2004) research was done during an ERP implementation amidst prospective users with no or little system experience, focusing primarily on three external project related variables: a) project communication related to the ERP system; b) shared belief in the benefits of the ERP system; and c) training on the ERP system. Obviously these participants had no sense of usefulness and were unable to formulate an intention toward using the system.

The path terminates with a positive relationship from behavioural intention to use towards actual system use. This finding is consistent with that reported by Davis (1986); and Malhotra and Galletta (1999); but inconsistent with Shih and Huang (2009) who reported it as being of insignificant effect. Shih and Huang (2009) conducted their research prior to an ERP implementation incorporating additional behavioural constructs, such as: a) senior management support; b) computer self- efficiency; and c) computer anxiety. This finding of

Shih and Huang (2009) could possibly be attributed to a lack of hands-on experience; thus, potential users were unable to formulate a behavioural intention to use the system.

Results acquired from structural equation modelling as to the effect of technostress on the TAM confirmed that negative relationships exist between technostress and all TAM constructs. This finding is consistent with that reported by Gunson and de Blasis (2002), that technostress has a negative effect on the implementation, exploitation, and preservation of a computer system like ERP. This negative effect is attributed to technostress adversely influencing user productivity (Ayyagari, 2007; Sanderlin, 2004; Tarafdar et al., 2007), user self-efficacy and satisfaction with the computer system in question (Brillhart, 2004), and enhancing dissonance amongst users (Sanderlin, 2004), to mention a few. The previous researchers studied technostress among new users working on unfamiliar systems prior and during the implementation phase, where the likelihood of technostress is higher merely due to the uncertainty of change. In contrast, this present study focused on participants who are mostly experienced users participating in the consolidation of several familiar systems on which they are well versed; nevertheless, levels of technostress are present. This can be attributed to the after effect of the continuous updating and improving of familiar systems, such as SAP ERP.

The low estimates of the standardised path coefficients revealed that technostress had weak relationships with all TAM sub-constructs and was therefore insignificant. This is contrary to statistics declared by previous researchers like Tarafadar et al. (2010) and Doyle et al. (2005), who declared negative significant path coefficients. This inconsistency can be explained by the fact that users participating in this study were mostly proficient around SAP ERP and, therefore, experienced low levels of technostress. Furthermore, aspects such as effective training, clear deadlines, effective teamwork, recurrent performance evaluations, job security, career development and realistic job load are all antidotes for technostress (Sethi et al., 2004), and could be assumed as the reason for low technostress reported in this study. However, from an organisational perspective, one should be aware that technostress could surface, should the user-system relationship be altered due to system-, job-, or employee relation issues.

Considering the most probable impact of location of technostress on the progression of technology acceptance, it is imminent from the results (although low in magnitude) that

technostress impacts predominantly perceived ease of use and perceived usefulness. This finding is congruent with that made by Amoako-Gyampah and Salam (2004), Lucas and Spitler (1996), and Malhotra and Galletta (2005), who identified the entry point of external variables to be that at perceived ease of use and perceived usefulness. The implication this finding has on organisations is that, should one wish to decrease the level of technostress amongst SAP ERP users, change management should be deployed, focusing on enhancing these two areas.

This study had several limitations. Firstly, the sample size has a limitation, specifically the distribution of cultural groups, age generations and gender. This limitation could be ratified by a stratified random sampling approach of larger samples in securing adequate representation in each of these categories. Another limitation was that the measurement of this model's variables was solely based upon self-reports. According to Spector (2006), the exclusive use of self-report measures increases the likelihood that at least part of the shared variance between measures can be attributed to method variance. Thirdly, the study population was very homogeneous, since from a sample of 241 respondents, 64.7% were male, and 75.5% white. South Africa's multicultural society demands studying the constructs of technology acceptance from different cultural group perspectives; ensuring construct equivalence in the absence of item bias for all these groups. Stratified random sampling might amend this inadequacy.

RECOMMENDATIONS

Based on the findings of this study, it is recommended that future studies include larger sample sizes obtained from stratified random sampling to secure adequate representation in all sample categories, and in doing so, prevent a homogeneous sample model. It would also be sensible that future studies follow a longitudinal design where causal inferences can be identified prior to SAP ERP system implementations, upgrades or functional enhancements; subsequently revealing the acceptance progression of adapted technological functionality. This will enable an understanding as to the motivational impact such changes have on end users.

It is furthermore proposed for future research to consider including the generational theory categories in the sample population to determine the aptitude and consequent acceptance of

new IT technologies. This will enable corporate leadership to most successfully interact with each generation during system changes and developments, and in doing so, ensure higher levels of acceptance which could secure system benefits. Lastly, it is recommended that future research be done to determine the reverse effect, if any, of the TAM constructs of perceived usefulness and perceived ease of use on levels of technostress. It is further proposed that the non-significant role of attitude toward using ($\beta = 0.05$) be investigated to confirm whether it's due to duplication of its content in perceived usefulness and/or perceived ease of use, or whether it is due to the technical expertise of the sample population.

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CHAPTER 6

CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

The purpose of this chapter is to draw conclusions from the four articles which comprise this study. Conclusions are drawn in accordance with the research objectives. Furthermore, contributions and limitations of this study are discussed and recommendations are made for the organisation as well as for future research.

6.1 CONCLUSIONS

The conclusions are drawn, based on the specific objectives of this study:

- *The distinctive nature of a technology acceptance model (TAM), psychological attachment and technostress*

The first objective of this study was to theoretically investigate the distinctive nature of a technology acceptance model (TAM), psychological attachment and technostress. The TAM, introduced by Fred Davis (1986), was found to be the most appropriate framework to examine user acceptance of computer technology. The TAM was also found to be the most widely applied theoretical model (Lee et al., 2003), the most parsimonious and powerful (Venkatesh & Davis, 2000), as well as the most widely published (Lee et al., 2003).

Although being the most suitable research framework, the TAM's application scope is inhibited due to the omission of psychological attachment (social influence) (Davis, 1986; Davis et al., 1989). This limitation prevented the TAM from being applied to its full potential (Malhotra, 1999), seeing that social influence proved to be the main predictor of variances in perceptions of the intention to use computer technology (Venkatesh & Davis, 2000), and therefore needed to be resolved (Karahanna & Straub, 1998; Lee et al., 2003; Venkatesh & Davis, 2000; Venkatesh & Morris, 2003). Furthermore, by distinguishing between the three processes of commitment (compliance, identification and internalisation), it was evident that personal norms and values based on psychological attachment through internalisation of and identification with a management information system such as SAP ERP, performed a

significant role towards the sustained utilisation and exploitation thereof (Malhotra & Galletta, 2005).

In addition, technostress was found to lower employee efficiency and create dissonance in the work environment and consequently cost organisations time and money (Sanderlin, 2004). Rosen and Weil (1997) found technostress to manifest in three distinct ways amongst computer users, namely a) acceptance; b) hesitance; and c) resistance towards the system in question (Rosen & Weil, 2000). Therefore, technostress can, due to its link with both technology use and psychological stress (Ayyagari, 2007), affect a user's productivity level and cause dissonance in the workplace, resulting in loss of time and money for organisations (Sanderlin, 2004) and subsequently lowering the user's level of self-efficacy, leading to heightened anxiety levels (Brillhart, 2004; Doyle, Stamouli, & Huggard, 2005). Likewise, the findings of Gunson and de Blasis (2002) confirm that technostress also has a negative influence on the implementation, exploitation, and preservation of a management information system such as SAP ERP.

With the preceding discussion in mind, it made sense to employ the TAM as research platform to measure user adoption levels of a computer technology such as ERP, simultaneously considering the influences of both psychological attachment and technostress as external variables to this process.

- *Validation of the technology acceptance model (TAM) within a South African SAP ERP user environment.*

The second objective of this study was to empirically validate the technology acceptance model (TAM) within a South African SAP ERP user environment.

Results acquired through structural equation modelling confirmed that positive relationships exist among all the TAM constructs. Actual system use, which is the measurement for technology acceptance, was directly affected by behavioural intention to use the SAP ERP computer system, and indirectly by perceived usefulness. In turn, behavioural intention to use was directly affected by perceived usefulness, attitude toward using, and indirectly by perceived ease of use. Attitude toward using was directly affected by perceived ease of use and perceived usefulness. Perceived usefulness was directly affected by perceived ease of use.

Further, structural equation modelling rendered a best fit model which confirmed a positive statistically significant relationship path leading from perceived ease of use through perceived usefulness (explaining 26% of the variance); and behavioural intention to use (76% of the variance explained) to actual system use (38% of the variance explained). This finding is consistent with findings reported by Amoako-Gyampah and Salam (2004), Averweg (2008), Chau and Hu (2002), Davis (1986), Davis et al. (1989), and Venkatesh and Davis (2000).

The significance of identifying this relationship path to system use is that organisations can focus on appropriate interventions prior to system upgrades and modifications, in order to secure the optimal use of their ERP system amongst existing users. Therefore, during such ERP renewal projects, change management endeavours could focus on influencing the user's perceptions regarding the ease of use together with usefulness of the adapted system. Subsequently, through emphasising the benefits of these adaptations, their intentions to use the modified system can positively be influenced and thereby secure successful implementation, exploitation and upkeep of the system in question.

- *The relationship between technology acceptance and psychological attachment*

The third objective of this study was to investigate the relationship between technology acceptance and psychological attachment within a South African SAP ERP user environment.

With the TAM as validation platform, the following relationships were reported between some TAM sub-dimensions and that of psychological attachment, namely internalisation, identification, and compliance.

First, internalisation, the behaviour performed because its content is consistent with the user's personal values (Kelman, 1958; Venkatesh & Davis, 2000), and based on the relevance of the issue, regardless of surveillance or recognition (Hsu & Lu, 2004; Kelman, 1958; Malhotra & Galletta, 2005; Venkatesh & Davis, 2000), had a direct positive effect on behavioural intention to use and an indirect effect on actual system use via behavioural intention to use. Therefore, internalisation directly and positively affected SAP ERP users' motivation, resulting in an indirect, long-lasting behavioural intention to use the system. Incorporating the direct effect identification has on internalisation, a logical commitment path emerges wherein

constant stimulation of user identification will sustain this spontaneous and long-lasting commitment to use SAP ERP. This finding was contrary to that of Karahanna and Straub (1999), who had found that social influence (psychological attachment) affected user perceived usefulness and perceived ease of use via the process of internalisation. This discrepancy could be attributed to the fact that Karahanna and Straub (1999) gathered data from e-mail users who did not need technical insight into the working of the system other than its usefulness and ease of use. SAP ERP users, on the other hand, are technically informed and make their decision to use the system based on their conviction about the all-inclusive value added by the system.

Second, identification, which occurs when a person adopts attitudes and behaviours to achieve a satisfying, self-defining relationship with another person or group (Kelman, 1958; Venkatesh & Davis, 2000), and is produced solely based on the prominence of the acquired relationship (Hsu & Lu, 2004; Sun & Zhang, 2006), had direct positive effects on internalisation, perceived usefulness, perceived ease of use, and actual system use. Indirect effects emerged between identification and a) behavioural intention to use via internalisation; and b) behavioural intention to use via perceived usefulness.

Identification also directly influenced actual use of the SAP ERP. Actual system use is an indication of how many times a person uses a technological system within a given time period (Averweg, 2008; Malhotra & Galletta, 1999; Venkatesh & Davis, 2000). In this relationship, actual system use was based on possible social rewards awarded in the form of relationships with important others and a likely favourable self-image and status. The danger of relying on this relationship of identification for actual system use is that, should the relationship and/or self-image weaken or terminate, so would actual use and upkeep of the system.

Identification directly influenced perceived usefulness, explaining 59% of the variance. Perceived usefulness signifies the degree to which a person believes that using a particular technology will enhance his or her job performance (Hsu & Lu, 2004). People tend to use or not use a technology to the extent they believe it will help them perform their job better. This belief is either positive or negative and is of fluctuating intensity (Alrafi, 1998; Davis, 1986). Furthermore, this finding corresponds with that made by Sun and Zhang (2006) during mandatory tasks and projects. However, Sun and Zhang (2006) report that although this relationship exists, it wears off over time and users tend to depend more on their own beliefs

through internalisation. Perceived usefulness in turn affects behavioural intention to use directly, through a personal sense of system worth in career advancement. This enhancement of behavioural intention to use assists with prolonging the actual use of the system.

In order to prolong the use of the system, an organisation should endeavour to focus on a user's behavioural intention to use. Behavioural intention is the measure of the strength of a user's intention to use the ERP system (Fishbein & Ajzen, 1975; Malhotra & Galletta, 1999). Identification indirectly affected behavioural intention to use (via internalisation and perceived usefulness), which subsequently leads to long-lasting use. Identification also affected perceived ease of use directly, which has a sustaining effect on perceived usefulness and in turn directly affected behavioural intention to use. Therefore, should an ERP system be installed, upgraded or refurbished, an organisation can achieve immediate short term system use through advancing and sustaining identification endeavours, which in turn will grow internalised commitment to natural/spontaneous use of the system.

Lastly, compliance occurs when the person predominantly produces a behaviour or act to obtain rewards or avoid punishments. Such induced behaviours are based neither on content of the behaviour nor on the prominence of relationships (Malhotra & Galletta, 2005), and is performed under surveillance of the influential person (Hsu & Lu, 2004; Kelman, 1958; Malhotra & Galletta, 1999, 2005; Venkatesh & Davis, 2000; Warshaw 1980). In this study, compliance had insignificant negative direct effects on all TAM constructs of which the most prominent was that on attitude toward using. With the non-significant relation between attitude toward using and behavioural intention to use, compliance appears not to contribute towards actual system use.

In summary, effective use of new and altered information technologies, such as SAP ERP, is likely to require more than mere compliance. A failure to develop psychological attachment among potential users may require the organisation to endure the increased costs associated with more sophisticated control systems and/or fading performance returns on accumulating information technology investments. Having users that share the values underlying effective use of SAP ERP can ensure that users act instinctively to utilise the system in an effective way. Given the on-going trend toward end user computing and greater role of users' self-determination in interacting with increasingly flexible technologies in remote and virtual environments (Malhotra & Galletta, 1999), the theory of psychological attachment (social

influences) seems to offer a rich understanding of user behaviour in the implementation and continuous use of a technology such as SAP ERP.

- *The relationship between technology acceptance and technostress*

The fourth objective of this study was to investigate the relationship between technology acceptance and technostress within a South African SAP ERP user environment.

Results acquired from structural equation modelling as to the effect of technostress (inability to cope with computer technology due to negative thoughts) on the TAM, confirmed that negative relationships exist between technostress and all the TAM constructs. This finding is consistent with that reported by Gunson and de Blasis (2002) that technostress has a negative effect on the implementation, exploitation, and preservation of a computer system such as ERP. This negative effect is attributed to technostress adversely influencing user productivity (Ayyagari, 2007; Sanderlin, 2004; Tarafdar et al., 2007), user self-efficacy and satisfaction with the computer system in question (Brillhart, 2004), and enhancing dissonance amongst users (Sanderlin, 2004), to mention a few. The previous mentioned researchers studied technostress among new users working on unfamiliar systems, prior to and during the implementation phase where the likelihood of technostress is higher due to the uncertainty of change. In contrast, this current study focused on participants who are mostly experienced users participating in the consolidation of several familiar systems on which they are well versed, and yet, levels of technostress are present. This can be attributed to the after-effect of the continuous updating and improving of familiar systems, such as SAP ERP.

The low estimates of the standardised path coefficients revealed that technostress had weak relationships with all the TAM sub-constructs and was, therefore, of lesser significance. Tarafdar et al. (2010) and Doyle et al. (2005) reported significant negative path coefficients of -0.41 to -0.74 and -0.26 to -0.73, respectively. This discrepancy can be explained by the fact that users participating in this study were mostly proficient around SAP ERP, and therefore, experienced low levels of technostress. Furthermore, aspects such as effective training, clear deadlines, effective teamwork, recurrent performance evaluations, job security, career development and realistic job load are all antidotes for technostress (Sethi et al., 2004), and could be assumed as the reason for low technostress reported in this study. However, from an

organisational perspective, one should be aware that technostress could surface should the user-system relationship be altered due to system-, job- or employee relation issues.

Results from this study revealed that the most probable entry point of technostress on the progression of technology acceptance would be at perceived ease of use and perceived usefulness. This finding is congruent with that made by Amoako-Gyampah and Salam (2004), Lucas and Spitler (1996), and Malhotra and Galletta (2005), who identified the entry point of external variables to be at perceived ease of use and perceived usefulness. The implication of this finding for organisations is that, should one wish to decrease the level of technostress amongst SAP ERP users, change management should be deployed, focusing on enhancing these two areas.

This study contributes to psychology as science by validating the technology acceptance model (TAM) within a recent and complex South African ERP user environment. From this validation, the predictive ability of the TAM towards future user acceptance of the SAP ERP system is identified in terms of a prognostic path commencing at perceived ease of use through perceived usefulness and behavioural intention to use, concluding in actual system use, which is the measure for system use. These outcomes allow for an understanding of the change management and training interventions required prior to and during SAP ERP system renewal and upgrades, as well as preparing prospective users to secure optimal usage.

A further contribution is made by extending the TAM to allow for psychological attachment. By doing so, user commitment towards using the SAP ERP system can be related as to its longevity, whether it is insincere and temporary or whether it is a long-lasting change, manifested in behaviour which is integrated with a person's value system. This is done by determining whether system use is prompted by compliance, identification or internalisation. Furthermore, this study identifies psychological attachment's most likely points of influence during the technological acceptance process as portrayed by the TAM. This information again allows for an understanding of the change management and training interventions required prior to and during SAP ERP system renewal and upgrades, in order to ensure continuous optimal use of the system.

Additionally, this study also contributes by extending the TAM to allow for technostress. In doing so, user coping levels, whilst using the SAP ERP system, can be related to the intensity

of his/her negative computer thoughts about the use of the SAP ERP system. Furthermore, this study identifies technostress's most likely points of influence during the technological acceptance process as portrayed by the TAM. This knowledge again allows for an understanding of the change management and training interventions required prior to and during SAP ERP system renewal and upgrades. This may enhance user coping strategies and ensure continuous optimal use of the system.

Finally, all the above mentioned contributions pave the way for further research within a variety of research environments, while using this study as premise of departure.

6.2 LIMITATIONS

This study had several limitations. First, the sample size was limited, specifically with regard to the distribution of cultural groups, age generations, and gender. This limitation could be ratified by a stratified random sampling approach of larger samples in securing adequate representation in each of these categories.

Second, the measurement of this model's variables was solely based upon self-reports. According to Spector (2006), the exclusive use of self-report measures increases the likelihood that at least part of the shared variance between measures can be attributed to method variance.

Third, the study population was very homogeneous, since from a sample of 241 respondents, 64.7% were male, and 75.5% white. South Africa's multicultural society demands studying the constructs of technology acceptance from different cultural group perspectives, by ensuring construct equivalence and the absence of item bias for all these groups. Stratified random sampling might amend this inadequacy.

Fourth, the datedness of the measuring instruments was a constraint. The technology acceptance questionnaire (TAM) was compiled and validated by Davis (1986) and refined in 1989 (Davis, 1989); the psychological attachment questionnaire (PAQ) was compiled and validated by Malhotra and Galletta (1999); and the Technostress computer thought survey (CTS) was compiled and validated by Rosen and Weil (1992). The validation of all three instruments was done against single dimensional systems of the day. Compared to a multi-

dimensional system such as SAP ERP which is real time and fully integrated, these systems prove to be outmoded. The limitation, therefore, rests within the inadequacy of the said single dimensional measuring instruments to accurately measure a complex system, such as SAP ERP. The development of more recent and more relevant instruments is called for.

6.3 RECOMMENDATIONS

6.3.1 Recommendations to Solve the Research Problems

In order for modern businesses to compete and succeed in the business world, they are bound to adopt new dynamic computer technologies such as SAP ERP. Consequently, progressively more jobs require computer skills, whilst at the same time users are expected to cope with a continued infusion of new technologies, devices, and applications. Ineffective interactions with such technologies can result in frustration on the part of the user and can lead to further unfavourable encounters with computer-related technology, jeopardising business success. Therefore, the following three relevant recommendations are made to counteract such compromising user behaviour.

Firstly, resulting from the technology acceptance outcomes of this study, it is recommended that in order to secure acceptance of the SAP ERP system, organisations should, prior to a system implementation or upgrade, allow users practical exposure to the new or altered system in order to build a positive perception about the impending changes. This can be done by persuading users that the new or adapted system can be used effortlessly. In doing so, this positive perception of ease of use reinforces the user's perception of usefulness of the pending modifications, that is, believing the new or altered technology will improve his or her work performance. This in turn promotes higher intentions to use the system which inevitably leads to actual system use. On a practical level, user perceptions can be influenced through participatory system demonstrations, inviting users to contribute their system prerequisites, actively participate in system deployment and rewarding the identification of system customisation opportunities, to mention a few. The user's perceived usefulness, in turn, predicts his/her behavioural intention to use the system which finally culminates in actual system use enabling a competitive advantage over rival organisations and allows return on investment for an organisation.

Secondly, considering the psychological attachment findings of the current study, it is further recommended that organisations pay specific attention to ascertain the commitment level of users prior to system migration and upgrades. The level of commitment of a user can be insincere and temporary (compliance), long-lasting (identification), or ultimately integrated into the person's value system (internalisation). To secure long-lasting spontaneous use, users should ideally be migrated from compliance-commitment through identification into having internalised the system requirements and advantages into their value structure; subsequently securing system use via behavioural intention to use. In addition to this, although identification promotes internalisation, it also promotes perceived usefulness which consequently also leads to actual system use via behavioural intention to use. Practically, user commitment can be influenced through participatory system demonstrations, inviting users to contribute their system prerequisites, active participation in system deployment and most importantly, allow for honest user feedback in a safe environment free of consequential victimisation and intimidation discernments.

Finally, from a technostress perspective, organisations are encouraged to consider determining system user levels of technostress prior to, as well as during and after implementing a new system or revamping an existing one. The more a user struggles in coping with the new system and/or functionalities; the higher his/her level of technostress. The higher the technostress, the more negative self-talk develops that leads to negative thoughts about the system and consequently inhibits perceived ease of use and perceived usefulness thereof; decreasing actual system use via behavioural intention to use. Determining technostress is a longitudinal initiative which needs to be deployed on an individual level prior to, during and well after implementing a new or altered system. Although all users need to be monitored, special attention should be paid to new system users especially in the first year of system use,

In summary, it is vitally important for an organisation to ensure that system users first accept the system in question; secondly, commit to using it; and finally, be able to cope while using it in order to secure a return on investment, ensuring competitiveness and success in the business arena.

6.3.2 Recommendations for Future Research

Based on the findings of this study, it is recommended that future studies include larger sample sizes obtained from stratified random sampling in multiple SAP ERP using organisations, to secure adequate representation in all sample categories, in order to prevent a homogeneous sample model. This will ensure a more realistic representation of cultural groups, age generations, gender, educational levels, ERP system exposure, work domain and employee status; allowing for more consistent comparative research outcomes.

Furthermore, future studies should also follow a longitudinal design where causal inferences can be made prior to SAP ERP system upgrades or functional enhancements. This will enable an understanding of the motivational impact such changes have on end users. Knowing the motivational status of users, whether positive or negative, will enable insight into the premise of departure and content of intended change management interventions, whether to a) reassure; or whether to b) persuade SAP ERP users. Should the motivational status be found to be positive, change management interventions should focus on the enhancement of user perceptions (perceived ease of use and perceived usefulness) regarding system use, together with on-going user support. However, should the motivational status be found to be negative, intended change management interventions should first ascertain whether it is a) due to adaptation issues; or whether it is due to b) personal coping issues. In the event of it being due to system adaptation issues (psychological attachment), interventions should be geared to migrate users from compliance, through identification to internalisation of the system advantages and benefits, and in so doing, instil spontaneous use. In the event of it being due to personal coping issues (technostress), interventions should concentrate on appropriate education, training, coaching, and guidance initiatives to build user confidence towards using the system.

It is also proposed that the insignificant role fulfilled by attitude toward using in the process of technology acceptance, as deployed in this study, be investigated to determine whether it is due to intersection of its content within perceived usefulness and/or perceived ease of use, or whether it is due to the technical expertise of the sample population. Subsequently, the feasibility should be determined whether the TAM ought to be adapted by merging the items of attitude toward using with that of perceived usefulness and/or perceived ease of use or omitting attitude toward using as construct.

Finally, it is recommended that, instead of a three-stage approach, this study be repeated as a single stage research allowing for the simultaneous interaction between technology acceptance, psychological attachment and technostress. This will allow for not only determining the autonomous effects of psychological attachment and technostress on technology acceptance, but also their interaction with one another. From the results rendered by such a study, it can be determined whether technostress has an effect on psychological attachment and vice versa. This will allow for more relevant change management interventions.

It is recommended that future studies within South Africa be done using other relevant external variables as suggested by previous researchers, namely project communication (Somers & Nelson, 2004), senior management support (Al-Mashari, Al-Mudimigh, & Zairi, 2003), ethnic differences (Yusuf, Gunasekaran, & Abthorpe, 2004), effective systemintegration (Al-Mashari et al., 2003), and system training (Amoako-Gyampah & Salam, 2004). This will allow for more relevant and effective change management interventions, and in so doing, secure system use leading to an organisation obtaining a competitive edge over its rivals.

It is furthermore proposed that future research consider including the generational theory categories in the sample population to determine the aptitude and consequent acceptance of new IT technologies. This will enable corporate leadership to successfully interact with each generation during system changes and enhancements, and in so doing, ensure higher levels of acceptance which could secure system benefits, such as competitiveness, return on investment, and establishing a reliable brand.

Lastly, it is recommended that future research be done to determine the reverse effect, if any, of the TAM constructs of perceived usefulness and perceived ease of use on psychological attachment constructs. It is further proposed that the insignificance of attitude toward using be investigated to confirm whether it is due to duplication of its content in perceived usefulness and/or perceived ease of use, or whether it is due to the technical expertise of the sample population.

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