The effects of individual, organizational and environmental factors on the adoptions of e-commerce by SMEs in the Netherlands

An examination of factors influencing managerial beliefs, attitudes and the use of an e-commerce system using the technology acceptance model.

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Abstract

Since the 1990s the use of the Internet and electronic commerce (e-commerce) has exploded, yet few SMEs seem to benefit from its potential. The lack of personal involvement and low level of use are an indication that managers still have not committed themselves to e-commerce. Consequently they are not reaping the full benefits first hand.

The objectives of the study are to identify key factors and relationships likely to influence e-commerce use by SME managers in the Netherlands and to investigate whether relevant and significant factors can be combined in a new model to predict how SME managers will use new technology.

To achieve these objectives, a well-established model of IT usage behaviour, the Technology Acceptance Model (TAM), was used. Building upon TAM, a theoretical research model was developed to investigate a large number of external variables that are possible antecedents of managerial beliefs, attitudes, and the use of IT. E-commerce systems were chosen as the IT tool under review. A cross-sectional field survey was conducted to investigate the theoretical research model. The results are based on the analysis of questionnaire data from 114 managers from Dutch SMEs. Using Structural Equation Modelling (SEM) the results show significant support for external variables, mostly of an individual nature, in the categories of demographics, managerial and IT knowledge, individual characteristics, and company characteristics. Contrary to expectations, two categories - social factors and environmental characteristics - had few or no variables with a significant relationship.

This study further presents empirical evidence to suggest a limited number of antecedents under managerial control influencing beliefs, attitudes, and use. A better understanding of the various factors that may impede or increase effective utilization of IT can facilitate the design of organizational or managerial interventions that address these issues.

Building on the core TAM model a new model, the e-Tam Model, has been developed based on the results of the theoretical research model. In this model, it is hypothesized that IT usage is directly and indirectly influenced by seven external variables divided into three categories: demographics, personality, and company characteristics.

Using the e-Tam Model, effective and increased use of managerial IT tools can be promoted. This will enable managers to have a better use of e-commerce systems leading in turn to better margins and opportunities.

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1 Introduction and overview of the study

1.1 Introduction

Electronic commerce (e-commerce) emerged in 1970s. The use of electronic data interchange (EDI) at the beginning of the 1980s boosted the development of electronic business (e-business) greatly. Until the mid-1990s, some countries such as the U.S.A. and Canada, took the lead in developing e-commerce. Into the 21st century, e-commerce still developed very fast, and a lot of enterprises in western developed countries have been successful in this area.

In their latest available report of the United States Census Bureau, business-to-business (B2B) e-commerce in the United States amounted to $ 9,059 billion in 2004, 93.3 % of all e-commerce in the United States (US Census Bureau, 2006). The Gartner Group estimated that by 2008 all types of e-commerce transactions will exceed US $ 13.5 trillion, 90% of which will be B2B transactions. (McCall, 2004).

Similarly, Jupiter research estimated that the combination of B2B and B2C e-commerce transactions will surpass US $ 12 trillion by 2007.(Grover and Teng, 2003)

The Forrester Company predicted that in the coming five years, the number of Europeans shopping online will grow from 100 million to 174 million. Their average yearly net retail spending will grow from around € 1,000 to € 1,500 as UK Net consumers outspend even their US counterparts online. Overall, this will cause European eCommerce to surge to €263 billion in 2011 with travel, clothes, groceries, and consumer electronics all above the €10 billion per year mark. (Favier and Bouquet, 2006).

Clearly, the Internet and e-commerce has grown at a remarkable pace since the emergence of the World Wide Web in the early 1990s. The positive impact of the Internet

on commercial organizations has been addressed in many studies (Avlonitis and Karayanni, 2000, Chan and Swatman, 2000, Wilson-Jeanselme and Reynolds, 2005, Park et al., 2004). Development in the e-commerce arena in recent years has resulted in various applications. According to Kalakota et al. (2000), there are four types of e-commerce applications:

1. Business-to-Business. An example in the Business-to-Business category would be a company that uses the Internet for ordering from its suppliers, receiving invoices, and making payments.
2. Business-to-Customer. The Business to Customer category largely equates to electronic retailing. This category has expanded greatly with the advent of the World Wide Web. There are now shopping malls all over the Internet offering a variety of consumer goods.
3. Business-to-Administration. The Business-Administration category covers all transactions between companies and government organizations. Currently, this category is still at an early development stage. Administrations may also offer the option of electronic interchange for such transaction as VAT returns and the payment of corporate taxes.
4. Consumer-to-Administration. The Consumer-Administration category is emerging slowly. However, in the work of growth of both Business-consumer and Business-Administration categories, governments are extending electronic interaction to such areas as welfare payments and self-assessed tax returns.

It is extremely tempting to study all these types of Internet applications, nevertheless this study focuses on business-to-business aspects of e-commerce because it is generally

accepted that Business-to-Business accounts for the largest Euro or dollar volume of e-commerce, with approximately 82% of the total e-commerce activities (Eurostat, 2006) and is the fastest growing and most rapidly evolving area of e-commerce. Business use of the Internet reaches a very high rate in the Netherlands with an Internet saturation point of 92% of businesses connected (Eurostat, 2006). This puts the Netherlands at the top of the European countries only to be surpassed by Finland (92%) and Denmark (95%).

Although the term "electronic" is very broad and allows the consideration of technologies such as EDI, the Internet, and others (Overby and Min, 2001), some authors define e-commerce as the trade that actually takes place over the Internet, usually through a buyer visiting a seller's Web site and making a transaction there (Duffy and Dale, 2002). This research will only consider e-commerce that takes place over the Internet.

Since industrial and academic interest in business-to-business e-commerce is very new and still evolving, any definition of what is or is not included in e-commerce is bound to be controversial. The author goes along with the definition of Westland and Clark (2000, p.1): "Electronic Commerce – or e-commerce – is the automation of commercial transactions using computer and communication technologies." Rebstock (2001) uses a similar broad definition, which says that e-commerce summarizes all opportunities, which support commercial transactions with electronic technologies. To narrow the definition commercial refers only to activities that create transactions between firms (business-to-business or B2B), excluding transactions between firms and individuals (business-to-consumers). These transactions involve the exchange of money, goods, obligations, information or ideas.

Next to the business-to-business related e-commerce, the focus of this research is on small and medium size enterprises (SMEs) and their managers in the Netherlands. In the Netherlands, as well as in most other countries of the world, small and medium-sized companies (SMEs) represent the vast majority (99%) of all enterprises (OECD, 1998). The contribution of SMEs to economic growth, job creation and innovation has been widely recognised (Audretsch and Keilbach, 2004, Van Stel et al., 2005)

One of the key difficulties facing researchers is that there is no commonly held definition of what constitutes a small- or a medium-sized business (Gibb, 1993). The Commission of the European Communities (1992) counters this charge (in its accustomed manner) by compromise, by recognising the need for "flexibility" in defining SMEs. Depending on the aim of the policy at issue, the Commission claims it is possible to use different definitions. What matters is the goal of the measure: is the "right" group of businesses being identified for support? In line with this philosophy the author takes the view that any sensible definition may be used to characterise SMEs. Hence, if entrepreneurial traits or activities (Boyatzis, 1982, Gartner, 1989, Gibb, 1993) are displayed by senior management or managers (operating in any form of managerial structure) (Gibb, 1993, Goss and Jones, 1992), then, by implication, that firm may be deemed to be an SME, provided that it employs less than 500 people. The Commission of the European Communities (Eurostat, 2002) and the European Network for SME Research (Commission of the European Communities, 1994, European Commission, 2004) identify as per January 1st, 2005 the following groups:

- Micro: Nought to nine employees.
- Small: Ten to 99 employees.

- Medium: 100 to 499 employees.
- Large: 500 or more employees.

On this basis SMEs are those enterprises that employ between ten and 499 people. While this represents an SME class in its strictest sense, it is clear that micro-enterprises are also effectively SMEs. Throughout this piece, when using a size-oriented classification, SMEs refers to those enterprises with at least ten employees and up to 499. Enterprises employing fewer than ten people are referred to as micro-enterprises.

As stated before, SMEs contribute to economic growth, job creation and innovation. However, not all SMEs are successful and provide these benefits to society. Besides macro economic (economic climate) and firm-level characteristics (size, age, resource-based arguments), managerial behaviour is of fundamental importance in explaining a venture's long-term survival (Gimeno et al., 1997, Ciavarella et al., 2004, Aragón-Sanchez and Sánchez-Marín, 2005)

One of the significant functions of managers is decision-making, albeit not the only one (Mintzberg, 1983). Previous research (Finkelstein and Hambrick, 1996, Feltham et al., 2005, Van Gils, 2005) shows that also in Dutch SMEs the manager is the main decision maker. Formulating the company's strategy, selecting new managers and taking expansion decisions are some of his main tasks. As such the manager will be involved in the selection and implementation of an e-commerce system within the organisation. Although an extensive body of literature (Bajwa et al., 1998b, Bergeron et al., 1995, Kelly Rainer and Watson, 1995a, Leidner and Elam, 1995, Seely and Targett, 1997, Walstrom and Wilson, 2004) is available which looks at the factors to successfully implement an information system and the managerial roles required no commonly accepted framework exists. Most

studies reported various factors for a successful introduction and even adoption, but to my knowledge, little empirical research focused exclusively on SME managers has been conducted on the factors influencing managerial beliefs, attitude and the use of an e-commerce system.

For SMEs and their managers, the Internet has much to offer as a business vehicle since it can serve as a relatively efficient and effective channel for information provision and exchange, advertising, marketing, completing transactions, and in some cases facilitating or directly supporting the distribution of goods and services to global trading partners and customers (Jeffcoate et al., 2002). However, it is argued that SMEs do not always seem to appreciate that ignoring e-commerce because the current level of transactions is relatively low and few short-term benefits are being derived (Poon and Swatman, 1999). This puts them at risk of becoming uncompetitive in the medium and long-term, and hence of failing in the future (Gattiker et al., 2003), perhaps succumbing to more aware and aggressive international operators. Combined with reported feelings that SME managers often lack the requisite technological knowledge and skills (Albrecht et al., 2005), are unsure of whether their businesses are suited to e-commerce, and are fearful of alienating vital intermediaries, and so on, this lack of achievement of substantial benefits in the short-term does not act as much of a motivator for SME managers. But what does?

1.2 Research problem

In a literature review conducted by Wareham et al. (2005), 582 articles about e-commerce in both academic and professional journals were analysed. Of the 582 articles 10% (58) were directly concerned with adoption of technology. These studies tend to focus

on the diffusion and adoption practices of enterprises in specific regions of the world, as well as experimental evaluation of technology adoption models. (Lefebvre et al., 2005, MacGregor and Vrazalic, 2005, Simpson and Docherty, 2004, Lawson et al., 2003, Taylor and Murphy 2004, Kaynak et al., 2005, Mendo and Fitzgerald, 2005, Grandon and Pearson, 2004, Grandon and Pearson, 2003, Mehrtens et al., 2001, Riemenschneider et al., 2003, Thatcher et al., 2006). However, despite an emerging interest of Information Systems (IS) acceptance, there is only a limited and fragmented understanding of the forces that influence its use or the factors that determine an individual's resistance to e-commerce.

This study focuses on an examination of the factors that can influence the acceptance and actual use of e-commerce by SME managers in the Netherlands. Different models have been used over the last ten to twenty years as a basis for investigating the acceptance and use of IS. The most salient models include the Innovation Diffusion Theory (Moore and Benbasat, 1991, Rogers, 1995), the Theory of Reasoned Action (Ajzen, 1991, Ajzen and Fishbein, 1980) and the Technology Action Model (Davis, 1989, Davis et al., 1989). Of these models, the Technology Acceptance Model (TAM) has emerged as a powerful model, a more detailed explanation will be presented in Chapter 2.. The goal of TAM is to provide an explanation of general determinants of computer acceptance that would help explain user behaviour across a broad range of end-user computing technologies and user populations (Davis et al., 1989). The model was originally developed to predict and explain future user behaviour based on simple measures taken after a very brief period of interaction with a system. Subsequent research has used and extended the model for various situations, both when introducing new information technologies as well as when explaining the use of IS that has already been implemented. TAM is illustrated in Figure 1-1.

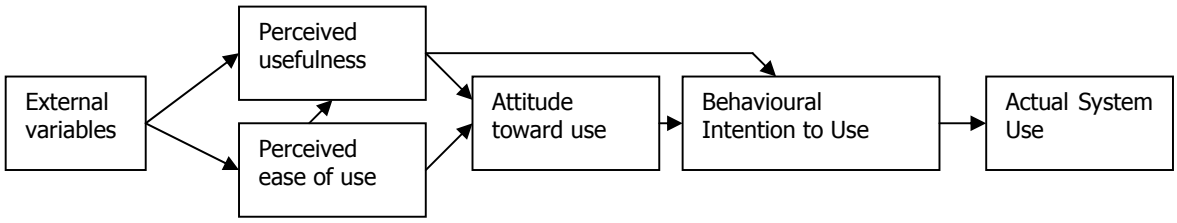

Figure 1-1 Technology Acceptance Model (Davis, 1989 p.985)

A detailed description of all elements of TAM is presented in Chapter 2. This study is above all interested in the external variables that are important antecedents of user perceptions in TAM. Neither Davis et al. (1989) nor Davis (1989) fully investigated the external factors in their model. They made a few suggestions for future research as to what variables provide the bridge between internal beliefs, attitudes and intentions represented in TAM and the various individual differences, situational constraints and managerially controllable interventions impinging on behaviour. In a later study, Davis (1993) specifically stated that "future research should consider the role of additional [external] variables within TAM" (p. 484).

As mentioned above actual use of IS by SME managers is still very low. If usage is to improve, first and foremost the variables actually influencing the formation of beliefs in technology acceptance must be identified. Very little research to date has looked at these external variables for their influence on usage behaviour as mediated by the belief and attitude constructs. As Agarwal and Prasad (1998a) purport, external variables are the only channels for influencing behaviour as the intermediate and dependent variables in TAM are hypothesized to be an internal psychological process

1.3 Research questions

The objective of the study is to identify key factors and relationships that are likely to influence the use of IS by SME managers. For this purpose, IS is restricted to the use of e-

commerce. This study is aimed at providing a scientific contribution to the following practical research questions:

1. What are the major factors that influence SME managers' use of IS, and in particular an e-commerce system?
2. Which of these factors influence the actual use of an e-commerce system, either directly or indirectly through user beliefs and attitude?
3. Is there a parsimonious model to predict SME managers' use of an e-commerce system?

To answer these questions, the research builds on an existing model. The study has a number of objectives, related to these questions: First, to examine a number of key factors and relationships between external variables, individuals' perceptions as well as attitudes towards e-commerce, and the way in which these perceptions and attitudes can affect actual use. Second, to combine these factors in theoretical models to assess if these relevant variables and relationships are significantly correlated. The rationale for a number of theoretical models is the investigation of direct as well as indirect relationships between the external variables and the beliefs, attitude, and use constructs. Third, to investigate whether relevant and significant factors can be combined in a new model to predict how SME managers will use a new technology. Furthermore, the model should help to identify what interventions are required to increase the use of an e-commerce system.

Effective and increased use of an e-commerce system will give managers a more competitive edge, leading in turn to increases in sales and margins. Nonetheless, it is

evident that greater readiness on the part of the manager to use e-commerce systems and the increasingly competitive nature of today's business environment provides strong support for this research.

While the term *manager* is ambiguous as described in the literature, for the purpose of this study a manager is defined as 'an person who is concerned with the strategic directions of their organization's business' (Seely and Targett, 1999) and:

- Is in a position to influence significantly the strategic decision-making processes for the organization;
- Has substantial control and authority over how resources are deployed;
- Is in a position to influence the strategic direction of the business of their organization;
- May have other (lower ranked) managers reporting to him or her.

Based on this definition it is clear that managerial influence in the organisation can encourage (or discourage) acceptance explicitly through expressed preferences and/or mandates (Moore and Benbasat, 1991). Thus studies that examine acceptance at the level of the organization need to account for the potential importance of managerial influence.

1.4 Importance of the study

No previous study has targeted the combination of SME managers in the Netherlands, e-commerce, factors influencing IS use, and the application of a robust theoretical model. Few studies (McFarland and Hamilton, 2006, Igbaria et al., 1997b, Venkatesh and Brown, 2001, Venkatesh and Morris, 2000, Legris et al., 2003), which uses the Technology Acceptance Model, specifically addresses external variables. Igbaria et al. demonstrate the utility of investigating external factors to belief variables. However, only five external

variables were used. Even so, the authors acknowledged their model should be expanded to include other variables such as organizational size, age, peer support, social pressure, availability, and accessibility. Most of these factors and many more will be used in this study.

This research is grounded in a well-established theory, the Technology Acceptance Model. Furthermore, the study uses a heterogeneous sample of companies that can be expected to have ample experience with e-commerce. Also, it uses real live subjects, managers in real-world settings, instead of student populations.

One of the objectives of the study is to develop a parsimonious model that can explain and predict how individual managers use e-commerce by examining the potential antecedents to user perceptions of technology. Although there is now a substantial body of evidence suggesting that user perceptions are indeed important determinants of system use, there is considerably less work done in the area of examining what influences user perceptions in the first place, or more importantly, how user perceptions can be proactively influenced so as to encourage system use (Agarwal et al., 1996). A better understanding of the determinants of perceived usefulness, perceived ease of use, attitude, and use would enable us to design organizational interventions that would increase user acceptance and usage of new and existing systems. As a result SME managers will have a better understanding of why SMEs use e-commerce.

1.5 Key assumptions

This study is aimed at providing theoretical and practical explanations to the research questions, yet it has to be recognized that a number of key assumptions exist. First, the broad concept of use can be divided into voluntary, discretionary, and mandatory use.

Discretionary use is distinguished from voluntary use in that there are no defined tasks that require completion. Indeed managers could choose not to perform the task altogether. It is assumed that use of e-commerce is discretionary. Delone and Mclean (1992, 2003) posit that use only makes sense for voluntary or discretionary users as opposed to captive (mandatory) users.

Second, the tool under investigation is a system used by the organisation, not just by the SME manager. The question arises as to whether findings generally apply to other IT-tools and other managerial levels like Marketing, HRM, Finance and middle management. The variety of tasks and responsibilities a SME manager carries out make it hard to make definitive statements on this issue. However, given the investigation is aimed at the behaviour of the SME manager and is used to ensure full and informed responses this is a reasonable assumption to make. The take-up of technology by senior management could, however, reasonably be viewed as likely subsequent adoption by the organisation. Leidner and Elam (1992, 2003) argue that successful use is followed by individual and organizational impact; that is the effect of information on the behaviour of the SME manager and consequently on organizational performance. Chapter 7 specifically addresses these issues, although some issues are left to future research.

Third, it is possible that important variables may be missing from current research on user acceptance using Technology Acceptance Models. Yet in my study the goal is not to identify every single possible variable that might affect e-commerce usage, either directly or indirectly, but rather to determine those factors that can be combined in a comprehensive instrument that can explain and predict e-commerce usage by SME managers. Therefore,

the literature review focuses on those studies that identify and suggests relevant factors in the e-commerce acceptance and usage process.

Fourth and finally, the selection of the level of analysis appropriate to investigate the phenomenon can be at either the individual or organizational level. Acceptance and use of e-commerce is studied at the individual level, because the focus in this research is on the SME manager. Although use is measured at an individual level, e-commerce systems use may have organizational consequences and consequently affect the organizational structure.

Moreover, as Leidner and Elam (1995) argue when focusing on information systems (IS) measuring at the organizational level is not particularly meaningful for two major reasons. First, as IS target individuals in the middle and upper management ranks, it can be concluded that there are usually only a small number of potential users in any give organisation. Second, IS are a new technology and its use has not become institutionalized in many organizations. To summarize, the individual SME manager will be the unit of analysis. This senior manager was defined making or affecting the structure of an organization. Thus, although use is measured at an individual level, IS use may have organizational consequences and consequently affect the organizational structure and decision-making process.

1.6 Outline

In this chapter the general nature of the problem and research objectives for the study were presented. Chapter 2 provides the main general theoretical models and the background of the Technology Acceptance Model. In Chapter 3 the research model for SME managers usage of e-commerce systems is presented. Chapter 4 describes the research methodology used to test the research model and the underlying hypothesis as described in Chapter 3.

Chapter 5 presents the findings of the study, including the specific statistical procedures that were used to test each hypothesis. Is there a parsimonious model to predict SME managers' use of e-commerce? This is discussed in Chapter 6. The final Chapter 7 presents an overview of the results of this study and the theoretical and practical contributions and limitations. Finally, some suggestions for future research are presented.

Chapter	Title	Contents
1	Introduction and overview of the study	Research problem and research objectives
2	Theoretical background	Relevant literature review and introduction of the Technology Acceptance Model
3	Research model	Theoretical research model and research hypotheses
4	Research methodology	Research design and research methodology
5	Research results	Statistical analyses and research results
6	The e-Tam model	Presentation of the e-Tam model
7	Summary, limitations and future research	Conclusions, contributions, limitations and suggestions for future research

Table 1-1 Overview chapters

1.7 Chapter summary

This chapter has outlined the structure of the research. It introduced the background of the study and presented the research problem and objectives. The research was then justified, the research process explained and the thesis chapters outlined. On these foundations, the report can proceed with a detailed review of the Technology Acceptance Model.

2 Theoretical background

2.1 Introduction

A variety of factors can affect users' acceptance of an information system. Of these factors users' perceptions and expectations of the system are said to be the key factors that influence their acceptance. This is because it is users' perceptions and expectations of a system that mediate the process by which a system is defined within an organisation; and it is that definition of the system that often decides users' attitudes towards acceptance or rejection and their use of the system (Venkatesh et al., 2003, Davis et al., 1989, Venkatesh and Davis, 2000, Orlikowski, 2000).

A range of conceptual frameworks exist for studying the factors that contribute to the formation of user perceptions and expectations of an information system (Venkatesh et al., 2003). Four frameworks are reviewed here: innovation diffusion theory, theory of reasoned action, theory of planned behaviour and the technology acceptance model.

Innovation diffusion theory

Perhaps the principal theoretical perspective on technology acceptance is innovation diffusion theory, which has been applied at both the individual (Rogers, 1995) and organizational (Zaltman and Stiff, 1973) levels of analysis. Its primary intention is to provide an account of the manner in which any technological innovation moves from the stage of invention to widespread use (or not). Although not concerned with information technology exclusively, diffusion theory offers a conceptual framework for discussing acceptance at a global level.

Diffusion theory posits five characteristics of innovations that affect their diffusion: relative advantage (the extent to which a technology offers improvements over currently available tools), compatibility (its consistency with social practices and norms among its users), complexity (its ease of use or learning), trialability (the opportunity to try an innovation before committing to use it), and high observability (the extent to which the technology's outputs and its gains are clear to see). Each of these characteristics on its own is insufficient to predict either the extent or the rate of diffusion, but diffusion studies have demonstrated that innovations affording advantages, compatibility with existing practices and beliefs, low complexity, potential trialability, and observability, will be more extensively and rapidly diffused than an innovation with a cluster of opposite characteristics (Rogers, 1995). An early meta-analysis of the innovation diffusion literature found that three of these characteristics had the greatest influence on adoption: compatibility and relative advantage were positively related to innovation adoption ($p < .05$), while complexity was negatively related to adoption at marginally significant ($p < .062$) levels (Tornatzky and Klein, 1982). However, the authors criticized the then-current conceptualizations of these constructs. Relative advantage, in particular, was cited as especially ambiguous because the criteria used to judge what is "advantageous" are often not defined (e.g., an innovation could be advantageous because it costs less or is less complex).

In examining and extending these characteristics in a context specific to information technology (IT), Moore and Benbasat (1991) report an extensive effort to develop an instrument which can be used to evaluate user perceptions of IT innovations. Their results suggest that the most important perceived characteristics of an IT innovation which affect decisions regarding its use are: voluntariness of use, image ("the degree to which use of an

innovation is perceived to enhance one's image or status in one's social system," p. 195), relative advantage, compatibility, ease of use, trialability, result demonstrability, and visibility. These results lend at least partial support to Rogers' factors, but add an important emphasis on variables related to discretion and ease of use.

Innovation diffusion theory suggests that factors at the level of the individual user are also important. Rogers divides technology or innovation adopters into five categories, depending on their speed of uptake: innovators, early adopters, early majority, late majority, and laggards. Such distinctions could be seen as somewhat unclear, not least because any distribution over time is difficult to sustain over time. However, Rogers plots these categories over a normal distribution where each major category (innovators and early adopters are combined into one for this purpose) represents a standard deviation of dispersion. Accordingly, the division between early and late majority is the mean, with laggards and late adopters constituting 50% of the population. On this basis, Rogers estimates that early adopters and innovators jointly make up only 16% of the total population. Early adopters have disproportionate influence over the adoption of any technology, and profiling studies of these categories have revealed a number of personality (e.g., risk-taking, adventure seeking) and socioeconomic (e.g., wealth, education) variables that supposedly distinguish their members.

This approach seems to have direct relevance to studies of IT acceptance in organizations. Brancheau and Wetherbe (1990) showed that the cumulative adoption distribution of spreadsheet use closely follows a sigmoidal, S-shaped curve, as predicted by innovation diffusion theory. Thus, organizations evaluating technology for use in the organization must be cognizant of the user base for which the tool is both designed and purchased. For a

tool that will be used throughout the organization, it is reasonable to expect that a protracted period of time may be required before all users are "up to speed" on how to use the tool effectively. Understanding users who are likely to be "laggards" is important; intervention strategies (i.e., extended training) can be designed with those users in mind.

While diffusion theory provides a context in which one may examine the uptake and impact of information technology over time, it provides little explicit treatment of user acceptance. Its most direct link would appear to be in the area of innovation characteristics that may drive individual adoption decisions (i.e., the perceived complexity, compatibility, etc., of a particular IT) and innovation positioning (the planned marketing of a technology to a specific group or organization) (Rogers, 1995).

As researchers seek to identify the factors that determine user acceptance of any information technology and, in particular, factors that can be influenced by design, the question of acceptance has come to be tackled more directly by researchers working outside of (or at least on the outskirts of) the classical innovation diffusion tradition. Most noticeably, researchers in the fields of human-computer interaction and management information systems (MIS) have drawn heavily on theoretical work in social and cognitive psychology, as well as sociology, in studying user acceptance. For purposes of clarity, a distinction is drawn here between those theoretical approaches seeking to understand the social and psychological determinants of user acceptance at an individual level and those seeking to understand user acceptance in terms of the design and implementation process of new technology.

Theory of reasoned action

Fishbein and Ajzen's (1975) Theory of Reasoned Action (TRA) in the social psychology literature defines relationships between beliefs, attitudes, norms, intentions, and behaviours. According to this theory, an individual's behaviour (e.g., use or rejection of technology) is determined by one's intention to perform the behaviour, and this intention is influenced jointly by the individual's attitude and subjective norm, defined as "the person's perception that most people who are important to him (sic) think he should or should not perform the behaviour in question" (Fishbein and Ajzen, 1975 p. 302).

According to TRA, attitude toward a behaviour is determined by beliefs about the consequences of the behaviour and the affective evaluation of those consequences. Beliefs are defined as the individual's subjective probability that performing a given behaviour will result in a given consequence. Affective evaluation is "an implicit evaluative response to the consequence" (Fishbein and Ajzen, 1975 p. 29); thus the attitude construct in TRA is general in nature and is not anchored to any given belief set. This approach represents an information processing view of attitude formation and change which states that external stimuli influence attitudes only through changes in the person's belief structure (Fishbein and Ajzen, 1975).

However, attitude alone does not solely determine behavioural intentions. Intentions are determined also by subjective norms, which, in turn, are determined by an individual's normative beliefs and motivation to comply with perceived norms. The end result is a generalized model for understanding the determinants of human behaviour in situations where people may exert their choices. In their meta-analysis examining the application of

TRA, Sheppard et al. (1988) found that the theory performed extremely well in the prediction of choice among alternatives. They concluded that the theory was exceptionally robust and offered strong predictive utility, even when it was used to investigate situations and activities falling outside the original boundary conditions of the theory (such as predicting non-voluntary behaviour, or when intentions were assessed even before subjects had all the information necessary to form a completely confident intention).

The Technology Acceptance Model (TAM)

While TRA is a general model applicable to many areas, a number of MIS-specific models have been derived from TRA. Of these models, the most widely cited is Davis' (1989) Technology Acceptance Model (TAM). The goal of TAM is to predict information system acceptance and diagnose design problems before users have experience with a system. TAM predicts that user acceptance of any technology is determined by two factors: perceived usefulness and perceived ease of use.

Within TAM, perceived usefulness (U) is defined as the degree to which a user believes that using the system will enhance his or her performance. Perceived ease of use (EOU) is defined as the degree to which the user believes that using the system will be free from effort. Both U and EOU are specific perceptions and are anchored to specific beliefs users hold about the system. According to TAM, U and EOU have a significant impact on a user's attitude toward using the system (A), defined as feelings of favourableness or unfavourableness toward the system. (Thus, attitude is a general construct which is not tied to any specific beliefs about the technology.) Behavioural intentions to use the system (BI) are modelled as a function of A and U. BI then determines actual use. Research has

consistently shown that BI is the strongest predictor of actual use (Davis et al., 1989, Taylor and Todd, 1995)

There are several interesting differences between TAM and TRA. First, Davis et al. (1989) explicitly drop subjective norms from the model, arguing that the subjective norm construct is context-driven. They explain that while subjective norms may be important in some settings, in the empirical work validating TA, they were not found to be an important predictor of intentions. Davis et al (1989) also demonstrate that, because the technology studied was of a personal and individual nature (i.e. use of the technology was not dependent on others' use of the same technology), system usage was not likely to be driven by social influences.

Another important difference is that TAM proposes a direct path from perceived usefulness to intention, in contrast to TRA which shows attitude completely mediating the relationship between beliefs and intention. According to Davis et al (1989), in the work environment, intentions to use IT may be based on its anticipated impact on job performance, regardless of the individual's overall attitude toward that system. In other words, even though an employee may dislike a system, that employee may still use the system if it is perceived to increase job performance (thus, it has high perceived usefulness).

A final note of interest regarding TAM's divergence from TRA is the direct effect of EOU on U. In other words, when faced with two systems offering identical functionality, a user should find the easier one to be more useful. Davis et al. (1989) state that if a user becomes more productive via ease-of-use enhancements, then he or she should become more productive overall. The converse (that U influences EOU) does not hold, however. Thus,

from a theoretical perspective, perceived ease of use influences perceived usefulness, but not vice versa.

In their work validating TAM, Davis et al. (1989) found a stronger relationship between perceived usefulness (U) and intentions to use than perceived ease of use (EOU) and intentions. The relationship between EOU and intentions was largely mediated by U. In comparing TAM and TRA, Davis et al. (1989) found that TAM was a better predictor (based on the amount of variance explained, R2) of intentions to use a particular software package, reporting an R2 of .47 for Time 1 (immediately after the introduction of the software) and an R2 of .51 for Time 2 (14 weeks later). These figures were compared with .32 and .26 for TRA at Time 1 and Time 2, respectively. Davis (1993) reports similar results in looking at different technology and removing behavioural intentions from the model. TAM has been found to be extremely robust and has been replicated using different tasks (Mathieson, 1991, Adams et al., 1992). In a comparison of several models, Mathieson found that TAM predicted intention to use a spreadsheet package better than alternative models. In another comparison of theoretical models, Tayler and Todd (1996) found that TAM provided a good fit to data on the use of a computing resource centre, accounting for 34% of the variance in behaviour, 52% of the variance in intention, and 73% of the variance in attitude.

Theory of Planned Behaviour

While the Theory of Reasoned Action (TRA) has been the most widely used theory for examining user acceptance, other theoretical perspectives have also been used. The Theory of Planned Behaviour (TPB) is a descendant of TRA and adds a third antecedent of

intention, perceived behavioural control, to the TRA model. Perceived behavioural control is determined by the availability of skills, resources, and opportunities, as well as their perceived importance in achieving outcomes. Perceived behavioural control has been viewed to be close to Bandura's (1982) self-efficacy belief concept (Azjen, 1991).

TPB holds that attitudes, subjective norms, and perceived behavioural control are direct determinants of intentions, which in turn influence behaviour.

In attempting to apply TPB (which, like TRA, is a generalized model), a Decomposed Theory of Planned Behaviour (Taylor and Todd, 1995) has also been examined in the IS literature which attempts to identify and model the specific antecedents to attitude, subjective norm, and perceived behavioural control relevant to IT use. Taylor and Todd (1995) suggest perceived usefulness, perceived ease of use, and compatibility as antecedents of attitude (largely consistent with TAM). In addition, they suggest that peer influence and superiors' influence are antecedents of subjective norm. Finally, they model self-efficacy, resource-facilitating conditions, and technology-facilitating conditions as determinants of perceived behavioural control.

Innovation Diffusion Theory (IDT)	Core Constructs	Definitions
Grounded in sociology, IDT (Rogers 1995) has been used since the 1960s to study a variety of innovations, ranging from agricultural tools to organizational innovation (Tornatzky and Klein 1982). Within information systems, Moore and Benbasat (1991) adapted the characteristics of innovations presented in Rogers and refined a set of constructs that could be used to study individual technology acceptance. Moore and Benbasat (1996) found support for the predictive validity of these innovation characteristics (see also Agarwal and Prasad 1997, 1998; Karahanna et al. 1999; Plouffe et al. 2001).	Relative Advantage	"The degree to which an innovation is perceived as being better than its precursor" (Moore and Benbasat 1991, p. 195).
	Ease of Use	"The degree to which an innovation is perceived as being difficult to use" (Moore and Benbasat 1991, p. 195).
	Image	"The degree to which use of an innovation is perceived to enhance one's image or status in one's social system" (Moore and Benbasat 1991, p. 195).
	Visibility	The degree to which one can see others using the system in the organization (adapted from Moore and Benbasat 1991).
	Compatibility	"The degree to which an innovation is perceived as being consistent with the existing values, needs, and past experiences of potential adopters" (Moore and Benbasat 1991, p. 195).
	Results Demonstrability	"The tangibility of the results of using the innovation, including their observability and communicability" (Moore and Benbasat 1991, p. 203).
	Voluntariness of Use	"The degree to which use of the innovation is perceived as being voluntary, or of free will" (Moore and Benbasat 1991, p. 195).
Theory of Reasoned Action (TRA)	**Core Constructs**	**Definitions**
Drawn from social psychology, TRA is one of the most fundamental and influential theories of human behaviour. It has been used to predict a wide range of behaviours (see Sheppard et al. 1988 for a	Attitude Toward Behaviour	"An individual's positive or negative feelings (evaluative affect) about performing the target behaviour" (Fishbein and Ajzen 1975, p. 216).
	Subjective Norm	"The person's perception that most people who are important to him think he should or should not perform the behaviour in question"

review). Davis et al. (1989) applied TRA to individual acceptance of technology and found that the variance explained was largely consistent with studies that had employed TRA in the context of other behaviours		(Fishbein and Ajzen 1975, p. 302).
Technology Acceptance Model (TAM)	**Core Constructs**	**Definitions**
TAM is tailored to IS contexts, and was designed to predict information technology acceptance and usage on the job. Unlike TRA, the final conceptualization of TAM excludes the attitude construct in order to better explain intention parsimoniously. TAM2 extended TAM by including subjective norm as an additional predictor of intention in the case of mandatory settings (Venkatesh and Davis 2000). TAM has been widely applied to a diverse set of technologies and users.	Perceived Usefulness	"The degree to which a person believes that using a particular system would enhance his or her job performance" (Davis 1989, p. 320).
	Perceived Ease of Uses	"The degree to which a person believes that using a particular system would be free of effort" (Davis 1989, p. 320).
	Subjective Norm	Adapted from TRA/TPB. Included in TAM2 only.
Theory of Planned Behaviour (TPB)	**Core Constructs**	**Definitions**
TPB extended TRA by adding the construct of perceived behavioural control. In TPB, perceived behavioural control is theorized to be an additional determinant of intention and behaviour. Ajzen (1991) presented a review of several studies that successfully used TPB to predict intention and behaviour in a wide variety of settings. TPB has been successfully applied to the understanding of individual	Attitude Toward Behaviour	Adapted from TRA.
	Subjective Norm	Adapted from TRA.
	Perceived Behavioural Control	"The perceived ease or difficulty of performing the behaviour" (Ajzen 1991, p. 188). In the context of IS research, "perceptions of internal and external constraints on behaviour" (Taylor and Todd 1995b, p. 149).

acceptance and usage of many different technologies (Harrison et al. 1997; Mathieson 1991; Taylor and Todd 1995b). A related model is the Decomposed Theory of Planned Behaviour (DTPB). In terms of predicting intention, DTPB is identical to TPB. In contrast to TPB but similar to TAM, DTPB "decomposes" attitude, subjective norm, and perceived behavioural control into its the underlying belief structure within technology adoption contexts.		

Table 2-1 Models and Theories of Individual Acceptance

Summary

The question of user acceptance is of concern to all researchers and procurers who wish to predict which candidate technologies will prove most suitable for an organization and how a given design is likely to be received by users. As such, the issue draws on multiple theoretical perspectives and on research topics as diverse as change management in organizations, human attitude formation, systems analysis, user interface design, and technology diffusion.

Innovation diffusion theory provides a general framework within which the social impact of a technology can be modelled and, in so doing, it seeks to provide insights into the characteristics of those groups who will adopt a technology at different phases, or into characteristics inherent in the technology that may influence specific groups to adopt it. However, predicting how any one group or user will receive a new technology is not the

province of diffusion theory, and this question is better tackled within the specific decision-making framework provided by TAM.

While TRA is a general, well-researched intention model that has been applied extensively in predicting and explaining behaviour across many domains—"virtually any human behaviour" (Ajzen and Fishbein 1980, p.4) it is limited in dealing with behaviours over which people have incomplete volitional control. For this purpose, TPB adds a third antecedent of intention, perceived behavioural control, to the TRA model.

While not as extensively studied as TAM, the literature provides several tests of TPB. However, the results have been somewhat mixed. Mathiesion (1991) tested both TAM and TPB and found that, while TPB was predictive of user intention, it did not provide as complete an explanation of intention as TAM. In addition, Mathieson noted that TAM was easier to apply.

Taylor and Todd (1995) tested the decomposed version of TPB discussed above and found that TAM was a (slightly) better predictor of usage, but that the decomposed TPB model provided a more complete (albeit slight) understanding of the determinants of intention (R2 = .57 for TPB and .52 for TAM). The authors note that, in choosing between TAM and the decomposed TPB, the trade-off of moderate increases in explanatory power for intentions versus added complexity is a difficult one. The decomposed TPB adds seven more variables to increase the predictive power of behaviour by 2% over TAM. However, the decomposed TPB also helps researchers better understand the roles of subjective norms and perceived behavioural control, which are absent from TAM. Taylor and Todd conclude that if the goal is to predict IT usage, TAM may be better.

In this chapter, I will do a thorough review of the TAM model, its development, its extensions, its limitations and its component constructs, e.g. perceived usefulness--PU and perceived ease of use-PEOU.

In the following, I will review 44 relevant articles (see appendix A) published in the top 5 information systems research journals (Vessey et al., 2002), including. *Information Systems Research-ISR, Management of Information Systems Quarterly-MISQ, Decision Science-DS, Management Science-MS, and Journal of Management Information Systems-JMIS* from 1989 till 2006. Next to this I will provide an overview of TAM research as presented at international conferences from 2005 until 2007 shown in table 2-3.

The journal articles used PU as an internal belief to explore its role in end-users' behaviour towards information systems, and used TAM as the theoretical basis to find the causal links between (i) external variables and PEOU to PU, (ii) PU-A, (iii) PU-BI and (iv) PU's relationship with usage behaviour. Moore and Benbasat (1991) based on Rogers' (1983 and 1995) work on the diffusion of innovations, have proved that perception of the characteristics of an innovation (PCI) affect the end-user's adoption behaviour. Relative advantage is one of these PCI instruments that shares some similarity with PU. Thus, in this review, I include several articles that use relative advantage instead of PU to study its role in users' behaviour to IS. In appendix A, I list all these reviewed articles and present them in chronological order. I briefly overview their target IS applications, research context, subjects, research methods, PU and findings. The list is numbered in order to analyse them easily in the following discussion.

This chapter is organized in 5 sections. In the second section I will review the original work on TAM. The third section will explore its adoption, validation and

extensions. Section four will discuss some main limitations of TAM. A discussion follows with a conclusion in section five..

2.2 Technology Acceptance Model (TAM): An overview

TAM is an adaptation of the Theory of Reasoned Action (TRA), which was specifically introduced to explain computer usage behaviour. TAM uses TRA as a theoretical basis for identifying the strong causal links between two key beliefs-- (i) Perceived usefulness (PU) and (ii) Perceived ease of use (PEOU), and the user's attitude (A), behavioural intentions (BI) and actual computer adoption and usage behaviour. Therefore, TAM is a causal model that studies the covariance of these constructs to determine if there exists a causal relationship among them.

Generally, the goal of TAM is *"to provide an explanation of the determinants of computer acceptance that is, 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, p. 985)

According to TAM, BI is a major determinant of usage behaviour; behaviour can be predicted by measuring BI. BI is viewed as being jointly determined by the person's attitude toward using the system—A and PU. PU and PEOU have been hypothesised to have positive influences on A. PEOU influences attitudes and behaviour through two mechanisms: self-efficacy and instrumentality. This means the easier the system is to use, the greater will the user's efficacy be felt to be regarding his or her capacity to use the system. To the extent that increased PEOU leads to improved performance, PEOU will have a direct influence on PU. External variables represented in TAM provide the bridge between the internal beliefs (PU and PEOU), attitude (A) and behavioural intentions (BI)

and various individual differences, situational constraints, organisational characteristics and system characteristics etc. which impact on behaviour. Just as Davis (1989, p985) demonstrated: *"A key purpose of TAM is to provide a basis for tracing the impact of external factors on internal beliefs, attitudes, and intentions."*

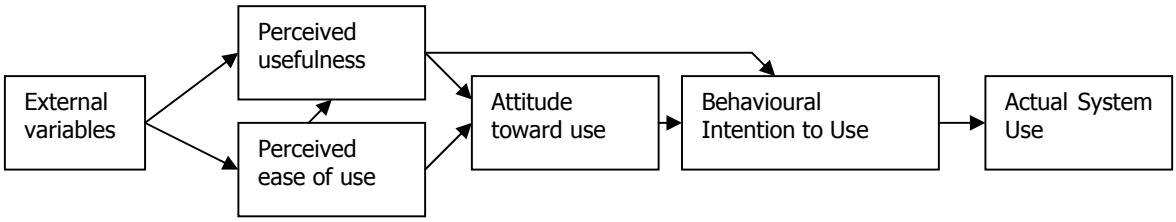

Figure 2-1 Technology Acceptance Model (Davis, 1989, p.985)

TAM's *"PU and PEOU are postulated a priori, and are meant to be fairly general determinants of user acceptance"* (Davis et al., 1989). This approach was chosen in order to construct a belief set that can more readily be generalised to different computer systems and user populations. In contrast, TRA and TPB (Theory of Planned Behaviour, another theoretical extension of TRA) need to elicit the specific perceived beliefs held by specific subjects targeting the specific system under investigation. Davis (1989) defines PU as "the degree to which a person believes that using a particular system would enhance his or her job performance", and PEOU as "the degree to which a person believes that using a particular system would be free of effort". He develops scale items based on their definition and pre-tests and tests their content validity, reliability and construct validity. The final scales have been refined and reduced to two six-item lists with reliabilities of .98 for PU and .94 for PEOU.

In reviewing these two original papers (Davis 1989 and Davis et al 1989), one could make several primary conclusions about TAM:

1. TAM is a specific model developed to explain and predict users' computer usage behaviour in organisations.
2. TAM is a causal model. The BI-actual usage and the PU-BI relationship observed in the studies are very strong. BI is a proper predictor of Behaviour. It fully mediated the effects of how other variables affected usage. PU has great impacts on BI over time beyond A. The A-BI relationship changes over time. Its link became non-significant when users used the system for a longer time. Attitude is found not to fully mediate the effect of PU and PEOU on behaviour; it only partially mediated these relationships.
3. PU and PEOU correlated significantly with both self-reported current usage and self-predicted future usage. But PU had a greater effect on usage behaviour than PEOU when users had used the system for a longer time. Because users seemed to process PEOU from a self-efficacy perspective in early exposure to the system, they were concerned about the likelihood of succeeding in learning to use the system. As learning progressed and more experience was gained over time, this consideration became less important. Users evolved PEOU into a more instrumental perspective, considering how much of the relative effort of using the system would influence their performance. The importance of PU in determining usage behaviour should be emphasised. The usefulness of the system may encourage users to surmount the difficulties in their interaction with it. The greatest PEOU of the system may not lead to usage of it if it does not do useful work.
4. TAM does not include social norms (SN) as a determinant of BI, which is an important determinant theorised by TRA and Theory of Planned Behaviour (TPB).

SN refers to " a person's perception that most people who are important to him think he should or should not perform the behaviour in question" (Fishbein and Ajzen 1975, p.320). The SN-BI relationship was not observed to be strong in their studies. Davis et al. (1989) explained that SN scales have a very poor psychometric standpoint. It may not exert any influence on BI, especially when IS applications are fairly personal and individual usage is voluntary.

5. Davis and his colleagues claimed that system usage is only a necessary, not a sufficient condition for fulfilling performance improvements due to IS. PU and PEOU are the user's subjective appraisal of performance and effort respectively; they cannot be regarded as surrogates to reflect objective phenomena.
6. Finally, they call for future research to apply the model to other contexts. They pointed out that practitioners evaluated systems for two purposes. One is to predict acceptability, the other is to diagnose the reasons resulting in lack of acceptance and to take proper measures to improve user acceptance. Therefore, one should pay attention to external variables that influence the user's internal behavioural determinants to computer usage behaviour in order to meet the two evaluation purposes, particularly the second one.

2.3 Model adoption, validation and extensions

IS researchers who are interested in studies of user acceptance of technology have adopted, validated and extended the original TAM to explain and predict users' computer usage behaviour across different IS applications and organisational contexts.

2.3.1 Model adoption

TAM aims to be parsimonious and theoretically justified in predicting and explaining user behaviour across various IS and organisational contexts. Davis and his colleagues tested TAM in studying user behaviour about WriteOne, a word processing program, PROFS email, XEDIT file editor and IBM PC-based graphic systems, i.e., Chart-Master and Pendraw in the context of universities and an organisation in Canada, using both students and knowledge workers as subjects. The reviewed articles showed that TAM has been tested and adopted across a wide range of IS applications and other contexts. For examples, key office IS applications, such as Spreadsheet Lotus 1-2-3, WordPerfect, Word, and Excel (see appendix 1 No.3,5,6,7,11,13,16,18,23); communication technologies, such as e-mail, voice mail, customer dial-up system and fax (see appendix No.5,7,8,12,17,18,21); database systems (see appendix No.6,9,23,39,43); microcomputers (No.10,15,25); workstations (No.4,26); telemedicine technology for physicians (No.29,36,40); specific systems for specific organisations (No.31,33), wireless technology (No.44), etc. With the internet being adopted by the business world, some researchers studied TAM to explain user behaviour about Internet-related IS applications, such as WWW (No.30), WWW information services (No.22), online services (No.24), virtual workplace systems (No.27,39), and digital libraries (No.36). As consumers increase their purchases through the internet, TAM has been adopted to study consumer behaviour in B2C e-commerce applications, such as web-based bookstores (Koufaris 2002 and Gefen et al 2003, No.37,41 in the appendix).

TAM-based studies also have been conducted in many organisations, such as a large financial institution in America (No.12), a large Canadian integrated steel company (No. 14), accounting firms (No.20), public tertiary hospitals in Hong Kong (No.29,36,40), investment banks (No. 26) and some Fortune 100 corporations (No.25), etc. Universities are the other research context, mostly universities in North America, such as University of Michigan (No.1), Boston University (No.2), Temple and Minnesota University (No.18), and also universities in other countries, such as the open university of Hong Kong (No.38), etc. When B2C e-commerce became an important research issue, on-line services firms (No.24) and on-line bookstores (No.37, 41) and other such virtual organisations emerged as research contexts.

Knowledge workers and students in different organisations and universities are usually the "user population" in TAM-based studies. These users constitute large numbers and a great diversity of the user base. As indicated before, online e-commerce consumers are a new user group.

Although the reviewed articles have adopted TAM across different IS applications, research contexts and various user populations and shown it to be both parsimonious and theoretically justified, many of them do not apply the original TAM exactly in their own research design. They validate it and extend it by developing other important variables or constructs. Some of these studies are summarised in the next two sections.

2.4 Model validation

The validation of TAM goes two ways. One is to validate its PU and PEOU instruments to prove their psychometric properties. The other is to validate its supported causal links among its component constructs, i.e. BI-behaviour, A-BI, PU-BI, PEOU-BI,

PEOU-PU, PEOU-PU-BI, PU-A, PEOU-A, and external variables to PEOU and PU relationships.

2.4.1 PU and PEOU instrument validation: measurement and psychometric characteristics

In the TAM, perceived usefulness (PU), together with perceived ease of use (PEOU), are indicated as fundamental and distinct constructs that influence an individual's decision to use information technology (or systems), per Davis (1989).

Davis (1989) introduced a detailed scale and items used to measure perceived usefulness (PU) and perceived ease of use (PEOU). The frequently used PU items in most research are as follows: Using a particular system 1) would improve an individual's job performance, 2) would increase the individual's productivity, 3) would enhance individual effectiveness on the job, 4) would encourage the individual to accomplish tasks more quickly, 5) would make it easier to do the job, and 6) would be useful on the job. This 6-item scale has been adopted in many empirical studies, and almost all had significant statistical explanation and prediction power to illustrate the phenomena of the user's behaviour towards IS or IT (Davis et al., 1989, Mathieson et al., 2001, Adams et al., 1992, Venkatesh, 1999). Some researchers may use a 4-item scale, mainly items 1,2,3 and 6 to measure an individual's perception of usefulness about using a particular system and validated in the relevant empirical settings (Davis et al., 1989, Venkatesh and Morris, 2000). Researchers usually ask users to rate their agreement with the statements by choosing a number based on 5-point or 7-point Likert-type scale.

PU is a construct to measure an individual's psychological belief about using a particular IS thus the scale must possess "content validity", defined as "the degree to which the score or scale being used represents the concept about which generalizations are to be

made" (Bohrnstedt, 1970, p91, quoted from Davis 1989). The Spearman-Brown Prophecy formula was used to choose the number of items for the PU scale. Therefore, the 6-item scale was developed. Construct convergent reliability and discriminant validity were tested and were all statistically significant. Davis' PU scale has high content validity and has been used by other researchers. Since researchers adopted PU in different studying settings, the PU construct reliability and validity are performed firstly in these various situations; all had statistically significant reliability and validity. In order to detect whether PU is a different construct from PEOU or other constructs, factorial validity is usually done as follows. The pattern of factor loadings will confirm the structure of PU, with its items loading highly on this factor. Using these techniques, this will confirm the psychometric strength of the PU scale.

The frequently used PEOU items are: 1) Learning to operate the system would be easy for me; 2) I would find it easy to get the system to do what I want it to do; 3) My interaction with the system would be clear and understandable; 4) I would find the system to be flexible to interact with; 5) It would be easy for me to become skilful at using the systems; 6) I would find the system easy to use. As with the PU instruments, this 6-item PEOU scale has been adopted in the reviewed articles and mostly got statistical support showing it to be valid and reliable in measuring individual perceptions of the system's ease of use. Some studies, used only 4-items i.e. items 1,2,5, and 6 (Davis et al., 1989, Subramanian, 1994); item 2,3,6 and re-worded a new item:Interaction with the system does not require a lot of my mental effort (Venkatesh and Morris, 2000). Sometimes, researchers used only 2 items, items 2 and 6 (Lucas and Spitler, 1999). Researchers use the same

methods as in studying PU to ask users to rate their agreement and to validate its psychometric properties.

The psychometric properties of the two measures developed by Davis appear to have been robust across studies and user groups. Still, one may find that there is no absolute measure of PEOU and PU across varying technological and organisational contexts. Minor changes may be necessary in some of the variables used in measuring these constructs. User perceptions of these constructs may vary with time and experience for any given application (Adams et al., 1992). It seems plausible that both task and user characteristics alter the nature and importance of perceptions that explain technology use (Segars and Grover, 1993). Doll et al. (1998) conducted a confirmatory and multi-group invariance analysis of Davis' original PU and PEOU instruments. Their results are mixed, indicating that PU and PEOU instruments are not invariant across different types of applications, different users with no prior computing experience, novices, and experienced users, or across gender. PU is invariant across three applications, i.e. graphics, spreadsheet and database, but not for word-processing. PU is invariant across two groups, novice and experienced users, but not for users with no prior computing experience. PU is invariant across gender. But PEOU is invariant across applications and users with different experiences, although not across gender.

Thus, we may conclude that PU and PEOU are very powerful belief constructs to determine user behaviour about computer technologies in organisations. Their measurement scales and psychometric properties are empirically shown to be robust. But we must be aware that for different users, perceptions of PU and PEOU may vary across contexts in term of technology and organisation.

2.4.2 Validation of casual links

TAM supports strongly the causal links between BI-behaviour, PU-BI, PEOU-BI, PEOU-PU and external variables to PU and PEOU relationships. The empirical testing and validation of the TAM-theorised causal links are summarised in Table 2-2. The relationships are theorised and tested by original TAM work (Davis, 1989, Davis et al. 1989)

BI-Behaviour

The TAM asserts that intention is a proper proxy to examine and predict a user's behaviour towards information systems. System use was usually voluntary and was measured as frequency of use, diversity of use, predicted future usage, initial (immediate) usage or continued sustained usage (Venkatesh et al., 2003), or discontinuance of usage (Bhattacherjee, 1998).

Empirical results from literature (No. 1, 11 ,13 ,32 ,33 and 39) tested the correlation between behaviour intention and behaviour, and the correlations were found to be significant in each of the studies. The results from No. 13 (Taylor and Todd, 1995) found that behavioural intention predicted behaviour more strongly for experienced users. The results from No. 39 (Venkatesh et al., 2003) further pointed out that behavioural intention fully mediated the influences of other factors on immediate use or short-term use of a system but did not have effects on continued use. Their results showed that short-term use is the sole predictor of continued usage, not behavioural intention.

PU-BI and behaviour

More than 20 studies have tested PU effects and its correlations with users' behaviour and behavioural intention to use a specific system. Their results found this link was statistically significant. PU proved to be a major determinant of behavioural intention

(No. 1, 2, 16, 25, 28, 29, 30, 31, 38, 39, 40, 41, 43, 44) and to correlate highly with various usage dimensions for example, self-reported current usage (No. 1, 2, 17), self-predicted future usage (No. 1, 2, 5, 10, 19), variety of use (No. 10,), choice behaviour of software packages (No. 9), the user's behaviour in both the pre-implementation and post-implementation stages of a system (No. 17), continued sustained usage (No. 19), subsequent discontinuance behaviour (No. 24) and mandatory use (No. 33). There is empirical evidence which shows that PU is a stronger predictor for inexperienced users' intentions towards using systems (No. 13).

PEOU- BI and behaviour

Some 18 studies have found PEOU relationships with BI or behaviour to be significant. Compared with PU, PEOU is the second most important determinant of a user's behavioural intention toward a system. In the pre-implementation stage, PEOU does not have a significant and direct effect on users' behaviour intention to use a system, but does affect intentions only through PU in the post-implementation stage (No. 17, Szajna 1996). It indicated that unless users perceived an IS as being useful, its ease of use has no effect on the formation of intentions. When we analyse how PEOU influences the user's intention to use only directly via PU, Chau 1996 (No. 16) found that it was only through near-term usefulness, not long-term usefulness.

Attitude

Because attitude appeared to have no sustained effect on individual behavioural intention and only partially mediated the belief-intention link, this construct is frequently not included in empirical testing. About 11 studies tested attitude effects on behaviour intention and its antecedent belief constructs, i.e., PU and PEOU. PU and PEOU are usually

the positive direction to one's attitude towards using the system (No, 1, 3, 5, 11, 20, 25, 36, 40, 43). Together with PU, attitude was a significant predictor of intentions (No. 25, 29). The relationship between attitude and behavioural intention will be stronger for users than for potential adopters, and PU is the only belief underlying potential users' attitude to adopting and users' attitude to continuing to use (No. 28)

PU, PEOU and external variables (EV)

TAM emphases the importance of how external variables affect the individual internal decision process when it comes to using a system within organisations. Nearly 20 studies have found such effects. PEOU has positive effects on PU (No.1, 3, 5, 18, 26, 35, 39, 43). PEOU only influenced the user's near-term perception of usefulness, not long-term (No. 16). External variables affect PU directly or indirectly via PEOU. For example, user training, end-user policy, management support, system quality and PEOU have a direct effect on PU, and explained 48% of variance of PU (No. 10); No. 14 found information-centre product specialists and end-users may have a different assessment of PU. User skills, organisational support and perceived complexity of a system had significant effects on PU (No. 15). Intrinsic involvement in software development may influence the user's perception of how useful the system is (No. 20). Gender, perceived social presence and information richness of the medium (e.g. e-mail, voice mail) (No. 21), individual difference (i.e., participation in training) (No. 25), intrinsic motivation (e.g., cognitive absorption) (No. 30, 39) and relevance of the system to the task (No. 38) have all been found as predictors of PU. Venkatesh and Davis (2000) (No. 33) have incorporated additional theoretical constructs spanning social influence processes (SN, voluntariness and image) and cognitive instrumental processes (job relevance, output quality, result demonstrability

and PEOU) as antecedents of PU. Their results confirmed the importance of these processes in the user's perception of usefulness and explained 60% of the variance of PU.

PEOU and external variables (EV)

Eleven studies validated PEOU relationships with external variables. The results are statistically significant. System quality, user training, organisational support, end-user computing support, management support, and computer experience have been found to have significant direct effects on PEOU (No. 10). Interaction between systems, direct experience with a system, system characteristics (No. 18, No. 38), gender (No. 21), individual difference (i.e. individual organisation role with regard to technology, prior experience with similar systems, and their level of education), No. 25 and knowledge of search domain (No. 38) all determine the user's perception of ease of use of a system. Individual computer self-efficacy (No. 18, 31, 38), intrinsic motivation (No. 39) (e.g.,- playfulness No. 27, No. 31,- or cognitive absorption- No. 30) and computer anxiety (No. 31) were all determinants of PEOU. The study of on-line consumer behaviour showed that PEOU fully mediated the effects of a consumer's familiarity on the trust issue (No. 41).

Relationships	Supported Literatures[1]
Individual's use of systems can be predicted well from its intentions (BI-Behaviour)[2]	No.1,11,13,17,32,33,39
PU is a major determinant of individual's intentions to use systems (PU-BI), has a high correlation with usage behaviour.	No.1,2,3,5,8,9,10,13,16,17,19,24,25,28,29,30,33,35,36, 37,38,39,40,41,43,44
PEOU is a significant secondary determinant of individual's intentions to user systems (PEOU-BI). But this effect may subside over time, mostly through PU to influence BI (PEOU-PU-BI).	No.1,2,3,5,9,10,16,17,18,20,25,27,31, 33,35,38,39,41
Attitude effects on BI become less significant over time (A-BI). Attitude partially medicated belief-BI link (PU-A, PEOU-A).	No.1,3,5,11,13,20,25,28,29,36
PU is affected by various external variables (EV) over and above PEOU (PEOU-PU, EV-PEOU-PU and EV-PU).	No.1,3,5,10,14,15,16,17,18,20,21,25, 26,30,33,35,37,38,39,42,43
PEOU is to be determined by external variables (EV-PEOU).	No.10,18,21,25,26,27,30,31,38,39,41

Table 2-2 Validation of casual linkages

Overview abbreviations:

A : Attitude
BI : Intentions
PEOU : Perceived ease of use
EV : External variables
PU : Perceived usefulness

2.4.3 Model extension

In addition to the many papers that have tested and validated the TAM model, many studies also included other variables to extend the model itself. They have contributed to a better understanding of the way individuals adopt information systems and to elaborate the

[1] Number shows in the same order as that in the appendix
[2]Since Intention is a proper predictor of individual's behaviour. Not all the following studies presented the correlations between BI-Behaviour (actual use of systems); they considered behavioural intention as their study outcomes instead of actual behaviour. That does not mean that they do not support the link between BI-Behaviour. Here, I only give the references that presented BI-Behaviour correlations

TAM more comprehensively, its antecedents of beliefs, moderating role of experience and voluntariness and different dimension and measurement of usage. A summary of these extensions follows below.

Extension of PU and PEOU

PU and PEOU are formulated as two fundamental beliefs determining a user's behaviour towards computer technology. These two constructs are parsimonious and empirically validated across various IS applications and usage contexts. There are two main extensions of understanding PU and PEOU. One is the extension of the constructs themselves; the other incorporates relevant external variables as important antecedents of PU and PEOU. Segars and Grover (1993) took a confirmatory approach to re- examining PU and PEOU. They found that a third underlying construct termed " Effectiveness", should be introduced into the original two-factor structure postulated by Davis (1989). The three-factor model exhibits sound psychometric properties and a certain degree of validity. It is interesting that very few researchers used these three factors in their empirical studies in the reviewed article. According to motivation theory, PU is considered as an extrinsic motivation, and means performing behaviour to achieve a specific goal (Venkatesh et al., 2002, Venkatesh and Speier, 1999, Venkatesh, 1999). Combining Triandis' theory (Thompson et al., 1991, Thompson et al., 1994) about the "perceived consequences" of behaviour, Chau (1996) expanded PU into two different constructs, perceived near-term usefulness and perceived long-term usefulness. Near-term PU can be improving job performance or enhancing job satisfaction, and long-term PU means improving one's career prospects or social status (future consequences). His results showed that perceived near-term usefulness was the most significant factor affecting the user's intention to use a

system. Also, it had a significant and positive influence on perceived long-term usefulness. That implies that a user who finds a technology useful in accomplishing current tasks is predisposed to believe it will help in his or her future career. In this case, PEOU was found to have no significant direct relationship with long-term usefulness. Its effects on intention to use were only through near-term usefulness.

As indicated above, external variables determine PEOU and PU to some extent. Therefore, the second extensions of TAM go to the development of the antecedents of PEOU and PU. The major contributions are from Venkatesh and Davis (1996), Venkatesh (2000) and Venkatesh and Davis (2000). Venkatesh (2000) improved the work of Venkatesh and Davis (1996) and made a comprehensive study of the determinants of PEOU. He demonstrated an anchoring and adjustment-based theoretical model for the antecedents of PEOU, or system-specific PEOU to be precise. The model proposes control (internally and externally-defined as computer self-efficacy and facilitating conditions), intrinsic motivation (defined as computer playfulness), and emotion (defined as computer anxiety) as anchors that influence users' early perceptions about the PEOU of a new system. With increasing experience in using the system, users' perceptions about the PEOU of the system will be still anchored in general computer beliefs, and also will be adjusted regarding objective usability, perceptions of external control specific to the new system environment and system-specific perceived enjoyment. His results strongly supported this proposed model and explained up to 60% of the variance in PEOU.

Venkatesh and Davis (2000) published their TAM2 model. TAM2 extends original TAM by explaining PU and usage intentions in terms of social influence and cognitive instrumental processes. They defined social influence processes (subjective norm,

voluntariness, and image) and cognitive instrumental processes (job relevance, output quality, result demonstrability, and PEOU) as determinants of the user's formulation of PU. Their results derived from four longitudinal studies showing the theoretical rationale for the causal relationships of the model. SN's effect on PU was significantly moderated by experience; image was not found to be significant for PU. Job relevance and output quality influence PU interactively. TAM2 explained up to 60% of the variance in PU and up to 52% of the variance in the intention to use.

Beside these important external variables, innovation characteristics (No. 19), individual differences (role with regard to technology, tenure in workforce, level of education, prior similar experiences, participation in training) (No. 25), individual traits (such as personal innovativeness in the domain of IT-PITT (No.22), cognitive absorption-CA (No. 30) and the relationship of these traits to computer self-efficacy and computer anxiety (Thatcher and Perrewe, 2002) and situational factors (the positive, neutral and negative mood when the individual participated a training programme) (No. 39 and Venkatesh and Speier 1999) are proved to be antecedents of PU or PEOU.

Such extension fulfils the key purpose of TAM to *"tracing the impact of external factors on internal beliefs, attitudes, and intentions."* Meanwhile, a thorough understanding of the antecedents of PEOU and PU could help practitioners to diagnose the reasons for resistance to technology. If would also help them to take proper efficient external measures to improve user acceptance of technology.

Moderators: experience and voluntariness

The original TAM did not include any moderating effects either of experience or voluntariness. The reviewed literature has suggested the importance of these two dimensions being incorporated into TAM to predict and explain user behaviour with regard to a given technology.

Experience is basically conceptualised as one of several individual differences factors that influence a user's formation of beliefs about using a system. Experience gained through direct use or past usage affects the user's perception of relevant beliefs concerning the target systems, current attitude and usage of the system positively, in most cases. It is one of the most important sources of information about the target object and one's self-efficacy in computer technology. Five of the reviewed articles examine the effects of experience in terms of individual differences (No.13, 14, 17, 23, 25). No. 13 found that users' prior experience of using a system influenced their assessment of system usage. The results showed that the experienced users assessed the relationships of BI to Behaviour and behavioural control to behavioural intention much more strongly than inexperienced users. PU and PEOU were stronger predictors of intention for inexperienced users. However, neither experienced nor inexperienced users differed much in their assessment of attitude to behavioural intention and social norms to behavioural intention relationships. No.17 studied the beliefs-intention-acceptance relationship at both the pre and post-implementation stage. They argued that the determination of the role of experience might be the key to understanding this relationship. They also pointed out that when an individual becomes more experienced with the given technology, PU directly determines not only

intention to use but also usage behaviour. It is important to address the experience dimension with TAM. No. 23 conducted an invariant analysis of the PU and PEOU instrument; the authors suggested that PU was invariant across novice and experienced users, but not comparable for users with no prior computing experience. However, the PEOU instrument is invariant across user groups with or without experience. No. 25 supported the significant effects of prior similar experience to PEOU. In general, we may conclude that experience is an important variable affecting the formation and change over time of user beliefs and decisions to adopt an IT innovation (Xia and Lee, 2000). But the results of study No. 14 showed that years of computer experience did not have a significant effect on the PU and PEOU of the software package. Four studies tested the moderating effects of experience (No.18, 31, 33, 42). No. 18 tested the role of experience in determining PEOU and its moderating effects in determining other factors influencing PEOU.

The results showed that direct experience with the system was important for users to formulate system-specific PEOU perceptions. Such perceptions could not be formed after only seeing a video mock-up, which is confirmed by the significance of the interaction between system and direct experience in determining PEOU. The moderation test suggested that objective usability effects on PEOU were moderated by direct experience. No. 31 pointed out the importance of experience in influencing and moderating users' general assessment and adjustment of determinants to PEOU over time. No. 33 clearly theorised experience as a moderator in TAM2. No. 42 found that when recipients received advice messages from their colleagues, their expertise and involvement moderated the effects of

the argument quality of the advice on information usefulness significantly, but only marginally for source credibility.

Experience influences the utilization of PC directly (Thompson et al., 1994). The results from this study also suggested that the moderating influence of experience on the relations between other constructs, e.g. job fit or technical support, to utilization was generally quite strong.

One assumption of TAM is that usage of a system is voluntary. The empirical studies in this review mostly followed this assumption. No. 3 developed a perceived voluntariness scale to help clarify assumptions about the freedom of choice in adopting innovations. No. 19 examined its role in user acceptance of IT. The results showed that perceived voluntariness was significant in explaining current usage, but did not affect the intention to continue use. In TAM2, presented in No. 33, voluntariness was theorised as an important moderator, a control variable influencing a user's internal beliefs, attitude and intentions with regard to a system. The results showed that effects of social norms on behavioural intention were significantly moderated by both experience and voluntariness. When usage is mandatory, social norms will directly affect intention. The result from No. 26 indicated much the same.

Dimension of usage

Information technology can probably improve individual and organisational performance. The systems that are available in organisations cannot fully demonstrate their value until they are used. In the review of literature, there are different dimensions of usage behaviour. From the temporal dimensions, we may categorise behaviour into two groups. One is initial adoption behaviour, i.e., initial adoption, first-time usage, and rejection at the

pre-implementation stage; the other is post-adoption or post-implementation behaviour, i.e., sustained continuous usage, discontinuance (replacement or disenchantment). From the volitional perspective, usage could be mandatory or voluntary.

(i) Temporal dimension of system usage

One of the main purposes of the intention-based theory is to explain and predict initial adoption behaviour (Davis et al., 1989, Moore and Benbasat, 1991). In this dimension, frequency and volume of system usage are adapted to measure the initial adoption behaviour, besides variety of use, e.g., accomplishing a number of tasks or using a number of applications (Igbaria et al., 1995a). ISs diffuse because of the cumulative decision of individuals to adopt them. Users maybe persuaded to use a new system early in the implementation process, but the benefits offered may never be achieved in the absence of continued sustained usage (No. 17, 19, 28). Some discontinuance behaviour may happen as well. Two types of discontinuance behaviour may occur. Replacement means users use an alternative system instead of the original one that they used initially. Disenchantment means users become dissatisfied with the systems or services and thus do not use them any more (No. 24).

The temporal dimension of system usage may give rise to different behavioural intentions, attitudes and beliefs towards the system being formed. These are used in turn to predict the probability of usage.

(ii) Mandatory use vs. Voluntary use

As we indicated above, one assumption of the TAM is that, given sufficient time and knowledge about a particular behavioural activity, an individual's stated preference to perform the activity (i.e., behavioural intention), will, in fact, closely resemble the way they

do behave. This assumption only applies, however, when the behaviour is under a person's volitional control (Ajzen and Fishbein, 1980).

The major differences between Ajzen's (1985) volitional control and the volitional control associated with mandatory behaviour is that, in the former category, the absence of volitional control hinders a person's will to perform the behaviour, whereas mandatory use of technology hinders a person's will not to perform the behaviour. Thus, Ajzen introduced perceived behaviour control, a measure of the extent to which the individual feels control over performing the behaviour rather than not performing the behaviour. Moore and Benbaset (1991) introduced perceived voluntariness to measure the degree of volition in performing behaviour. Venkatesh and Davis (2000) used this voluntariness as one of the control variables in their study.

Although most previous studies have been designed in the context of voluntary use, mandatory use is becoming an important research issue as it becomes increasingly prevalent in organisations (Rawstorne et al., 2000).

As previously indicated, TAM was originally developed for studying technology at work. Since that time, it has been used as such or modified to study user acceptance of consumer services such as Internet services or e- and m-commerce (Kaasinen, 2005). The Technology Acceptance Model constitutes a solid framework for identifying issues that may affect user acceptance of technical solutions. As Davis and Venkatesh (2004) have proved, the model can be enhanced from the original purpose of studying user acceptance of existing products to study planned product concepts, e.g., in the form of mock-ups. This indicates that TAM could also be used in connection with technology development projects

and processes to assess the usefulness of proposed solutions. Over the last few years researches have adopted TAM across different applications, research contexts and various populations. The general trend is that many of them do not apply the original TAM or even TAM2 model, they validate it and extend it by developing other important variables or constructs. Table 2.3 presents an overview of the TAM research presented at international conferences between 2005 and 2007.

Conference	Contribution
Proceedings of the 37th Annual Hawaii International Conference on System Sciences (Money and Turner, 2005)	This research investigates the applicability of Davis' Technology Acceptance Model to user acceptance of a knowledge management information system. It addresses two important questions: "Does the Technology Acceptance Model explain user acceptance and usage of an information system implemented to support knowledge management objectives?" and "Can previous Technology Acceptance Model user acceptance research serve as a basis for investigation of user acceptance of knowledge management information technology systems?" This study provides preliminary evidence that previous information technology acceptance research based on the Technology Acceptance Model may serve as a foundation for research into knowledge management system user acceptance. Relationships among primary TAM constructs are in substantive agreement with those characteristic of previous TAM research. Significant positive relationships between perceived usefulness, ease of use, and system usage were consistent with previous TAM research. The observed mediating role of perceived usefulness in the relationship between ease of use and usage was also in consonance with earlier findings. The findings are significant because they suggest that the considerable body of previous TAM-related information technology research may be usefully applied to the knowledge management domain, and promote further investigation of factors affecting the user acceptance and usage of knowledge management information systems.
Proceedings of the 38th Annual Hawaii International Conference on System Sciences (HICSS'05) (Kaasinen, 2005)	The original TAM has been modified based on studies of mobile consumer services: Technology Acceptance Model for Mobile Services. Kaasinen (2005) suggests that perceived ease of use, perceived value and trust affect the intention to use a mobile service. To move from an intention to use to real usage, the user has to take the service into use. This transition is affected by the perceived ease of adoption. Perceived value, perceived ease of use, trust and perceived ease of adoption need to be studied in order to assess user acceptance of mobile services
Proceedings of the 38th Annual Hawaii International	Healthcare is a stressful sector and besides the traditional stress, there is exposure to IT-related stress due its structure and

Conference on System Sciences (HICSS'05) - Track 6 (Raitoharju, 2005)	personnel. In this paper some general needs for a re-evaluation of IT evaluation are addressed. Moreover, a new perspective-IT related stress-is presented to broaden the evaluation. The main purpose of this paper is to develop a theoretical model based on the widely used TAM-model to evaluate IT stress as a factor of IT acceptance.
International Conference on Mobile Business (ICMB'05) (Lee and Jun, 2005)	Authors propose contextual perceived usefulness (CPU) as a new construct that reflects mobile commerce (MC)-specific features. By adding CPU to the technology acceptance model (TAM), this study extends the applicability of the TAM in MC context. The empirical results support the extended TAM in explaining consumers' behavioural intentions to use MC
World Conference on Educational Multimedia, Hypermedia and Telecommunications (EDMEDIA) 2005 (Dagada, 2005)	In this study the author reflects how the technology acceptance model (TAM) affects the implementation of computer-integrated education. The study on which this paper is based took place in the South African corporate training environment. The literature review revealed how some South African information and communication technology (ICT) projects, which were worth billions of rands, failed. The failure of these projects was attributed, among other things, to issues related to TAM. The aim of this study was to investigate the possible relevance of TAM in determining the success or failure of computer-integrated education projects.
Proceedings of the 2005 Southern Association of Information Systems Conference (Johnson, 2005)	Security breaches have increasingly become a major threat to organizations. Nevertheless, according to recent reports, many organizations do not plan to increase spending on information security. In fact, little is known about an organization's motivation to invest in information security. This paper uses the Technology Acceptance Model as a basis for studying factors that might motivate organizations to invest (or not to invest) in information security. It proposes that perceived usefulness and ease of use of information security influence such investment decisions. It further proposes that seven other variables influence perceived usefulness and ease of use. They are: external environment, prior information security experiences, perceived risks of not securing information, information security budget, security planning, confidence in information security, and security awareness and training. The research proposes a model of information security investment. A Delphi study and a mail survey will be used to test it.
11th IEEE International Software Metrics Symposium (Umarji and Emurian, 2006)	Technology adoption concepts are applied to metrics program implementation to develop a predictive model that takes as input organizational culture, practitioner mindset, and the nature of the metrics program. The model relates these inputs to the likelihood of a successful metrics program implementation and to areas that may need improvement. The paper includes the results of a pilot study. The predictor variables Ease of Use, Usefulness, Control, and Attitude were significantly correlated with the dependent variable, the respondent's Intention to perform metrics activities.
Proceedings of the 39th Annual Hawaii International Conference on System Sciences (HICSS'07) Track 8	Zhang et al. proposed and empirically tested a construct named cognitive absorption that has preceding effects on important user technology acceptance constructs. They propose that an important antecedent of cognitive absorption is perceived affective

(Zhang et al., 2007)	quality (PAQ) of the target IT. Such perception is a user's impression of the IT itself prior to any other cognitive appraisal and evaluation on the consequences or potential interactions with the IT. Rooted in psychological work on affect and cognition, they develop a theoretical model that depicts the causal relationships among PAQ, cognitive absorption, cognitive beliefs, and IT use intention. A field study was conducted to validate this model. Their results indicate that PAQ is a strong antecedent to cognitive absorption, explaining 39% variances in it, and has direct impacts on cognitive beliefs.

Table 2-3 Overview of TAM research presented in international conferences 2005 – 2007

2.5 Model limitations

Beside the many papers that have adopted and validated the TAM, several articles have been published that challenge and criticise the model. On balance, these articles have contributed to a better understanding of limitations of the TAM. These articles and the issues they raise to the TAM are summarised below.

2.5.1 Cultural dimension of TAM

The reviewed articles, No. 21 and No. 33, examined the impact of gender on IT diffusion. They argue that gender is a fundamental aspect of culture; it does affect the IT adoption process. But these two studies did not address the cultural dimension of the TAM. The obvious reason of why discussion of cultural effects on IT adoption is lacking is that most empirical studies have been conducted in North American culture, mostly in U.S firms. Culture does have an impact on an individual's decision-making to adopt and use a specific system. The examination of cross-cultural working and IS is dominated by Hofstede-type studies (Myers and Tan, 2002).

Straub, Keil and Brenner (1997) discussed the issue in an article published in Information & Management. They conducted a three-country study to test the TAM across cultures: Japan, Switzerland and the United States. The study administered the same TAM

construct instruments to employees in three different airlines companies, all of which had access to the same IS, i.e., email. The results demonstrated that TAM holds for both the U.S. and Switzerland, but not for Japan. This implies that TAM may not predict technology use across all cultures in the world. The study results from articles No. 29, No. 36, No. 38 and No .40 in our review which were conducted in Hong Kong, did not arrive at a similar conclusion. But one result might be enough to question whether the TAM cannot equally predict user behaviour across culture. It calls our attention to considering the cultural dimensions of the TAM when studying user behaviour in other cultures than just North America.

2.5.2 Applicability and generalisability issue

Four articles (No.26, 29, 36, 40) questioned the applicability of the TAM in their studies. Lucas and Spiter (1999) (No. 26) found that in the field setting of broker workstations, the individual perception variables PU and PEOU in the TAM did not approach significance in predicting use. Surprisingly, PU and PEOU correlated at 0.62. They argued that, in this circumstance, combining these two into a single variable would make it a significant predictor of use for a full sample at the 0.05 level, including brokers and sales assistants, and a sample of sales assistants at the 0.10 level. Such a combination provided limited support for the original TAM model. Obviously, the TAM does not support it; PU and PEOU are postulated as two distinct constructs. Their explanation for the TAM's weak support lay in the nature of the system, not enough voluntary use of the system and the field environment in which their study was conducted. They concluded that it was possible the TAM could not work well for a modern, complex technology, i.e., multifunctional workstations where usage is mandatory in nature and there are no

alternative systems to complement it. They found similar results in the following studies published in Information & Management (Lucas and Spiter, 2000).

The empirical results from Hu et al (1999) (No. 29) and Chau and Hu (2001 and 2002) (No. 36 and No. 40) found that PEOU had no significant influence on PU and attitude. They suggested that this might reflect limitations in the TAM's applicability to technologies, user populations or both. They explained that their study subjects, physicians, might differ subtly from the subjects commonly examined in prior technology acceptance/adoption studies. Physicians are professionals and might exhibit considerable differences in general competence, adaptability to new technologies, intellectual and cognitive capacity and the nature of their work. They concluded that the explanatory power of the TAM, particularly the PEOU factor, might weaken as the competency of the users increases.

2.5.3 Measurement of usage

Different empirical designs usually have different indicators to measure system usage. Behavioural intention is a proper predictor for current and future usage.“ Assuming the system were available in my job, I predict that I will use it on a regular basis in the future”. Such self-predictions, or “behavioural expectations”, are among the most accurate predictors available for individual future behaviour. Not enough is currently known about how accurately self-reports reflect actual behaviour. Szajna (1996) (No. 17) argued that the intention-usage link appeared to be dependent on the method for measuring usage. Intentions predict self-reported usage but do not predict actual usage well. His results showed that intentions explain 32% of the variance in self-reported usage, and only 6% of

the variance in actual usage. Self-reported usage and actual usage correlated at 0.26. This implied the necessity of validating self-reported usage as a construct.

Some researchers use computer-recorded system usage to measure actual usage (e.g., Straub et al; Szajna 1996). But these two constructs do not appear to be strongly related to each other, counter to the expectations of earlier MIS research. In the face of this contrariety, it would be tempting to argue that *research that has relied on subjective measures for dependent variables, such as system usage, may not be uncovering the true, significant effects, but mere artifacts* (No. 12).

Agarwal and Prasad (1997) (No. 19) proved that current usage was not a significant predictor of future use intentions. This suggested that factors generated by initial use couldn't be relied on to explain and predict continued, sustained use of the target innovation. Initial usage is an outcome of individuals' assessments of the utility offered by the innovation. They argued that "*at this point (initial usage), the technology is essentially an addition to other options potential adopters may have to accomplish their work and does not entirely replace any of these options. Thus, the technology is not at the stage of maturity where adequate work-related benefits have been unequivocally established, consequently, initial use is not instrumental in predicting future use*." Venkatesh et al. (2002) (No. 39) also reported that short-term use is the sole predictor of continued usage. All other variables measured at the time of initial adoption were non-significant predictors of continued use.

Therefore, the temporal dimension of system usage draws attention when designing empirical studies to explore system usage behaviour. The momentum generated by initial

use should be reconsidered or modified when we take the temporal dimension into consideration.

Model Limitation	Relevance to this study
Cultural dimension of TAM	Al Gahtani (2001) investigated the applicability of the TAM model in Western Europe (United Kingdom) and found that the fundamental relationships and linkages among the TAM motivational constructs and the outcome construct (IT acceptance) were in full agreement with prior research. Next to this, a study of the latest TAM-based research in The Netherlands (Horst et al., 2006, Kleijen et al., 2003, van der Heijden, 2003) does not reveal any issues with the cultural dimension of TAM
Acceplicability and generalisability	The system under research is not a highly sophisticated system, it is not mandatory in use and is a replacement of the current system, hence alternatives are available.
Measurement of usage	To ensure that the measure of usage would not be a limitation, one of the criteria that had to be met by the researched organizations was that the e-commerce system had to be in operation for at least one year (see chapter 4), ensuring a stable system with a critical mass of users.

Table 2-4 Overview of limitations of TAM and relevance to research

2.6 Summary

In this chapter, a thorough review of TAM was conducted and the original work published in year 1989 and various adaptations was reviewed. TAM focuses on user technology acceptance behaviour in organisations. It is proposed to be parsimonious and theoretically justified. After just over a decade of research, TAM has fulfilled this aim and empirically proved to be robust across a broad range of end-user computing technologies and user groups.

The interpretation of TAM from the cultural, organisational, individual and system contexts, respectively, will help researchers and practitioners gain more insights into what promotes user acceptance and what hinders acceptance. It is crucial to understand these

contexts and their effects on user behaviour towards a given technology comprehensively. But, it may be hard to generalise from the findings across different research settings.

The limitation of TAM is minor in comparison with its great supportive achievements. But it draws attention to the need to be cautious when applying it to a specific case or a specific user population. The comparison of TAM with other competing models has indicated its robustness. Owing to its intended generality and parsimony, possible supplementation of TAM by other theories is necessary in some cases.

Overall TAM is a well developed, empirically supported model for investigating user technology acceptance and, with its potential limitations taken into account, an adequate model for this research.

3 Research model

3.1 Introduction

This chapter presents the research model for SME managers' usage of e-commerce systems. The research model described here is developed with reference to the Technology Acceptance Model (TAM) and the existing base of research in the literature. Various studies have been conducted to investigate user perceptions and attitudes. These practical results are used to build the research model and the hypothesis.

3.2 Theoretical research model

The focus of this study is exclusively on SME managers in The Netherlands and their use of e-commerce systems. Based on the original TAM the theoretical research model is presented in Figure 3-1. The major difference with the original TAM is the exclusion of one variable, Behavioural Intention to Use, from the research model. The constituent TAM model elements have evolved over time (Davis et al. 1989, Davis 1989, Davis, 1993, Ventkatesh and Davis, 2000), most notably by excluding the behavioural intention to use construct when actual or self-reported usage measures are available. Other researchers (Adams et al., 1992, Al-Gahtani and King, 1999, Moore and Benbasat, 1991, Thompson et al., 1991) also dropped behavioural intention to use because they were interested in actual behaviour (system usage) and not intentions. Moreover, behavioural intention to use is dealing with future behaviour, whereas in our model, acceptance of the IT tool has already taken place. However, Davis' representations of TAM have always included an attitudinal construct. The attitude toward use construct is essential because TAM asserts that the principal influence of the belief constructs is on attitudes that subsequently influence usage behaviour, rather than on usage behaviour directly. As already shown, the result of previous

studies using TAM showed that attitude and behavioural intention strongly predict usage. Leaving one variable out of the research model would not jeopardize the integrity of the model as explained in section 2.1. Therefore, for theoretical and practical reasons and in line with Davis (1993), the intention to use construct was not considered.

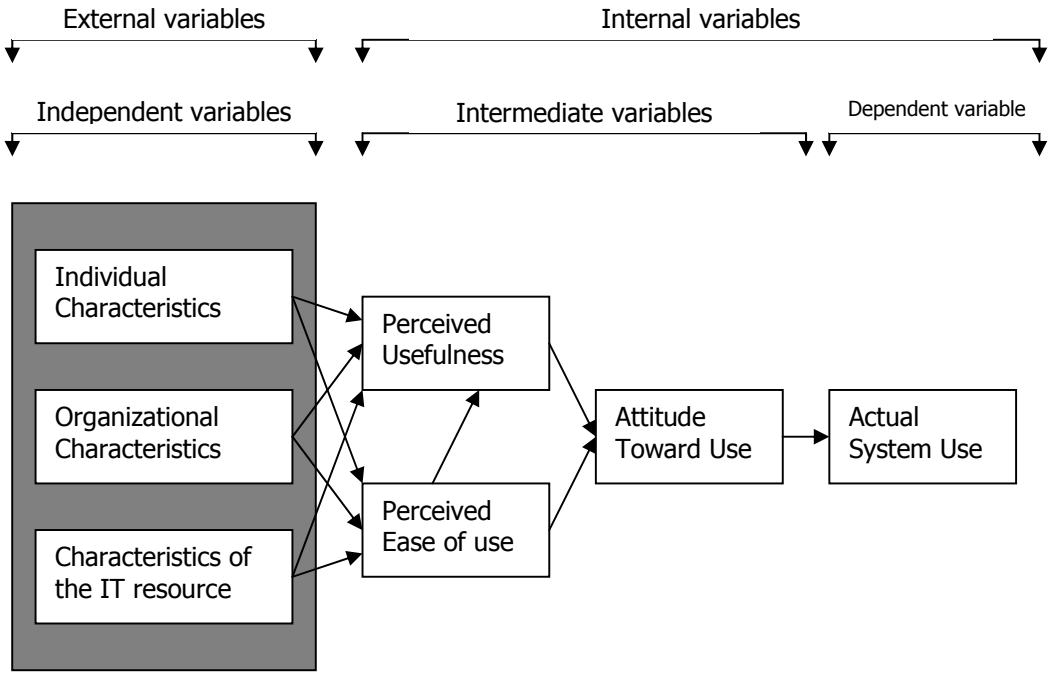

Figure 3-1 Basic theoretical research model

The following sections elaborate on the theoretical research model, starting with the dependent variable (system usage), followed by the intermediate and the independent (external) variables. All variables are described with evidence from literature.

3.3 The dependent variable – system usage

System usage, the utilization of information technology by individuals and groups or organizations, is a core variable in IS research (Straub et al., 1995), because system usage is viewed as a surrogate measure for IS success (Delone and McLean, 2003, Delone and

McLean, 1992). The choice of system usage behaviour as a surrogate for system success is also consistent with innovation diffusion research (Agarwal and Prasad, 1997). The other, often-used category is user information satisfaction (UIS). Both categories have been widely used by IS researchers and practitioners. The use of UIS, "the extent to which users believe the information system available to them meets their information requirements" (Ives et al., 1983), implies a manager knows his information requirements and goals. Whether these goals are personal or business-driven highly influences his perceived satisfaction with the information system. Although DeLone and McLean (1992) argue that user information satisfaction is the most widely used single measure of IS success, it is normally applied when the use of an information system is required. In my research, usage of e-commerce by SME managers is voluntary (or to make it more specific: discretionary; see below). Moreover, before individual satisfaction can be assessed, the manager has to adopt and use the IT resource. In essence, TAM equates system success to actual system usage (Agarwal and Prasad, 1999). Hence, system usage is the only suitable measure for this research.

Literature on system usage does not give clear guidance on how to measure it. Despite the conceptualization problems, system usage has been employed in a variety of approaches in measuring IS success. The most common forms of system usage measures are (1) subjective, self-reported measures and (2) objective, computer-recorded measures (Straub et al., 1995). In their study, Straub et al. found that system usage should be factored into these two types of measures. According to them, it may be desirable to reformulate system use as two entirely separate and separable constructs, i.e., perceived system use versus actual system usage. Using TAM, they found in their study that perceived measures

of system usage did not correlate well with those captured by the system, which were good measures of system usage. At the same time, they acknowledged the weak support for these findings, thus maintaining the integrity of TAM studies that measure system usage subjectively.

DeLone and McLean (1992) provide an overview of actual use through recorded connect time, information requests, or other quantitative, objective measures, and reported use, the perceived measure of use by questioning managers about their use of an information system. From Szajna (1993) we obtain the perspective to include a measure of the users' perceptions in the study, which is in fact the subjective usage measure. She also considers the task of the manager when operationalizing the particular method of measuring usage. Similar remarks are put forward by Ghani (1992), who states managers' tasks have very high levels of task uncertainty. In summary, a self-reported measure of use has been frequently adopted in research on TAM, since actual usage statistics by objective measurement are difficult to obtain.

A major drawback of self-reported system usage measures is the time order of the variables and the over-time changes in behaviour caused by the use of the IT resource (Rice and Rogers, 1984). Clearly, introducing a new system into an organization is a dilemma for managers. They could simply start using the system and changing their work routine. On the other hand, they may have a positive attitude towards the system, although they are not using it, believing instead that usage implicates negative consequences for their work. Furthermore, they still might prefer to utilize high profile media, such as face to face communication and observational tours (Ghani, 1992) instead of this new system.

Same authors posit measuring usage intentions instead of actual usage (Agarwal and Prasad, 1999, Jackson et al., 1997, Szajna, 1996). Agarwal and Prasad (1999) argue that data were gathered at a single point in time and thus intentions are more appropriate since they are measured contemporaneously with beliefs. Szajna (1996) found that intentions predicted actual usage and self-report usage at post-implementation time, which indicates that intentions can be used in situations where the technology is already installed and operational. However, consistent with the majority of TAM studies, actual usage will be measured and not intentions to use.

In the original Technology Acceptance Model Davis (1989) argues usage of information system needs to be voluntary. In their meta-analysis, DeLone and McLean (1992) posit usage, whether actual or perceived, is only pertinent when such use is voluntary or discretionary. Discretionary use in this respect means users could choose to use an IT resource to accomplish the task, they could choose another IT resource to accomplish the task, or they could choose not to perform the task altogether. Discretionary use is distinguished from voluntary use in that when usage is voluntary, the tasks for which the IT resource may be used still need to be accomplished. Seddon (1997) confirmed and extended the model of DeLone and McLean (1992) while elaborating the three possible meanings for use in their model:

(1) as a variable that proxies for the benefits from use,

(2) as the dependent variable in a variance model of future use, or

(3) as an event in a process leading to individual or organizational impact.

According to Seddon, the second meaning competes with Davis et al.'s (1989) Technology Acceptance Model, yet the role of use is to describe behaviour, not as a

measure of success. This latter explanation, a variance model for use as a behaviour, is consistent with the use construct of this study.

The proposed study uses an e-commerce system as the IT resource under review, where the user accesses the e-commerce system through a PC. In the practical part of the study, organizations were selected where an e-commerce system had been operational for at least one year. Therefore, the use of an e-commerce system is at least voluntary, but most likely discretionary, also because the SME manager to date normally receives and sends orders through various channels, e.g., face-to-face contacts, other information systems, faxes, letters, and so forth. In summary, system usage will be assessed using subjective, self-reported measures, yet acknowledging the drawbacks and problems in the operationalization process.

3.4 The intermediate variables – belief and attitude

The perceived ease of use, the perceived usefulness and to a certain extent also the attitude toward use constructs have been specifically investigated in many TAM studies. Most studies used Davis' original measurement scales, only changing the wording to fit the specific technologies studied. The reliability of these scale measures was very high.

3.5 The independent variables – external variables

Many researchers have attempted to identify the variables, direct or indirect, which might influence beliefs, attitude toward use, and system usage, although few studies have been conducted with managers' behaviour with information technologies. A number of studies using TAM identified numerous external variables, yet no consistent groups of variables have been found.

The present study, however, has not sought to identify all variables but merely the factors that have been already recognized and tested in this specific area of research. Some variables clearly were not relevant given the scope and depth of the study, e.g., organizational level, while other variables have not yet had enough attention to indicate the precise meaning for this study, e.g., perceived complexity (Igbaria et al., 1996). Various authors, who emphasize the importance of the quality of the system under review (Cao et al., 2005, Chuan-Chuan Lin and Lu, 2000, Davis, 1989, Davis and Venkatesh, 1996, Igbaria et al., 1996, Venkatesh and Davis, 1996), even state that system quality may function as a source of information relevant to feelings of self-efficacy, judgments of mastery, and self-determination, and hence as determinants of perceived ease of use and usefulness. Nevertheless, this study has opted to use an e-commerce system as the target system for assessing usage and consequently the quality of the system, whether high or mediocre, as a fixed starting point.

Apart from TAM, several other research areas were used as research perspectives for the present study, e.g., innovation theory, e-commerce systems, and microcomputers. Based on keywords in the research questions an extensive search of the literature was conducted, using several renowned literature databases. This meta-analysis resulted in a large number of variables and relationships with regard to the theoretical research model. These variables have been posited or demonstrated to be associated with perceptions, attitudes toward IT or system usage in previous research. Although these variables are not comprehensive by any means, they may represent some relevant factors for system usage behaviour. A detailed discussion of these variables is presented below.

A review of the relevant literature (Al-Gahtani and Olusegun Wallace, 1999, Alavi and Joachimsthaler, 1992, Hubona and Kennick, 1996, Igbaria, 1993, Igbaria et al., 1995a, Kwon and Zmud, 1987, Larsen, 1993, Mawhinney and Lederer, 1990) suggests the independent variables can be categorized into (A) Individual characteristics, (B) Organizational characteristics, and (C) Characteristics of the IT Resource. Each category is further broken down into subcategories, if applicable.

3.6 Constructs

Before describing the variables of the model in detail, special attention is given to the fact that most studies on technology adoption and usage acceptance examine cognitive factors, leaving affective factors or the underlying feelings unexplored.

The early conceptualization of attitude was synonymous with affect or affective responses (Davis et al., 1989, Fishbein and Ajzen, 1975, Venkatesh et al., 2003). To avoid the conceptual and operational ambiguity resulting from treating attitude as affect, Ajzen (2001) redefined attitude as "a summary evaluation of a psychological object" captured in both the functional and hedonic dimensions. Spangenberg et al. (1997) also proposed that attitude, which is evaluative in nature, contains cognitive as well as affective elements, and should be distinguished from affect. This study adopts this idea of attitude, and reflects the idea in the research model. Many researchers agree that attitude comprises both cognitive and affective elements (Batra and Ahtola, 1990; Petty and Caccioppo, 1985). In contrast, affect pertains only to a general mood, specific emotions or states of feeling (Ajzen, 2001). Thus, attitude highlights summary evaluation while affect emphasizes emotional status.

Conceptualizing attitudes as having feelings and thinking bases has been a typical means of classifying the different types of information on which attitudes are based. According to the dual process models of attitude change (Wood, 2000), the determinants and processes of attitude change depend on people's motivation and ability to process issue-relevant information. Specifically, the Elaboration Likelihood Model (Petty and Cacioppo, 1985) posits that attitude guides decisions and other behaviours, where persuasion is the primary source for attitude formation. The model features two routes of persuasive influence: central and peripheral. The thinking-attitude link acts as the central route, involving thoughtful and effortful cognitive processing of relevant information in the message. In addition, individuals need to draw on prior cognitive experience and knowledge to assess and elaborate on the information presented while forming attitude. Such elaboration processes include learning the message content, generating cognitive responses, and performing dissonance-induced reasoning (Wood, 2000); they are in operation where the individual is both motivated and able to process information carefully.

However, in the opposite situation, where the individual is not highly motivated and does not have high processing capacity, the individual is more likely to process information that is less complex, such as simple peripheral cues. Thus, the feelings–attitude link can be explained via the peripheral route. Feelings, mood, the effect of mere exposure, and the classical conditioning effect are affective cues leading to persuasion through peripheral route processing. Peripheral cues spontaneously evoke a positive or negative affective response. When the subject is aware of the contingency between the peripheral cue and the target, affect will transfer from the peripheral cue to the target. This subsequently influences evaluative judgment.

A number of previous studies view cognition as having a direct influence on behavioural intention, implying a direct thinking–behavioural intention linkage. For example, Davis (1989) incorporates the direct effect of beliefs on intention in TAM, which departs from TRA, which shows a complete mediation of attitude between belief and behavioural intention. Bagozzi (1982) also supports the linkage from cognitive perceptions to behavioural intention by hypothesizing that the direct path between them works through stored imperatives in memory. One way of doing so is via the activation of a personal goal by previous thoughts, which in turn influences one's behavioural intention to act.

Regarding the direct effect of feelings on behavioural intention, the theory of emotion and adaptation (Lazarus, 1991) identifies coping responses as important mechanisms for inferring action and goal attainment from feelings. Depending on the feelings generated, behavioural intentions emerge to activate plans for avoiding undesirable outcomes or increasing/maintaining positive outcomes (Bagozzi et al., 1992). Bagozzi et al. (1999) went a step further by proposing that action tendencies are automatic, "pre-wired" responses linked to emotions, thus supporting the relationship between emotions and behavioural intention.

Several emotional factors have been studied by prior IS adoption and continuance studies. Among them are enjoyment and anxiety. In IS continuance research, positive affect has been commonly and narrowly conceptualized and measured as the enjoyment which a person derives from using computers (Compeau et al., 1999). Enjoyment has been defined as 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 use (Davis et al.,

1992, Thong et al., 2006, Venkatesh, 2000). For negative affect, the focus has been on computer anxiety. Computer anxiety has been conceptualized as an individual's apprehension, or even fear, when he is faced with the possibility of using computers (Compeau et al., 1999, Venkatesh, 2000, Hackbarth et al., 2003).

An indirect measurement of emotion is used by Agarwal and Venkatesh (2002), who measured emotion in terms of challenge (capturing the idea of difficulty), plot (related to how the site piques the user's interest), character strength (related to the credibility conveyed by the site) and pace (the extent to which the site provides users an opportunity to control the flow of information) based on Microsoft usability guidelines (MUG). Only the plot measurement item is related to emotion.

Regarding satisfaction, previous IS research (Bhattacherjee, 2001, Khalifa and Liu, 2003) has highlighted the evaluative judgment aspect based on expectation-confirmation theory. The measurement item defining satisfaction ("this web site offers what I expect from a good web site") asks for a cognitive judgment. Consistent with the evaluative aspect of the concept, previous research (Khalifa and Liu, 2003, De Wulf et al., 2006) attempted to judge overall usage experience. Thus, satisfaction is not a pure affective construct (Kempf, 1999, Mano and Oliver, 1993, Russell, 1980).

Table 3-1 summarizes emotional constructs which were examined in previous IS research

Construct	Definition	Measurement items
Affect (focusing mostly on enjoyment) (Compeau et al., 1999)	The enjoyment a person derives from using computers.	• I like working with computers. • I look forward to those aspects of my job that require me to use a computer. • Once I start working on the computer, I find it hard to stop. • Using a computer is frustrating for me (reversed). • I get bored quickly when working on a computer (reversed).
Anxiety (Compeau et al., 1999, Venkatesh, 2000)	The feelings of apprehension or anxiety that one experiences when using computers.	• I feel apprehensive about using computers. • It scares me to think that I could cause the computer to destroy a large amount of information by hitting the wrong key. • I hesitate to use a computer for fear of making mistakes I cannot correct. • Computers are somewhat intimidating to me.
Enjoyment (Davis et al., 1992, Thong et al., 2006, Venkatesh, 2000, Yi et al., 2006)	The extent to which the activity of using a specific system is perceived to be enjoyable.	• I found using the system to be enjoyable. • The actual process of using the system is pleasant. • I have fun using the system.

Table 3-1 Overview emotional constructs

In the next sections, the variables of the model are described, starting with the independent (external) variables, followed by the intermediate and the dependent variable, system usage. All variables are described with evidence from literature and will be illustrated in relation to one another and the base TAM. Although one might expect certain variables to be more important than others, it is assumed in this model they all have equal weights. The theoretical research model is depicted in Figure 3-2 in section 3.7

3.6.1 The independent variables – external variables

A. Individual characteristics – demographics

1 Age

Age has been found to be related to beliefs toward system usage, attitudes towards computers, and actual usage (Morris and Venkatesh, 2000, Brigman and Cherry, 2002). Igbaria (1993) found that age was negatively related to user acceptance of microcomputer technology. The results of his study showed that respondents who were older had more negative beliefs about the usefulness of computers than their younger counterparts. In their study, Jarvenpaa and Ives (1991) found that a manager's age was a significant predictor of progressive use of IT. Their findings might suggest that the new generation of managers are more participative in IT management than veteran managers. In a study of the effects of external variables on usage behaviour, Hubona and Kennick (1996) reported a negative influence of age on ease of use. Czaja et al. (1989) found that computer skills were more easily learned by younger subjects than older subjects. Harrison and Rainer (1992) reported similar findings. In their study, Igbaria and Parasuraman (1989) found age had a negative effect on attitudes toward microcomputers. Brancheau and Wetherbe (1990) found that early adopters of a new technology were younger than late adopters. In a recent study aimed at investigating the extent to which managers use electronic information systems Pijpers et al. (2001) found that younger executives use electronic information systems more than their older counterparts. In sum, older managers are likely to have less computer knowledge, and consequently have a negative attitude regarding IT. Therefore, based on the above findings, the following hypotheses are presented:

H.A. 1.1. Age is negatively related to the perceived usefulness of the e-commerce system

H.A. 1.2. Age is negatively related to the perceived ease of use of the e-commerce system

2. Education

Higher levels of formal education, which indicates a person's knowledge and skill base, have been empirically associated with enhanced computer abilities and with more favourable attitudes towards computers. Dealing with computer anxiety as an intervening variable of attitudes towards microcomputers, Igbaria and Parasuraman (1989) found education had significant direct effects on computer attitudes. Hubona and Kennick (1996) and Igbaria (1993) reported similar findings. Davis and Davis (1990) reported that end users with more education perform significantly better in a training environment than those with less education. Harrison and Rainer (1992) stressed that overcoming negative attitudes is important in enhancing individual computer skills. They maintained that education and training are effective techniques to overcome negative attitudes towards computers. In their study, Agarwal and Prasad (1999) found that educational level was positively associated with ease of use beliefs, but not with perceived usefulness. Mathieson et al. (2001) argued that education level could be positively associated with perceived behaviour control because it reflects users' levels of internal capabilities, such as technical skills and intelligence. Based on the overview above, the following hypotheses can be postulated:

H.A. 3.1. Education is positively related to the perceived usefulness of the e-commerce system

H.A. 3.2. Education is positively related to the perceived ease of use of the e-commerce system

A. Individual characteristics – managerial and IT knowledge

3. Professional experience

Few studies to date have investigated professional experience, i.e. experience in the job, and the relationship to IT use. Although Larsen (1993) has some doubt regarding a possible relationship between job tenure and IT innovation, he incorporated job tenure in his model as an independent variable. In a more recent study, Agarwal and Prasad (1999) hypothesized the length of tenure in the work force as negatively associated with perceived usefulness and perceived ease of use. However, their empirical data did not support it. Hackbarth et al.(2003) found that users perceive a system as easier to use as they gain more knowledge and confidence through direct experience in using the system In our study, it is assumed that there is a positive relationship between professional experience, i.e., the number of years working as a manager, and usage of IT. The following hypotheses are put forward:

H.A. 4.1. Professional experience is positively related to the perceived usefulness of the e-commerce system

H.A. 4.2. Professional experience is positively related to the perceived ease of use of the e-commerce system

4. Computer (IT) experience

Numerous studies have related the impact of computer experience to usage behaviour (Hubona and Geitz, 1997, Igbaria and Chakrabarti, 1990, Igbaria, 1993, Igbaria and Iivari, 1995, Igbaria et al., 1996, Lakhanpal, 1994, Thompson et al., 1994, Szajna, 1996, Chung and Tan, 2004). Thompson et al. (1994) conducted a study that investigated the influence of

prior experience on PC utilization, arguing that the relationship between experience and usage is not straightforward. They found that experience influenced utilization directly, that indirect influences of experience on utilization were weak, and that the moderating influence of experience on perception and attitude was quite strong. In an attempt to examine the user acceptance of microcomputer technology, Igbaria (1993) found that computer experience had direct and indirect effects on perceived usefulness and user acceptance. Igbaria and Chakrabarti (1990), Igbaria et al. (1996), and Hubona and Geitz (1997) reported similar findings. A number of studies also found a relationship between computer experience and perceived ease of use (Igbaria and Iivari, 1995, Igbaria et al., 1995b). These authors corroborated the importance of prior computer experience in promoting increased microcomputer usage. In a study of factors related to microcomputer usage by middle managers, Lakhanpal (1994) found that a middle manager's prior experience with computers had a strong positive influence on microcomputer usage. Szajna (1996) used a revised Technology Acceptance Model. Her study results suggested that the addition of an experience component to the original TAM might be a significant enhancement. In a study to assess the role of prior experience, Taylor and Todd (1995b) suggest that the different variables within TAM may have different influences on usage depending on experience. The findings suggest that managers, who are more familiar and have more experience with Information Technology, will be more positive about its use. This leads to the following hypotheses:

H.A. 5.1. Computer (IT) experience is positively related to the perceived usefulness of the e-commerce system

H.A. 5.2. Computer (IT) experience is positively related to the perceived ease of use of the e-commerce system

5. Computer (IT) training

Several studies reported training is positively related to user beliefs, attitudes, and usage. Training in this context is the provision of hardware and software skills sufficient to enable effective interaction with the PC and an e-commerce system. Authors such as Igbaria and Chakrabarti (1990), Igbaria and Nachman (1990), Igbaria (1990), Igbaria (1994), Igbaria et al. (1995a), and Agarwal and Prasad (1999) have all suggested that user training is very likely to improve a person's perception and attitude toward the use of the technology by reducing or eliminating any fears they may have. Mawhinney and Lederer (1990) found that here was a direct link between managers using PCs and computer training. Training programs may also foster a feeling of self-efficacy, the belief that one can develop the skills necessary to effectively use microcomputers and strengthen confidence in one's ability to master and use them in one's work (Igbaria, 1993). Based on the research model, it is expected that computer training affects usage indirectly through its effect on perceived ease of use and perceived usefulness. Therefore, the following hypotheses were formulated:

H.A. 6.1. Computer (IT) training is positively related to the perceived usefulness of the e-commerce system

H.A. 6.2. Computer (IT) training is positively related to the perceived ease of use of the e-commerce system

A. Individual characteristics – personality of the manager

6. Computer anxiety

In their original article on TAM, Davis et al. (1989) mentioned that computer anxiety should be brought into future analyses of the factors affecting technology acceptance.

Computer anxiety is defined conceptually as the tendency of an individual to be uneasy, apprehensive, or fearful about the current or future use of computers in general (Igbaria and Parasuraman, 1989). Since then, a number of studies have been conducted documenting computer anxiety as a key variable related to perceived ease of use, perceived usefulness, attitudes, and usage (Igbaria and Parasuraman, 1989, Igbaria and Chakrabarti, 1990, Igbaria, 1993, Igbaria, 1994, Igbaria and Iivari, 1995, Parasuraman and Igbaria, 1990, Roberts and Henderson, 2000, Saade and Kira, 2006, McFarland and Hamilton, 2006). All authors provide empirical support to the notion that computer anxiety is a predictor of perceived usefulness and suggest that perceived usefulness may operate as an intervening variable between computer anxiety and usage. It has been suggested that individuals who experience high levels of anxiety are likely to behave more rigidly than individuals whose level of anxiety is relatively low. Based on the overview above, the following hypotheses have been developed:

H.A. 7.1. Computer anxiety is negatively related to the perceived usefulness of the e-commerce system

H.A. 7.2. Computer anxiety is negatively related to the perceived ease of use of the e-commerce system

7. User involvement

User involvement in the design and the implementation of information systems appears to be a key factor in the usage of an IT system. SME managers, the users in this case, normally have little or no time to devote to designing and implementing an e-commerce system. Only one study to date investigated user involvement in the context of the TAM model (Jackson et al., 1997). Barki and Hartwick (1989, 1994) redefine the user

involvement construct as consisting of two distinct constructs: user participation and user involvement. User participation refers to the behaviour and activities that users or their representatives perform in the system development process. User involvement refers to a psychological state of the individual, and is defined as the importance and personal relevance of a system to a user. Jackson et al. (1997) refer to these two constructs as situational involvement and intrinsic involvement, respectively. According to Hartwick and Barki (1994), there is a correlation between user involvement and attitude toward the system, an intermediate variable in the theoretical research model. Individuals who view the system as both important and personally relevant are also likely to have a positive attitude toward the system. In their study on user participation and system use, Hartwick and Barki (1994) found that voluntary use is strongly linked to attitudes and use as opposed to mandatory use, where no significant relationship was found. Jackson et al. (1997) found mixed relationships between the two involvement constructs and the two TAM beliefs. Intrinsic involvement had a significant positive effect on perceived usefulness, whereas situational involvement had a negative effect on ease of use. It was suggested that the latter finding is associated with the difficulty of developing effective complex information systems that will satisfy a variety of users.

Because we expect most SME managers and executives not to be drawn into the development process of the e-commerce system, we did not formulate any hypothesis on user participation. In line with the studies of Hartwick and Barki (1994) and Jackson et al. (1997), we believe user involvement to be positively related to the two beliefs. On the basis of this review the following hypotheses were developed:

H.A. 8.1. User involvement is positively related to the perceived usefulness of the e-commerce system

H.A. 8.2 User involvement is positively related to the perceived ease of use of the e-commerce system

8. Perceived fun/enjoyment

Davis et al. (1992) note the distinction between extrinsic and intrinsic motivation. Extrinsic motivation influences behaviour due to the reinforcement value of outcomes (e.g., perceived usefulness), whereas intrinsic motivation refers to the performance of an activity for no apparent reinforcement other than the process of performing the activity per se (e.g., enjoyment). The authors further define enjoyment as the extent to which the activity of using the computer is perceived to be enjoyable in its own right. Their study indicated perceived usefulness (an extrinsic motivator) is the first indicator of an intention to use computers; secondly, enjoyment (an intrinsic motivator) influences their behaviour. Van der Heijden (2003) added perceived enjoyment and verified that it positively affected an adopter's attitude towards personal website adoption. Similar findings are reported by Igbaria et al. (1996). Webster and Martocchio (1992) used the playfulness construct as a trait in their study, which is also described as guided by internal motivation and processes with self-imposed goals. Their findings emphasize the need to focus more attention on

positive influences of human-computer interaction, rather than negative influences, such as computer anxiety. This literature review leads to the following hypotheses:

H.A. 9.1. Perceived fun/enjoyment is positively related to the perceived usefulness of the e-commerce system

H.A. 9.2 Perceived fun/enjoyment is positively related to the perceived ease of use of the e-commerce system

B. Organizational characteristics – company characteristics

1. Organizational size

Few researchers explicitly take the size of the organization into account (Al-Gahtani and Olusegun Wallace, 1999, Grover and Goslar, 1993, Premkumar and Roberts, 1999, Thong, 1999, Thong and Yap, 1995). Rai and Bajwa (1997) (Rai and Bajwa, 1997) provide a rationale for the inclusion of organizational size in the study:

(1) larger organizations have more executives, who are spatially dispersed, thereby leading to a greater need for a sophisticated information technology infrastructure for communication and coordination,

(2) the complexity of larger organizations leads to a greater need for information infrastructures that can improve managerial control and planning systems, and

(3) larger organizations are more likely to be able to afford the costs of innovation.

Rogers (1995) remarks that the size of the organization is often included in innovation research, but most of the time has little theoretical importance. However, it is expected that large companies have enough resources to implement and support various information technologies. This leads to the following hypotheses:

H.B. 1.1. Organizational size is positively related to the perceived usefulness of the e-commerce system

H.B. 1.2 Organizational size is positively related to the perceived ease of use of the e-commerce system

2. IT maturity

Studies on TAM to date have not taken IT maturity and professionalism of the IT organization into account. Innovation research, however, indicates that the best predictor of IT use is increased knowledge about IT through the use of support functions (Larsen, 1993). In their study of the initiation, adoption, and implementation of telecommunications technologies, Grover and Goslar (1993) suggest that better funded, more mature, IS departments would tend to be proactive in evaluating and implementing telecommunications technologies. King and Sabherwal (1992) argue IT maturity represents the progress of the IS function from the era of data processing and management information systems into the strategic IS era. Similar remarks are made by Applegate et al. (1996), who coin four eras for the evolution of the IT infrastructure, ranging from the mainframe to the ubiquity of IT. Although the support variable (B.3) indicates the availability of a supportive organization, it does not reflect the level or credibility of a professional IT service organization. One of the reasons for improving the IT knowledge level is outsourcing (part of) the IT service organization. The following hypotheses are presented:

H.B. 2.1. IT maturity is positively related to the perceived usefulness of the e-commerce system

H.B. 2.2 IT maturity is positively related to the perceived ease of use of the e-commerce system

3. Organizational support

Organizational support consists of information centre support and management support. Information centre support is defined as the availability of development, assistance, and specialized instruction, guidance, coaching, and consultation in using microcomputer applications, whereas management support means management encouragement and sufficient allocation of resources (Igbaria, 1993). Based on the TAM model, Davis et al. (1989) stated that the two beliefs, perceived usefulness and perceived ease of use, are affected by user support consultants. Igbaria and Chakrabarti (1990) found that organizational support is positively associated with increased favourable attitudes. Thompson et al. (1991) include support for users as one of the facilitating conditions that can influence usage. Several other studies (Igbaria, 1993, Igbaria, 1994, Igbaria et al., 1995a, Igbaria and Iivari, 1995, Igbaria et al., 1996) confirmed the above findings, showing that organizational support influenced system usage directly or indirectly through perceived usefulness, perceived ease of use, and attitudes. In summary, in the context of personal use of information technologies, facilitating conditions will yield more positive user beliefs and attitudes and higher levels of system usage. The following hypotheses were derived from the review above:

H.B. 3.1. Organizational support is positively related to the perceived usefulness of the e-commerce system

H.B. 3.2 Organizational support is positively related to the perceived ease of use of the e-commerce system

B Organizational characteristics – social factors

4. Organizational usage

In his study on the factors contributing to microcomputer technology acceptance, Igbaria (1994) found that organizational usage, defined as use of IT by management, peers, and subordinates, had a positive direct effect on beliefs and motivation to comply. Moreover, when senior management uses computers, the individual use of end-user computing increases in the organization. These findings are confirmed in a later study (Igbaria et al., 1996). Thompson et al. (1991) also found that extensive organizational usage had a strong effect on individual usage. It is assumed that where microcomputers and software packages are widely used, more individuals are likely to perceive their use as the norm and to be favourably disposed toward using them. Therefore, the following hypotheses are proposed:

H.B. 4.1. Organizational usage is positively related to the perceived usefulness of the e-commerce system

H.B. 4.2 Organizational usage is positively related to the perceived ease of use of the e-commerce system

5. Social pressure

If it is a standard practice to use a PC and support packages in an organization, people will be highly influenced and even pressured to use these information technologies. These social norms, as Ajzen and Fishbein (1980) state, have an important influence on behaviour. The individual's notion of appropriate behaviour is influenced by the reference groups' subjective culture (Bergeron et al., 1995). Igbaria et al. (1996) used social pressure as an intermediate variable in their model, suggesting social pressure comes from individuals whose beliefs and opinions are important to them, such as supervisors, peers, and subordinates. These individuals use computerized systems because they think they will be perceived as technologically sophisticated by the people they regard as important. Their

findings show a direct link between social pressure and microcomputer use. Similar findings are reported by Igbaria (1994) and Thompson et al. (1991, 1994). According to Rogers (1995), peers and opinion leaders are important in the acceptance process. Consistent with the above findings, the hypotheses to be tested are:

H.B. 5.1. Social pressure is positively related to the perceived usefulness of the e-commerce system

H.B. 5.2 Social pressure is positively related to the perceived ease of use of the e-commerce system

B. Organizational characteristics – environmental characteristics

6. Environmental uncertainty

Although many innovation researchers emphasize the need to consider this contextual factor, Grover et al. (1993) are one of the few studies to take environmental uncertainty into account. In their study on the adoption of telecommunication technologies, they found supportive evidence that environmental uncertainty influenced the complete innovation cycle (initiation, adoption, and implementation). If managers are confronted with greater environmental uncertainty, they are more likely to effectively use information technologies to cope with the greater need to process information in such environments. Consequently, managers will need more external information, are more self-supportive, and have a better view of the possibilities of IT. This leads to the following hypotheses:

H.B. 6.1. Environmental uncertainty is positively related to the perceived usefulness of the e-commerce system

H.B. 6.2 Environmental uncertainty is positively related to the perceived ease of use of the e-commerce system

7. Competitor behaviour

Competitors play a major role in IT implementations. Many organizations are forced to use certain technologies to keep up with the industry standard. Porter's framework of competitive forces (referenced in Applegate et al., 1996) is often used to assess the competitiveness of an industry. Thong and Yap (1995) argue that competition and the strategic relevance of IT for the industry increase the likelihood of adoption of an innovation. It can be assumed that organizations using new information technologies (e.g. the Internet) force competitors to change their business needs for these technologies. As a result managers need to adopt new information technologies, most of the time not structurally planned. The following hypotheses can be postulated:

H.B. 7.1. Managers in a more competitive environment have a positive attitude toward the perceived usefulness of the e-commerce system

H.B. 7.2 Managers in a more competitive environment have a positive attitude toward the perceived ease of use of the e-commerce system

C. Characteristics of the IT resource

1. Accessibility

Accessibility is understood to mean access to a PC with a connection to an e-commerce system. Igbaria and Iivari (1995) refer to it as resource availability. They also emphasize the geographical aspects because North American users have more access to new technology than other users. As PCs become cheaper every year, it might seem trivial to include hardware and e-commerce access into account. Yet, accessibility largely determines IT use by managers. Moreover, accessibility is closely related to the need to have a complete and sophisticated system at hand. Every manager will ask whether it is

worthwhile having such a system and if it really saves him time retrieving the information he wants (Kraemer et al., 1993). Without doubt, the availability of an appropriate enabling technology (Fitzgerald and Murphy, 1994) is a prerequisite for access to e-commerce. In a recent study, Karahanna and Straub (1999) investigated perceived accessibility, encompassing both physical access to the system and the ability to use the system. They hypothesized and proved that accessibility influenced perceived ease of use, as physical access is a necessary condition of use. This literature review leads to the following hypotheses:

H.C. 1.1. Accessibility is positively related to the perceived usefulness of the e-commerce system

H.C.1.2 Accessibility is positively related to the perceived ease of use of the e-commerce system

2. Implementation process

This section is concerned with the manner in which managers are involved in the implementation of the e-commerce system. The nature of the implementation process refers to the strategy used to effectively incorporate the information system, the e-commerce system, in the activities of the manager. Although an information system is often centrally implemented for the total organizational unit, a separate strategy could be used for the e-commerce system implementation. Ideally, to fully leverage the IT investment, the e-commerce system should be deeply and comprehensively embedded in the executive's work (Sage and Zmud, 1993). It is assumed that a rational choice has been made for this infusion process. If there is a strategy, it is assumed that the user type and the characteristics of the e-commerce system are factors to be addressed. Griffith and Northcraft (1996) suggest the

implementation strategy should focus on positive values as well as negative surprises. They argue that negative surprises, if managed well, become valuable positive learning experiences for users. The presence of a senior executive as a sponsor also fiercely propagates and encourages the use of the e-commerce system. This leads to the following hypotheses:

H.C. 2.1. An effective implementation strategy is positively related to the perceived usefulness of the e-commerce system

H.C.2.2 An effective implementation strategy is positively related to the perceived ease of use of the e-commerce system

3.6.2 The intermediate variables – beliefs and attitude

The mediating variables have consistently been shown to predict actual usage. Based on TAM, perceived ease of use and perceived usefulness are thought to be potentially important determinants of system usage (Davis et al., 1989). Others also found perceived ease of use to have a strong effect on perceived usefulness (Gefen, 2003, Adams et al., 1992, Gefen et al., 2003). External variables influence system use through perceptions and attitude. Our hypotheses with respect to the intermediate variables are as follows:

H.M. 1. Perceived ease of use is positively related to perceived usefulness

H.M. 2. Perceived ease of use is positively related to the attitude towards use

H.M. 3. Perceived usefulness is positively related to the attitude towards use

H.M. 4. Attitude towards use is positively related to the usage of the e-commerce system

3.6.3 The dependent variable – system usage

There is no theoretically verified instrument to measure system usage. Most studies to date use self-reported measures. Davis (1993) uses two items to assess the frequency of use and amount of time using the target system. Other authors using TAM in their research also split actual use into these two measures (Adams et al., 1992, Davis et al., 1989, Hendrickson and Collins, 1996, Hubona and Geitz, 1997, Hubona and Kennick, 1996, Igbaria, 1994, Igbaria and Iivari, 1995). Few authors use objective measures to assess system use (Straub et al., 1995, Szajna, 1996). Objective use logs were not practical in the present study as it would be highly unlikely that an e-commerce system would reflect actual use, but only connect time. Bajaj and Nidumolu (1998) found that past use influenced perceived ease of use-a key factor in determining future use. They emphasize that a longitudinal model is needed to better understand IS usage, although they acknowledge the difficulty of conducting such a study in a business environment. Finally, Doll and Torkzadeh (1998) posit that the uni-dimensional concept of system use is not likely to provide sufficient explanatory power. However, their multidimensional instrument has not yet been extensively validated in other studies.

3.7 Summary

In this study, a large number of theories and studies have been evaluated in an effort to find an answer to the first research objective: What are the major factors that influence SME managers' use of IT, and in particular an e-commerce system? The discussions in the various sections of this chapter emphasize that there is no single theory or study that fully covers the constructs influencing beliefs, attitude and use. Also, the goal was not to identify every single possible variable that might affect IT usage or to be exhaustive regarding

possible variables and relationships in any of the categories. The three categories of external variables show a number of constructs that have not been investigated in TAM studies to date, but are likely to influence the two salient beliefs of the core TAM model. The model as depicted in Figure 3-2, which shows all variables and their relationships graphically, forms the basis for the hypotheses to be examined in the next two chapters. Furthermore, a summary of the hypotheses is given in Table 3-2; the sources for the constructs of the model are described in Table 3-3.

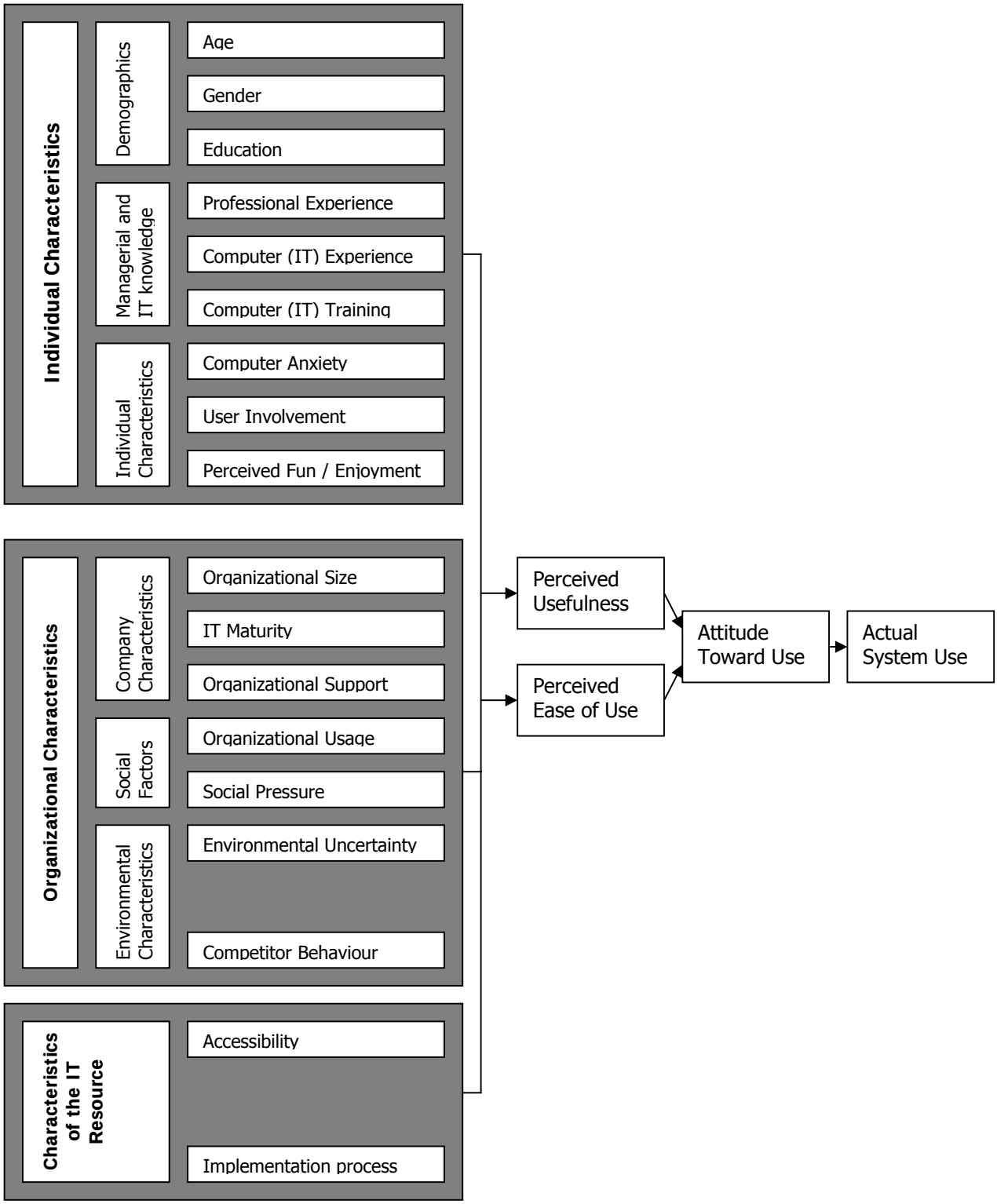

Figure 3-2 Full theoretical research model

Table 3-2. summarizes the hypotheses from the previous sections. Every construct from Categories A to C has two hypotheses related to the beliefs, perceived ease of use and perceived usefulness.

Construct		No.	Relationship
A. Individual Characteristics			
	Demographics		
	Age	H.A. 1	Negative
	Gender	H.A. 2	Men more than women
	Education	H.A. 3	Positive
	Managerial and IT Knowledge		
	Professional Experience	H.A. 4	Positive
	Computer (IT) Experience	H.A. 5	Positive
	Computer (IT) Experience	H.A. 6	Positive
	Personality of the Manager		
	Computer Anxiety	H.A. 7	Negative
	User Involvement	H.A. 8	Positive
	Perceived Fun / Enjoyment	H.A. 9	Positive
B. Organizational Characteristics			
	Company Characteristics		
	Organizational Size	H.B. 1	Positive
	IT Maturity	H.B. 2	Positive
	Organizational Support	H.B. 3	Positive
	Social Factors		
	Organizational Usage	H.B. 4	Positive
	Social Pressure	H.B. 5	Positive
	Environmental Characteristics		
	Environmental Uncertainty	H.B. 6	Positive
	Competitor Behavior	H.B. 7	Positive
C. Characteristics of the IT resource			
	Accessibility	H.C. 1	Positive
	Implementation process	H.C. 2	Positive
Mediating Variables			
	Perceived Ease of Use	H.M. 1	Positive to Perceived Usefulness
	Perceived Ease of Use	H.M. 2	Positive to Attitude Toward Use
	Perceived Usefulness	H.M. 3	Positive to Attitude Toward Use
	Attitude Toward Use	H.M. 4	Positive to use of e-commerce system

Table 3-2 Posited relationships

Table 3-3 lists relevant references for each construct considered.

Construct			Source
A. Individual Characteristics			
	Demographics		
		Age	(Brancheau and Wetherbe, 1990, Czaja et al., 1989, Harrison and Kelly Rainer, 1992, Hubona and Kennick, 1996, Igbaria, 1993, Igbaria and Parasuraman, 1989, Jarvenpaa and Ives, 1991, Morris and Venkatesh, 2000, Seely and Targett, 1997, Pijpers et al., 2001, Brigman and Cherry, 2002)
		Gender	(Dambrot et al., 1985, Gefen and Straub, 1997, Igbaria, 1993, Igbaria, 1990, Kwon and Zmud, 1987, Parasuraman and Igbaria, 1990, Venkatesh and Davis, 2000, Whitley, 1997, Ong and Lai, 2006)
		Education	(Agarwal and Prasad, 1999, Davis and Davis, 1990, Harrison and Kelly Rainer, 1992, Hubona and Blanton, 1996, Igbaria, 1993, Igbaria and Parasuraman, 1989, Mathieson et al., 2001)
	Managerial and IT Knowledge		
		Professional Experience	(Agarwal and Prasad, 1999, Larsen, 1993, Mathieson et al., 2001)
		Computer (IT) Experience	(Hubona and Geitz, 1997, Igbaria, 1990, Igbaria, 1993, Igbaria et al., 1995a, Igbaria and Iivari, 1995, Igbaria et al., 1996, Lakhanpal, 1994, Taylor and Todd, 1995, Thompson et al., 1994, Szajna, 1996, Chung and Tan, 2004)
		Computer (IT) Training	(Agarwal and Prasad, 1999, Alavi and Joachimsthaler, 1992, Igbaria, 1990, Igbaria, 1993, Igbaria, 1994, Igbaria and Nachman, 1990, Igbaria and Iivari, 1995, Mawhinney and Lederer, 1990)
	Personality of the Manager		
		Computer Anxiety	(Davis et al., 1989, Igbaria, 1993, Igbaria, 1994, Igbaria, 1990, Igbaria and Iivari, 1995, Parasuraman and Igbaria, 1990, Roberts and Henderson, 2000, McFarland and Hamilton, 2006, Saade and Kira, 2006)
		User Involvement	(Barki and Hartwick, 1994, Hartwick and Barki, 1994, Jackson et al., 1997)
		Perceived Fun / Enjoyment	(Davis et al., 1992, Igbaria et al., 1996, Webster and Martocchio, 1992, van der Heijden, 2003)
B. Organizational Characteristics			
	Company Characteristics		
		Organizational Size	(Cash et al., 1994, Currie, 1996, Grover and Goslar, 1993, Hope and Hope, 1997, King and Sabherwal, 1992, Klenke, 1994)
		IT Maturity	(Applegate et al., 2002, Grover and Goslar, 1993, King and Sabherwal, 1992, Larsen and Bloniarz, 2000)
		Organizational Support	(Davis, 1989, Igbaria, 1993, Igbaria, 1994, Igbaria, 1990, Igbaria et al., 1995a, Igbaria and Iivari, 1995, Igbaria et al., 1996, Thompson et al., 1991)
	Social Factors		
		Organizational Usage	(Igbaria, 1994, Igbaria et al., 1996, Thompson et al., 1991)
		Social Pressure	(Ajzen and Fishbein, 1980, Bergeron et al., 1995, Fitzgerald and Murphy, 1994, Igbaria, 1994, Igbaria et al., 1996, Thompson et al., 1991)
	Environmental Characteristics		

	Environmental Uncertainty	(Grover and Goslar, 1993, Rai and Bajwa, 1997)
	Competitor Behaviour	(Applegate et al., 2002, Fitzgerald and Murphy, 1994, Thong and Yap, 1995)
C. Characteristics of the IT resource		
	Accessibility	(Fitzgerald and Murphy, 1994, Igbaria and Iivari, 1995, Kraemer et al., 1993, Karahanna et al., 1999)
	Implementation process	(Griffith and Northcraft, 1996, Sage and Zmud, 1993)
Mediating Variables		
	Perceived Ease of Use	(Davis et al., 1989, Venkatesh and Morris, 2000)
	Perceived Usefulness	(Davis et al., 1989, Venkatesh and Morris, 2000)
	Attitude Toward Use	(Davis et al., 1989)
Dependent Variable		
	System Use	(Adams et al., 1992, Bajaj and Nidumolu, 1998, Davis, 1989, Davis, 1993, Davis et al., 1989, Doll et al., 1998, Hendrickson and Collins, 1996, Hubona and Geitz, 1997, Hubona and Kennick, 1996, Igbaria and Iivari, 1995, Leidner and Elam, 1995, Straub et al., 1995, Szajna, 1996)

Table 3-3 References for model constructs

4 Research methodology

4.1 Introduction

This chapter describes the research methodology used to test the research model and underlying hypotheses as described in the previous chapter. Also, the operationalization of the variables employed in the study is presented. In the last part of this chapter an introduction to Structural Equation Modelling is provided, as well as a rationale for its selection and the choice for AMOS 5.

Researchers in the information technology domain, like their colleagues in the social sciences field, employ a variety of research methodologies. The approach described below seeks to justify its appropriateness in the context of this study. The following characteristics describe the research process. These key research characteristics and methodology aspects are discussed in detail below.

Table 4-1 Research characteristics

Attribute	Characteristic
Method of research	Descriptive/exploratory and explanatory
Unit of analysis	Individual manager
Time dimension	Cross-sectional
Sample strategy	Purposive sampling
Research methodology	Field study
Data collection method	Survey

4.2 Research design

4.2.1 Methods of research

In general, there are three types or methods of research: (1) descriptive, (2) exploratory, and (3) explanatory. In the first part of this study the descriptive and exploratory methods are used to investigate and evaluate the factors influencing SME managers' use of e-commerce. This part of the research seeks to answer the first two

objectives of the study as laid down in Chapters 2, 3 and 5. In the second part of the research, the third objective, to achieve a parsimonious model for investigating relationships between different aspects of the phenomenon under review, is answered. An explanatory method is used and the results are described in Chapter 6.

4.2.2 Unit of analysis

Given that the goal of this study is to identify and evaluate factors influencing SME managers' use of e-commerce, the unit of analysis is at the individual level. Although an analysis of the individual's group or organizational level is not part of this study, how much a particular manager uses IT may well have a significant impact on his social or business environment.

4.2.3 Time dimension

In terms of time dimension, two options are available when conducting research: (1) cross-sectional and (2) longitudinal. In a cross-sectional study, the subjects are studied at only one point in time, whereas in a longitudinal study the subjects are studied over a longer period. Given the limited time available to most SME managers and the time required for a longitudinal study, it was decided that a cross-sectional approach would be most appropriate.

4.2.4 Sample strategy

Prospective participating organizations were subject to a number of criteria for the purpose of this study. The criteria for eligible target organizations using an e-commerce system were:

1. Organization had to classify as an SME.
2. Organization had to be based in the Netherlands.
3. The e-commerce system had to have been in operation for at least one year. This would ensure a stable system with a critical mass of users.
4. Unanimity within in the organization with respect to participation in the field study, shown by informed consent.

Collecting a simple random sample is often considered the best design to approach the sampling. However, the lack of a reliable nationwide sampling frame renders this option impossible. The sample method used to identify the participating organizations can best be described as purposive sampling. The basic assumption behind purposive sampling is that with an appropriate strategy we can choose the cases to be included, which will lead to a sample that is satisfactory in relation to our needs (Judd et al., 1991). Although it is acknowledged that purposive sampling can hamper generalization of the results, it is also widely used in social sciences. The rationale behind purposive sampling is that when a study is reproduced among many different purposive samples, showing comparable results, this will add to the strength of a theory. The total SME organisation network of the author was approached. This network consists of different types of SME organisations that together are a reflection of the types of SME organisation in the Netherlands as shown in Table 4-2

Branch	All companies (absolute)	All companies (percentage of Total))	SMEs (absolute)	SMEs (percentage of Total)	Customer base Netaffairs (absolute)	Customer base Netaffairs (percentage of Total)
Aggricultural	93365	12,5%	93365	12,53%	123	9,99%
Fishing	720	0,1%	715	0,10%	18	1,46%
Mining	215	0,0%	210	0,03%	0	0,03%
Industry	46605	6,2%	46405	6,23%	98	7,96%
Public industry (water, gas, etc)	550	0,1%	530	0,07%	0	0,00%
Construction industry	81690	10,9%	81640	10,96%	147	11,94%
Repairs consumer goods	164590	22,1%	164445	22,07%	296	24,04%
Restaurants and bars	36650	4,9%	36635	4,92%	45	3,65%
Transport, warehousing and communications	27925	3,7%	27850	3,74%	55	4,47%
Financial institutions	14665	2,0%	14630	1,96%	17	1,38%
Rental, commercial services	158650	21,3%	158495	21,27%	296	24,04%
Public management and insurances	1065	0,1%	940	0,13%	0	0,00%
Education	20500	2,7%	20365	2,73%	7	0,57%
Health care	42870	5,7%	42495	5,70%	55	4,47%
Culture, recreation; public services	56320	7,5%	56285	7,55%	74	6,01%
Total	**746365**	**100,0%**	**745030**	**100,0%**	**1231**	**100,0%**

Table 4-2 Overview Dutch SMEs by branch and size[3]

4.2.5 Research methodology

For this particular type of study conducting a field study in an organization should produce superior results to a laboratory study. This is because in a field setting using an e-commerce system is an integral part of the SME manager's job. Furthermore, a properly defined field study offers the researcher the opportunity to test the theory in realistic settings so as to best understand a SME manager's attitude and behaviour. One possible drawback is the relatively uncontrolled environment of the field setting. When conducting a field study the researcher opts for greater external validity at the expense of a decrease of the internal validity. By carefully selecting the subjects and technology used, concerns about the issue of control can be mitigated.

3 Based on the report "Companies by branch and size, CBS (2006) Bedrijven, per bedrijfstak en grootteklasse. Heerlen, Centraal Bureau voor de Statistieken.

4.2.6 Data collection method

The key question in data collection is what mode will be used to pose questions and collect answers from respondents. Given the research model, a great deal of information needs to be gathered from the respondents themselves, since this information is not available elsewhere. Two alternative modes of self-report were considered: (1) a self-administered questionnaire or (2) a face-to-face interview. An observational study was not considered useful because of the expected effects of social desirability in behaviour and the observer bias. In comparison to a face-to-face interview, a self-administered questionnaire has multiple advantages. It has a low degree of interviewer involvement, which increases the perceived privacy of respondents, which in turn increases the validity of the responses (Grooves et al., 2004). Furthermore, self-administered questionnaires can be completed in the respondent's own time and place, and difficult questions can be looked up. This is an extra advantage when the eligible respondents are companies or organisations (Snijkers, 2007). As managers are difficult to get in contact with and often do not have time available for in-depth interviews, a questionnaire was chosen to test the research model and its propositions. Then the choice was between postal questionnaires versus a digital questionnaire. Postal questionnaires were thought to be more appropriate because the sample would be small and digital questionnaires are notorious for their low response rate (Dillman, 2001). Furthermore digital questionnaires are perceived less and less as a guarantee for privacy protection (Weisband and Kiesler, 1996). This will be especially true when the respondents are IT experts.

4.3 Research procedure

4.3.1 Pre-test and pilot test

Both a pre-test and a pilot test were conducted to assess the quality of the questionnaire. For the pre-test, 8 colleagues within the company as well as 14 DBA students checked the questionnaire. They reviewed the questionnaire on the wording of the questions and answers, unclear instructions, redundant questions, the length of the questionnaire, question ambiguity, the format of the scales, the layout, and so forth. This led to eight changes. Furthermore, three companies that had declined to participate in the field study showed their willingness to assess a draft version of the questionnaire. Six of their managers were given the questionnaire and requested to check it for relevance and clarity. All reviewers were given precise instructions on how to assess the quality of the questionnaire. Their remarks indicated that only minor grammar and spelling alterations to the questionnaire were required. Every reviewer was sent a letter or e-mail of thanks and, as a sign of appreciation, was promised a copy of the final dissertation.

Overall, the results of the pre-test and the pilot test indicated that the questions were well understood and that the questionnaire and instructions were sufficient for SME managers to complete it without assistance being required. One drawback of the extensive questionnaire is the time required for completing it. However, I felt that the questionnaire could not be shortened if a useful indication of the constructs of the theoretical model was to be arrived at.

4.3.2 Field study

As stated above, purposive sampling was used to identify the organizations willing to take part in the study. As I work for an Internet consultancy company myself, I identified a group of companies that met the criteria for a potential object of study as mentioned in Table 4-2. Next, I contacted the managers of these companies by e-mail and asked if they had an operational e-commerce system and if they would be willing to participate in the study. A number of organizations were identified as prospective candidates.

Table 4-3 Overview criteria object of study

Criteria object of study
Organization has to classify as an SME.
Organization is based in The Netherlands.
The e-commerce system had to have been in operation for at least 1 year.
Unanimity within in the organization with respect to participation in the field study

The classification of SME is defined in section 1.1. 138 companies were approached to take part in the field study. A general research description detailing the objective and project schedule was sent by fax or e-mail to each contact person, a copy of which is contained in Appendix B. Of the original 138 organisations, 19 declined to participate, citing reasons such as the e-commerce system had not been in operation long enough, the information involved was too confidential, they never participated in this type of study, time constraints, and so forth. A number of organizations did not comply with the research criteria and were rejected. Often their e-commerce system was insufficiently used by SME managers. Table 4-3 gives a breakdown of the response to the questionnaires.

Table 4-4 Overview response to questionnaires

	Total
No. of companies approached	138
No. of companies that declined of were rejected	19
No. of companies that initially agreed to participate	119
No. of companies that withdrew on second thought	2
No. of companies that eventually took part	117
No. of questionnaires distributed	119
No. of questionnaires returned	117
No. of usable questionnaires	114
Response rate	98,3 %
Usable questionnaires	95.7 %

A total of 119 questionnaires were sent by post, accompanied by a letter explaining the procedure to be followed with the questionnaire and a cover letter (see Appendix B) explaining the purpose of the survey and giving reassurance on the issue of confidentiality. Most organisations returned the questionnaire within three weeks (65.5%). The non-respondents were reminded after four weeks by e-mail with a friendly request to send in the questionnaire. When the questionnaire was lost a new one was sent by mail. Two weeks later, only 17 organisations had not returned the questionnaire. Those companies were approached for the third time, now by telephone, to ask them for their participation. Finally, 117 were returned within 6 weeks. The data for this study was gathered during the spring and summer of 2005. Two organizations had second thoughts about participating and withdrew. This was because managers were unwilling to put time aside to complete the questionnaire. On closer analysis of the questionnaire, a number of SME managers refused to answer a number of questions that were of a personal nature. Further analysis revealed

that a number were incomplete and they were, therefore, dropped. This left a final number of 114 usable questionnaires for the sample, a response rate of 95.7 %.

4.4 Questionnaire development

In this section, the operationalization of the constructs addressed in Chapter 3 is explained. The instrument strategy is based, where possible, on existing construct measures taken from previous research. In some instances, existing measures have been adapted, while in other constructs changes in the wording have been made. Each of the measures used in this study is described below. Table 4-5 shows the 18 constructs, divided into 3 categories and 6 subcategories, as well as the 3 intermediate constructs and the dependent variable of the theoretical model. Table 4-5 also lists, where applicable, relevant references for the operationalization of each construct.

Table 4-5 References for construct measures

Construct			Source
A. Individual Characteristics			
	Demographics		
		Age	N/A
		Gender	N/A
		Education	N/A
	Managerial and IT Knowledge		
		Professional Experience	N/A
		Computer (IT) Experience	(Igbaria 1990)
		Computer (IT) Experience	(Igbaria 1990)
	Personality of the Manager		
		Computer Anxiety	(Igbaria and Chakrabarti 1990)
		User Involvement	(Hartwick and Barki 1994)
		Perceived Fun / Enjoyment	(Davis, Bagozzi et al. 1992; Igbaria, Parasuraman et al. 1996)
B. Organizational Characteristics			
	Company Characteristics		
		Organizational Size	N/A
		IT Maturity	(King and Sabherwal 1992; Grover and Goslar 1993)
		Organizational Support	(Igbaria 1990)
	Social Factors		
		Organizational Usage	(Igbaria 1994)
		Social Pressure	(Bergeron, Raymond et al. 1995)
	Environmental Characteristics		
		Environmental Uncertainty	(King and Sabherwal 1992; Grover and Goslar 1993)
		Competitor Behavior	(Thong 1999)
C. Characteristics of the IT resource			
		Accessibility	(Goodhue 1998)
		Implementation process	N/A
Mediating Variables			
		Perceived Ease of Use	(Davis 1989; Davis, Bagozzi et al. 1989)
		Perceived Usefulness	(Davis 1989; Davis, Bagozzi et al. 1989)
		Attitude Toward Use	(Taylor and Todd 1995a; Hubona and Kennick 1996)
Dependent Variable			
		Attitude Toward Use	(Davis 1993)

The following sections describe the operationalization of the questions in more detail.

4.4.1 External variables – Individual characteristics

Demographics

Single item questions were used to ascertain the respondents' age, gender, and educational level. The demographics variables were included in the questionnaire's personal information section.

Managerial and IT Knowledge

Three single-item questions were used to ascertain the respondents' professional experience. The computer experience of each respondent was assessed by asking them a number of questions to determine their working knowledge of computers, PC software and peripherals. The response options ranged from (1) very low to (5) very high, and were taken from Igbaria (1990). For computer (IT) training, first, the respondents were asked whether they had received any training from one or more sources: educational institute, vendor training, in-house training, or self-training. These items were also taken from Igbaria (1990). The response options ranged from (1) none or to a very little extent to (5) extremely intensive. Second, computer training was measured by each individual's responses to a number of questions, which asked them to report the extent of their training in microcomputers, PC software, and the e-commerce they had received. The response options ranged from (1) never or to a very little extent to (5) to a very great extent.

4.4.2 External variables – organizational characteristics

Company Characteristics

The organizational structure was analyzed on the basis of formalization. This was measured using King and Sabherwal's scale (1992). Organizational size was measured in

terms of total staff numbers of the organization as a whole. Organizational size was also measured using a self-reported sales figure for the organization as a whole. IT maturity was measured using a combination of instruments developed by Grover and Goslar (1993) and King and Sabherwal (1992). The measures of organizational support are taken from Igbaria (1990), who developed an instrument for measuring two categories of support, (1) information centre support and (2) management support. Apart from minor changes in the wording, the original scale was used.

Environmental Characteristics

Environmental uncertainty was measured using multiple-item scales, which capture the three components of uncertainty: heterogeneity, dynamism, and hostility (Grover and Goslar, 1993, King and Sabherwal, 1992). Environmental heterogeneity represents variations among the company's markets that require diversity in production and marketing orientations. Environmental dynamism reflects the rate of change and innovation in the industry and the unpredictability of the actions of competitors and customers. In contrast, environmental hostility indicates the degree of threat posed by the multifacetedness and intensity of the competition and the downswings of the company's principal industry. The items of the competitor behaviour construct were taken from Thong and Yap (1995).

4.4.3 External variables – Characteristics of the IT resource

The accessibility construct items were based on Goodhue (Goodhue, 1998). I developed items for the implementation process construct as well as the items for the user interface construct. However, I also make use of Sankar et al's (1995) generic DSS model and Bergeron and Raymond's (1992) study.

4.4.4 Mediating variables

The perceived usefulness was measured using a six-item scale from Davis (1989) and Davis et al. (1989) with appropriate modifications to make them specifically relevant to the tool under review. The measurement scale used for perceived ease of use is selected from Davis (1989) and Davis et al. (1989), again with appropriate modifications. The four items to measure attitude toward using were taken from Taylor and Todd (1995b) and Hubona and Kennick (1996).

4.4.5 Dependent variable

The items for system usage were based on Davis (1989).

4.4.6 Additional questions

The respondents were asked to classify themselves regarding their computer experience and e-commerce experience. The categories were taken from Seeley and Targett (1999) for the computer use type. All remaining questions were developed by myself. The questionnaire is contained in Appendix B.

4.5 Hypothesis testing

Hypothesis testing is done using the Structural Equation Modelling (SEM) technique, supported by the AMOS 5.0 software package, one of the modules of SPSS. The acronym AMOS stands for Analysis of Moment Structures, or more specifically, mean and covariance structures (Arbuckle and Wothke, 2004).

Structural Equation Modelling (SEM) encompasses an entire family of statistical procedures known by a variety of names, such as covariance structure analysis, latent

variable analysis and confirmatory factor analysis to name a few. SEM combines confirmatory factor analysis techniques with multiple regression analysis to a series of separate, but interdependent, multiple regression equations simultaneously. The advantages of SEM over repeated multiple regressions are: it becomes possible to check the overall goodness of fit of a proposed model, to compare the relative goodness of fit of competing models using the $\Delta \chi 2$ analysis, to modify a model according to relations in the data, and to compare different groups in one analysis . The program AMOS-5 was used (Byrne, 2001). AMOS is chosen for its user friendliness-it has a graphical interface that is very helpful in the translation of a theory into a statistical model. Furthermore, AMOS has a few features that are helpful in small sample analysis like the Expected Cross Validation indices (ECV) and the bootstrap procedure. Finally AMOS can impute missing data using a full maximum likelihood procedure, a procedure that is thought to be superior to the EM algorithm as in SPSS and equal to and sometimes better than propensity imputation (Rubin, 1996)

In essence, the structural equation modelling technique is top down, or theory driven and aims at demonstrating the overall plausibility of a theoretical model when it is confronted with empirical data. For a mathematical description of Structural Equation Modelling, refer to Appendix D.

When applying SEM on complex models, many researchers propose a two-stage process. A two-stage process is also a way to deal with smaller samples, since it helps to improve the power of the models (Boomsma and Hoogland, 1998). In stage one, scaling or data reduction is the primary object of the analysis; questions or items are combined to a number of observed constructs by means of Confirmatory Factor Analysis (CFA). Using CFA, an investigation into the structure between indicators (items or questions) and

constructs is carried out. CFA results in a series of factor loadings, which indicate the strength of the items as a measure for the underlying construct. These factor loadings are then used to compute a weighted mean for the underlying construct. This first phase is followed by the analysis of a structural model in stage two.

The structural model specifies the causal relationships (paths) between the constructs as posited by underlying theories. The analysis of the structural model results in estimated path coefficients which indicate the strength and sign of the theoretical relationship. As are suit, the various paths of the model, the hypotheses, are analyzed for their effect on the total model, that is, to optimize a number of fit indices.

Contrary to the theoretical considerations above, this study uses a dedicated approach for the analysis process of the various models. First, we will use confirmatory factor analysis to estimate the reliability and validity of the measures. Second, we will use the results of the CFA to estimate the structural model.

For the first part of the research process, all items / questions were grouped into 15 CFAs, typically corresponding to the constructs identified in Figure 3.2 (e.g., Professional Experience, Computer (IT) Experience, etc). As items like Age, Gender and Education cannot be combined to one construct, confirmatory factor analysis was not executed. An overview of which questions were used per CFA can be found in Appendix F. These CFAs models were used to evaluate the significance of each question for the construct, which suggests that this variable would also have a significant impact in the total model as represented in Figure 3.2. In the end only the measures that "passed" the measurement modelling phase were used in the computation of the final construct. This construct can than be added to the model as an observed variable. Clearly, as will be explained further on,

a single-stage analysis then is seen as the best approach. This is possible because of the strong theoretical rationale and highly reliable measures of the theoretical model, also confirmed by the results of the measurement model. So the first step in structural equation modelling is presenting the measurement model as is done below in Phase 1: Confirmatory factory analysis.

Based on the results of the Confirmatory Factor Analysis an initial model is constructed. Using Amos for the computations, the fit of the model is calculated. As will be shown in Phase 2: Structural model analysis, the fit of the model is increased by constructing alternative models. The procedures and assessment of how well the models fit will be described in greater detail in Phase 2.

This chapter described the research methodology, the operationalization of the variables employed in the study and an introduction to Structural Equation Modelling. The next chapter provides the research results, including the results of phase 1 and phase 2 as explained above.

5 Research results

5.1 Introduction

In this chapter the statistical procedures and the results are described. The statistical software package SPSS for Windows version 13.0 is used to lay down the initial data of the survey and to perform basic statistical tests on the raw data. Hypothesis testing is done using the Structural Equation Modelling (SEM) technique as described in the previous chapter. Before the results of these statistical analyses are presented, the characteristics of the population of interest are first discussed.

5.2 Descriptive statistics

Apart from the questions (indicators) relating to the various constructs, a large number of additional questions were asked of the respondents. Table 5-1 shows general information about the respondents. While some of the answers to general questions are used throughout the remaining sections, Appendix C contains more descriptive data about the respondents. This includes the functional work area, managers' use of information, IT and the e-commerce.

Table 5-1 Respondents demographics

Item	Mean	Std. Deviation
Years of work in present firm	7.46	5.71
Years of work in present position	5.02	5.40
Years of work in a managerial position	8.72	6.43
Number of employees in organization	38.71	35.18

At this point a number of remarks need to be made regarding the characteristics of the population. First, the educational level is relatively high-over 70% of the respondents have a bachelor or a graduate degree. Second, the average age is just above forty. The third and

final point is that the majority of the population (94,7%) answered to be an intermediate or advanced user of computers. These characteristics indicate a restriction of range, meaning less variance and potentially less fit. In later sections of this chapter, the characteristics of the respondents will be reviewed against the results of the hypotheses testing.

5.2.1 Initial assessment

A number of activities were performed to establish a good understanding of the collected data, as recommended by researchers such as Baumgartner and Homburg (1996). Apart from the obvious measures such as trying to identify coding errors and the appropriateness of the recoded variables, a large number of statistical techniques were performed on the raw data to examine missing data, distributional characteristics, univariate and multivariate outliers, linearity of relationships, and so forth. The next sections will further elaborate on these issues.

Normality

Several authors (Im et al., 1998, Kline, 2005) recommend examining the normality of the raw data. As SEM assumes multivariate normality, a number of tests were performed. The frequency distribution of all items was inspected by means of histograms as well as by computing the skewness and kurtosis of the measures, using both SPSS techniques and AMOS commands. All tests indicated the data were normally distributed.

Outliers

Outliers are cases with scores that are very different from the rest. Although there is no absolute definition of 'extreme', a common rule of thumb is that scores more than three standard deviations away from the mean may be outliers (Kline, 2005). As with normality

SPSS techniques and AMOS commands were used to detect outliers. The results highlighted no need to drop any cases from the sample.

Missing data

Missing observations are a fact of life when doing research and are often beyond the control of the researcher. Whilst only as little as 0,4% of the data was missing, we could assume the missing data to be MCAR, missing completely at random (Gorves et al. 2002). Therefore imputation of the missing data is justified. Amos uses full information maximum likelihood estimation (FIML) to handle missing data, a method that is superior to the EM algorithm that is provided by SPSS.

Sample size

The sample size plays an important role in the estimation and interpretation of SEM results, because it provides a basis for the estimation of sampling error (Hair et al., 2005). While a definite sample size does not exist, one criterion is that the number of observations is higher than the number of model parameters, which criterion is satisfied in this study. Another rule of thumb is a recommended size bandwidth between 100 to 200. In the present study, the sample size of 114 is above the lowest threshold and above the absolute minimum of 50 respondents (Hair et al., 2005). Another recommendation states the number of observations should be four times the number of observed constructs. In this study, 72 observations are necessary for the 18 observed constructs, which is less than the sample size of the present study. When a sample is small, the estimates can become less robust and dependent of the sample composition. To check for the robustness of the estimates for

variations in the sample a bootstrap can be performed (Kline, 2005). When the estimates are not biased, the sample composition is adequate.

Input data

SEM programs accept raw data as well as correlation/covariation matrices. In choosing between the two types of input data, Kline (1998) states that a number of considerations must be taken into account. Given that data is missing and in view of the method used to estimate the missing values, the raw data should be permitted to Amos.

5.2.2 Phase 1: Confirmatory factor analysis

CFA is used to study the relationships between a set of observed variables and a set of continuous latent variables. The aim of CFA is to test a hypothesized factor structure or model and to assess its fit to the data. Confirmatory factor analysis may be viewed as a submodel of the more general structural equation modelling (SEM) approach to analysis. Specifically, CFA is a measurement model of the relationships of indicators (observed variables) to factors (latent variables) as well as the correlations among the latter. Confirmatory factor analysis is generally based on a strong theoretical or observational foundation that allows the analyst to specify an exact factor structure in advance (Grimm and Yarnold, 2000). The CFA approach usually restricts which variables will load on which factors, as well as which factors will be correlated. This approach also provides significance tests on each factor loading coefficient, in contrast to relying on rules of thumb as is done in exploratory factor analysis (e.g., eigenvalue > 1 or factor loading cutoff criteria of .30 or .40). With CFA, each observed variable has an error term, or residual, associated with it that expresses the proportion of variance in the variable that is not

explained by the factors. These error terms also contain measurement error due to any lack of reliability in data for the observed variables.

Evaluation of each model was based on the consideration of a variety of fit measures, and model comparisons are based on incremental differences in fit using delta chi-square as an improvement indicator. An overview of the indices per CFA is presented in Appendix E. A brief discussion of the fit indices used follows under Phase 2: Structural Model Analysis.

5.2.3 Phase 2: Structural model analysis

The next phase in the research is to assess the structural model using the revised measure mode. Byrne (2000) and Chin (1998) among others strongly recommended providing the covariance matrix used in the model. The original theoretical model in Figure 3.2 was used to test the various relationships, the hypotheses, between the constructs.

As already mentioned a single-stage analysis was conducted for the sub-model. Single-stage means that the estimation of both structural and measurement models take place simultaneously.

The assessment of how well a model accounts for the data is based on a number of goodness-of-fit indices. There are currently no generally accepted measures of overall model goodness-of-fit, leading researchers to recommend the use of multiple fit criteria (Hartwick and Barki, 1994, Jackson et al., 1997). In the present study, a number of goodness-of-fit indices are employed. The chi-square statistic is the most used index, which tests the proposed model against the general alternative where all variables are correlated. With this index, significant values indicate poor model fit, whereas non-significant values indicate good model fit.

However, because the chi-square is sensitive to sample size, the chi-square/degrees of freedom index is a better indication of the fit of the model per degree of freedom used. But even better is the use of other indices to assess the overall model fit. The root mean square error of approximation (RMSEA) expresses the lack of fit due to reliability and model specification or misspecification (Browne and Cudeck, 1993). The RMSEA expresses fit per degree of freedom of the model and should be less than .1 for acceptable fit, with .05 or lower indicating a very good-fitting model. The goodness-of-fit index (GFI) ranges from 0 to 1, with values of .9 or greater indicating a good-fitting model. NFI represents the proportion of total covariance among observed variables explained by the target model when using the null (independence) model as baseline (Hu et al., 1999). The 3 model fit measures are recommended by various authors (Chau, 1997, Hartwick and Barki, 1994, Segars and Grover, 1993) and their recommend values are summarized in Table 5-2

Table 5-2 Goodness-of-fit measures recommended values

Goodness-of-Fit Measures	Recommended Value
Chi-square p-value	≥ 0.05
Chi-square/degrees of freedom	≤ 3.0
Goodness-of-Fit Index (GFI)	≥ 0.90
Normed Fit Index (NFI)	≥ 0.90
Root Mean Square Error of Approximation (RMSEA)	≤ 0.05

Next to a goodness-of-fit analysis, the model is also analyzed on statistical relevance, because significance is not the same as relevance and a significant fit is not necessarily an indication for the relevance of a model. Both standardized regression weights and the squared multiple correlation coefficient (R^2) provide a measure of the predictive power of the model. R^2 measures the proportion of the variance of the dependent

variables that is explained by the independent variables or indicators (Gefen et al., 2000, Harris, 1999).

The original model as depicted in Figure 1-1 is a so called second order model, with Characteristics of the IT resource , Organizational Characteristics and Individuals Characteristics as additional latent factors. The results of above mentioned analysis are shown in Table 5-3 and Table 5-4

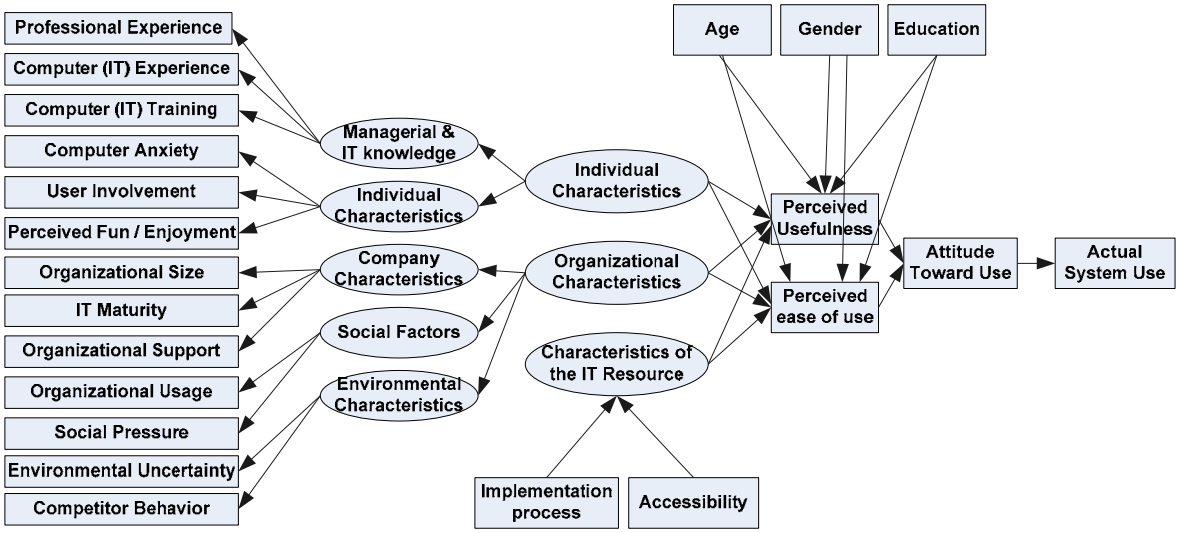

Figure 5-1 Initial model

Table 5-3 Goodness-of-fit measures: Initial model results

Goodness-of-Fit Measures	Recommended Value	Actual Value
Chi-square		448,333
Chi-square/degrees of freedom	≤ 3,0	2,423
Goodness-of-Fit Index (GFI)	≥ 0,90	0,770
Normed Fit Index (NFI)	≥ 0,90	0,607
Root Mean Square Error of Approximation (RMSEA)	≤ 0,05	0,112

Interpreting the contents of the table above leads to the following results. The chi-square/degrees of freedom indicator is below the recommended value and indicates a good fit. Most other fit indices indicate a bad fit of the model to the data. Similar field studies also found that the fit indices were below recommended values. As will be discussed later, the actual fit values improve, yet still not near or above the recommended values. In a discussion on the use of structural equation modelling in management information systems research, Chin (1998) notes that models with good fit indices may still be considered poor based on other measures such as R^2 and factor loadings. In our case, the path coefficients

and R^2 values indicate poor relevance: only 36% of the variance in actual use is explained by the model.

5.3 Model modification: An approach to alternative theoretical models

As Hair et al. (1998) and Rigdon (1998) postulate, a competing models strategy is required to gauge whether alternative models fit just as well, better or worse than the primary model. In both the initial research model as the original Technology Acceptance Model, the influence of the independent variables on the dependent variable 'actual useage' is by definition indirect, as it is mediated by the belief and attitude constructs. One of the objectives of this study is to examine the direct effects of the independent variables on 'actual usage'. To investigate this notion, an alternative model was defined and we introduced direct links between each of the external variables and the two dependent variables, as well as the attitude construct.

In the alternative model, a number of decisions are made to include or delete paths and constructs. As Harris (1999) remarks, these decisions should be based (1) on statistically reasonable criteria, (2) on a well-grounded knowledge of the phenomenon being studied, and (3) on the ability to provide reasonable and logically consistent explanations of the intercorrelations among the concepts and the variables in question. Anderson and Gerbin (1988), Im et al. (1998), and Schumacker and Lomax (1998) report similar arguments. This can be done using two different strategies: model building, i.e., adding paths and factor loadings to the model and model trimming, i.e. taking out all non-significant paths by constraining them to be zero. The AMOS software provides a very useful model building tool, known as modification indices, to conduct specific searches to

possibly improve the overall fit of a model. Modification indices are values associated with constrained or fixed parameters, that indicate the minimum amount that the overall chi-square statistic would decline (improve) if the constrain were removed or the parameter were freely estimated in the model (Ridgon, 1998). Although modifications are helpful in the exploration of a theory, in the end the theory should always be guiding the decisions of the researcher. Also, the correlations between the various constructs were examined for deletion, following the guideline suggested by Compeau and Higgins (1995).

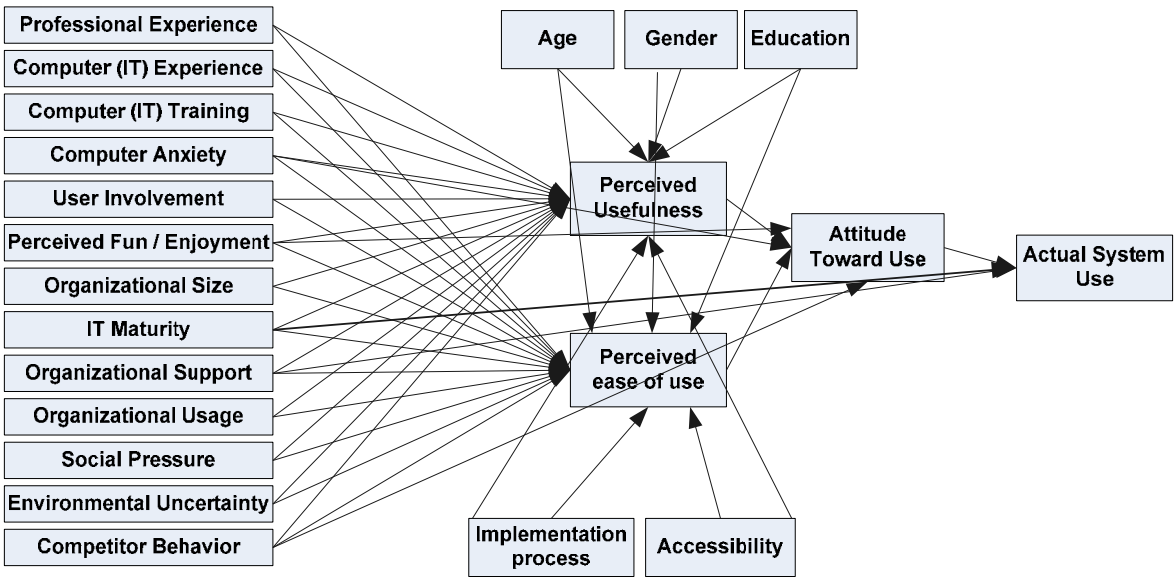

Figure 5-2 Alternative model

Table 5-4 Goodness-of-fit measures: Alternative model

Goodness-of-Fit Measures	Recommended Value	Actual Value
Chi-square		179,290
Chi-square/degrees of freedom	≤ 3,0	1,338
Goodness-of-Fit Index (GFI)	≥ 0,90	0,898
Normed Fit Index (NFI)	≥ 0,90	0,873
Comparative Fit Index (CFI)	≥ 0,90	0,955
Root Mean Square Error of Approximation (RMSEA)	≤ 0,05	0,045

Table 5-5 Structured equation mode: Alternative model

To / From	Perceived Usefulness	Perceived Ease of Use	Attitude Towards Use	Actual System Use
Age	-0,212*	-0,270**		
Gender	-0,122	-0,003		
Education	0,030*	0,008*		
Professional Experience	-0,081	0,227**		
Computer Experience	-0,433**	0,251**		
Computer Training	0,059	-0,185**		
Computer Anxiety	0,406**	-0,060	**0,514****	
User Involvement	0,060	-0,143		
Perceived Fun/Enjoyment	0,079**	-0,377**	**0,290****	
Organizational Size	0,048*	0,126		
IT Maturity	0,012	0,718*		**1,220**
Organizational Support	0,233**	0,629**		**0,284****
Organizational Usage	0,171	0,110		
Social Pressure	0,071	0,012		
Environmental Uncertainty	-0,271	-0,035		
Competitor Behaviour	-0,048	-0,012	**-0,239**	
Accessibility	0,178**	0,051		
Implementation Process	0,250*	0,174**		
Perceived Usefulness			0,350**	
Perceived Ease of Use	0,253**		0,021*	
Attitude Toward Use				0,537**
R^2	0,453	0,545	0,631	0,490

* $p<0,10$

** $p<0,05$

The alternative model was assessed whereby exogenous variables were connected directly to attitude and actual use and the role of the intermediate construct attitude towards use was examined. Next to this, all estimated regression weights were inspected. All non-significant values were set to 0. Again, the model was recalculated to inspect the

modification indices to establish which paths do not contribute significantly, but do contribute to the overall fit of the model. Based on the results the following paths were re-entered into the model: Computer Anxiety to Attitude, Perceived Fun to Attitude, Organizational Support to Actual System Use, IT Maturity to Actual System Use, Competitor Behaviour to Attitude and Access to Perceived ease of use.

The main rationale for this alternative model is in the original TAM: (1) the attitudinal construct is central to the underlying theoretical basis of TAM, and (2) TAM asserts that the principal influence of the belief constructs is on attitudes that subsequently influence system usage rather then system usage directly. Also previous studies contended that perceived ease of use and perceived usefulness do not fully mediate all external variables (Bajaj and Nidumolu, 1998, Mathieson, 1991), so the attitude construct could also mediate some of the external variables.

It was found that multiple paths from the external variables to the Attitude construct and Actual System Usage are statistical significant. The fit of the model improves significantly ($\Delta \chi^2 = 151.9$, df = 20, $p<.05$), although some goodness-of-fit measures still are not totally in compliance with the recommended values. The path coefficients and R^2 values indicate a good fit of model and data.

In summary

The initial model started with 18 observed and 8 latent variables, of which Individual Characteristics, Organizational Characteristics and Characteristics of the IT resource formed latent variables of the second order. All fit indicators indicated a

reasonable fit; however the path coefficients and R^2 indicate a poor fit. Finally, most external variables have a statistically insignificant path to the two belief constructs.

In an attempt to improve the model an alternative straight path model without any latent variables was introduced. From the 18 identified external variables in Figure 3-2 all variables were further investigated in this alternative research model. An evaluation of the behaviour of the above variables in the model reveals that most variables divide their influence over one or more relationships. Those variables that are not significant and do not contribute to the explanation of the model contribute to the total fit of the model and, as such are necessary.

Since N is relatively small cross-validation is difficult. In that case the Expected Cross Validation Index (ECVI) becomes the next best option (Browne and Cudeck, 1993). The ECVI is 1.693, which is satisfactory (Byrne, 2001), meaning that the model would be stable across different samples.

To further test the alternative model, a bootstrap procedure was performed. The Bollen-Stine bootstrap was performed to check the robustness of the fit of the final model. After 2000 bootstrap samples were taken, the model could not be rejected ($p = .287$), thus the fit of the model is robust.

The conventional bootstrap, again with 2000 samples, showed that almost all significant regression weights are robust, and the bias of the mean was not found significant. For two paths the bias of the bootstrapped regression weight could indicate a problem with the estimation. The path of access to perceived use (mean = -.175, bias, -.018, sd of the bias = .002) and the path of easy use to computer experience (mean = .191, bias = -.018, sd of the bias = .004) show a significant bias from the original regression weight.

Looking at these overall results we conclude that the model should not be rejected right away because of the small sample size, but that model seems to be underpowered and that collection of additional data is required as future work.

Nevertheless, except for two paths all weights are robust for fluctuations in the sample. Therefore, this model will be used to test the hypotheses of the research model.

5.4 Results of hypothesis testing

The final testing of the hypotheses involves interpreting the findings of the structural equation models. Each path in the final model represents a hypothesis and its size, sign, and statistical significance should be assessed for the model support (Im et al., 1998). In the previous chapters and sections, a number of constructs were excluded from further analysis. In the next paragraphs, the results of the remaining significant constructs will be discussed in detail. The hypotheses are based on the initial research model, represented in Figure 3.2. The additional paths between the external variables and the attitude construct and both usage constructs were originally not hypothesized in Chapter 3; nonetheless, they are also discussed here. Unless stated otherwise, it is assumed that the additional hypotheses have the same relationship suggested by the two original hypotheses (i.e., from the external variable to perceived usefulness and perceived ease of use). Other determinant variables with no significant relationships are also discussed (see Section 5.4.4). The results of the hypotheses testing will be used in Chapter 6 for the definition of the parsimonious model: the e-Tam model.

Table 5-7 data show that a number of antecedent variables had a significant effect on perceived usefulness, perceived ease of use, and attitude. The results also show that there are only a few variables directly influencing attitude towards use or actual system use.

The findings of this study strongly suggest that all three characteristics categories affect the intermediate and dependent variables. In the next sections the determinant variables and possible explanations of the findings are discussed.

5.4.1 Individual characteristics

For the first category, individual characteristics, the results of the hypothesis testing are summarized in Table 5-6.

Table 5-6 Hypotheses results of the individual characteristics variables

No.	Construct	Relationship	Dependent Variable	Supported?
H.A.1	Age	Negative	• Perceived Usefulness	Yes
			• Perceived Ease of Use	Yes
			• Attitude Towards Use	N/A
			• Actual System Use	N/A
H.A.3	Education	Positive	• Perceived Usefulness	Yes
			• Perceived Ease of Use	Yes
			• Attitude Towards Use	N/A
			• Actual System Use	N/A
H.A.4	Professional Experience	Positive	• Perceived Usefulness	No
			• Perceived Ease of Use	Yes
			• Attitude Towards Use	N/A
			• Actual System Use	N/A
H.A.5	Computer Experience	Positive	• Perceived Usefulness	Yes
			• Perceived Ease of Use	Yes
			• Attitude Towards Use	N/A
			• Actual System Use	N/A
H.A.6	Computer Training	Positive	• Perceived Usefulness	No
			• Perceived Ease of Use	Yes
			• Attitude Towards Use	N/A
			• Actual System Use	N/A
H.A.7	Computer Anxiety	Negative	• Perceived Usefulness	Yes
			• Perceived Ease of Use	No
			• Attitude Towards Use	Yes
			• Actual System Use	N/A
H.A.9	Perceived Fun/Enjoyment	Positive	• Perceived Usefulness	Yes
			• Perceived Ease of Use	Yes
			• Attitude Towards Use	Yes
			• Actual System Use	N/A

Age

As hypothesized, age had a strong negative effect on the two beliefs. Interestingly enough, no difference was found in managers' attitudes towards the use of e-commerce between the various age categories, contrary to previous research (e.g., Igbaria and Parasuraman, 1989). The data in Table C.3 (Appendix C) show the age categories of the respondents.

The hypothesis results indicate that younger managers perceive e-commerce to be more useful and easier to use in their work environments than do their older counterparts. This is understandable because older managers need more time to achieve the same results, based on the general opinion that younger people are more IT literate, are able to work faster to achieve the same results, and older people may have difficulty in acquiring the necessary skills to use information technology effectively (Czaja and Lee, 2003, Czaja et al., 1989). Because only a few studies specifically investigated the relationship between age and use (Igbaria, 1993, Khalil and Elkordy, 1997, Morris and Venkatesh, 2000, Vandenbosch and Higgins, 1995a, Venkatesh et al., 2003, Yi et al., 2006), ample theoretical reference material is not available.

However, when viewing managers IT literacy profiles in this study-which apart from age, include IT experience, IT training, and self-rated use of computers and an e-commerce-the older manager has, in line with what might be expected, has taken fewer IT courses, is less experienced with computers, and uses fewer computer and e-commerce functions. Table C.5 shows the research results relevant to these statements. In light of the fact that the average senior manager received no IT training at school, bringing senior

management up to scratch on IT use is a prerequisite to breaking the vicious circle of computer anxiety. Learning IT skills is not just something younger managers do, it is simply that older managers generally have limited or no opportunity to gain from their investment in learning new technologies and skills. However, managers often have a long enough career in front of them before retirement to be able to reap the benefits of their new skills. The above suggests that older managers have less positive beliefs about e-commerce and need more time to familiarize themselves with its commercial potential.

Education

Another user factor that relates to individual differences and is not specifically investigated in TAM to date is education. As shown in Table C.6, the educational level of managers is relatively high. Overall, the findings of this study corroborate the influence of education on both perceived usefulness and perceived ease of use, suggesting the level of education is indicative of a manager's ability to learn new information technologies. Although interpreting the results must be done in the context of certain limitations of the study, one might conclude that better educated persons develop positive opinions about IT and its use, and have a greater ability to learn in a novel situation (Agarwal and Prasad, 1999). This contradicts the often-referred to notion that managers attempt to hide basic computer illiteracy by claiming they are incapable of learning all these new IT skills.

Professional Experience

The length of tenure in a managerial position, measured as the construct of professional experience, was found to have a non-significant relationship with perceived usefulness and a significant relationship with perceived ease of use. The findings of the study show a strong relationship between professional experience and age, indicating that

length of tenure in a managerial position represents a surrogate for age. Contrary to research conducted by Agarwal and Prasad (1999), length of tenure was positively associated with usefulness, suggesting that experienced managers see the benefits of an e-commerce, although they clearly do not make use of those benefits. Professional experience did not affect perceived usefulness (Yi et al., 2006), probably because experienced managers do not use e-commerce often enough and are therefore indifferent towards whether or not the e-commerce is useful or not.

Computer training

Computer training exhibits only a significant positive relationship with perceived ease of use. This is in accordance with the findings of Venkatesh and Davis (2000) that training mechanisms aimed at improving the computer self-efficacy of users is more likely to be effective in gaining user acceptance. However, other authors (Igbaria et al., 1997a) examined the impact of internal and external training, internal and external support, and top management support on perceived usefulness and perceived ease of use They concluded that while internal training had no significant effect on perceived ease of use, it did have a significant effect on perceived usefulness. On the other hand, they observed that external training had no significant effect on perceived usefulness but it did have an effect on perceived ease of use. Thus, the impact of training on perceived ease of use and perceived usefulness might be dependent on its nature and source. In conclusion, other constructs in this study are more likely to identify the influence of the antecedent dimensions for belief and use.

Computer Anxiety

As many authors have found previously, computer anxiety has a significant impact on perceived usefulness and on the attitude towards use. However, its influence on perceived ease of use was non-significant. In most studies computer anxiety is a key intermediate variable, influenced by a number of other variables used as external variables in this study and in turn having a positive impact on beliefs, attitude, or use. As the results in this study indicate, only the perceived usefulness construct is significantly influenced, so efforts to reduce computer anxiety can only be instrumental in this belief. Several studies found evidence that a number of variables have a clear relationship with computer anxiety, such as computer experience, demographics, computer playfulness, and computer self-efficacy (Brosnan, 1999, Compeau et al., 1999, Day and Makirinne-Crofts, 1997, Maurer, 1994, Thomas, 2006, Webster and Martocchio, 1992).

Although intuitively appealing to investigate, one of the limitations of this study is that correlations between external variables are excluded. Yet the perceived usefulness of e-commerce or any information system is not just a function of anxiety, but rather a function of a complex interplay of a number of factors, a large number of which are related to the field of human-computer interfaces (Thomas, 2006). Computer anxiety is not a permanent, unchanging characteristic of the individual and it can be altered through adequate training offered at the user's level of ability and confidence. By carefully selecting situations, individuals who experience anxiety can encounter positive reinforcement and control over their computer interactions. These efforts to reduce computer anxiety should be

instrumental in improving managers' perceptions and behaviours about computers and e-commerce, thereby increasing the likelihood of their using them (Igbaria and Iivari, 1995).

Perceived Fun / Enjoyment

A key finding of the present study is that perceived fun/enjoyment plays a pivotal role in the antecedents of the use constructs. The relationship with the two use constructs is equivocal, because of the negative relationship with perceived ease of use and the positive relationship with perceived usefulness. Next to this, a direct positive relationship exists with attitude towards use. A possible explanation is that managers see the commercial benefits and productivity advantages of an e-commerce, but find it difficult to operate. Another explanation for the discrepancy in the results might be that perceived fun / enjoyment is an intermediate construct, next to the two other belief constructs, instead of an independent, external variable. Previous research (Roberts and Henderson, 2000, Igbaria et al., 1994, Igbaria et al., 1995b) has theorized this possibility and found ample evidence that perceived fun was directly and positively related to usage, although not as strongly as perceived usefulness.

Consistent with the findings of Davis et al. (1992) and Webster and Martocchio (1992), the findings suggest that an e-commerce system that is enjoyable to use contributes to increased levels of acceptance, competence, involvement, and satisfaction. Constructs such as playfulness and enjoyment present starting points for work that aims to create more favourable user perceptions about technology. In summary, just as people are more likely to make an effort when a task is enjoyable and externally rewarding, managers will also be more likely to use an e-commerce system or any other technology when it is fun to use as well as being useful or beneficial.

5.4.2 Organizational characteristics

The results of the hypotheses testing for the second category, organizational characteristics, are summarized in Table 5-7

Table 5-7 Hypotheses results of organizational characteristics variables

No.	Construct	Relationship	Dependent Variable	Supported?
H.B.1	Organizational Size	Positive	• Perceived Usefulness	Yes
			• Perceived Ease of Use	No
			• Attitude Towards Use	N/A
			• Actual System Use	N/A
H.B.2	IT Maturity	Positive	• Perceived Usefulness	No
			• Perceived Ease of Use	Yes
			• Attitude Towards Use	N/A
			• Actual System Use	No
H.B.3	Organizational Support	Positive	• Perceived Usefulness	Yes
			• Perceived Ease of Use	Yes
			• Attitude Towards Use	N/A
			• Actual System Use	Yes

Organizational Size

Organizational size exhibits only one small significant positive relationship with perceived usefulness. The findings indicate that individuals in larger organizations indeed use the e-commerce more, probably because they can rely on a stronger support organization and ample resources in terms of time and money.

Other constructs in this study are more likely to identify the influence of the antecedent dimensions for belief and use (e.g., perceived fun/enjoyment or organizational support). The remarks Rogers (1995) makes in his study about size often being a surrogate measure for other organizational constructs can then be taken into account.

IT Maturity

The results indicated there was only one significant relationship between IT maturity and any of the intermediate or dependent constructs: perceived ease of use. A possible explanation could be that IT organizations at present have at least a minimum knowledge and expertise regarding IT to support individuals effectively. This is confirmed implicitly by the organizational support construct (see next section), because the best predictor of IT use is still through the use of support functions. One might also posit that the necessary support for an e-commerce system is more available currently and therefore the maturity of IT becomes less of a distinguishing factor.

Organizational Support

Consistent with the hypotheses and most previous research, strong relationships were found between organizational support perceived usefulness, perceived ease of use and actual use. It once again corroborates the importance of support, i.e., people in the organization who help the managers to become more proficient. Organizational support incorporates two separate components: information centre support and management support. This indicates that management plays a leadership role in the organization of the support function. As to be expected, support for the e-commerce system has a significant impact on perceptions of ease of use or usefulness. The data confirms that the existence of support functions positively influences the perceived ease of use in addition to other relevant factors such as perceived usefulness. This is supported by several studies (Karahanna and Straub, 1999, Thompson et al., 1991, Venkatesh and Morris, 2000).

5.4.3 Characteristics of the IT resource

For the third category, characteristics of the IT resource, the results of the hypotheses testing are summarized in Table 5-8

Table 5-8 Hypotheses results of characteristics of the IT resource

No.	Construct	Relationship	Dependent Variable	Supported?
H.C.1	Accessibility	Positive	• Perceived Usefulness	Yes
			• Perceived Ease of Use	No
			• Attitude Towards Use	N/A
			• Actual System Use	N/A
H.C.2	Implementation Process	Positive	• Perceived Usefulness	Yes
			• Perceived Ease of Use	Yes
			• Attitude Towards Use	N/A
			• Actual System Use	N/A

Accessibility

Table C.8 shows respondent access to the e-commerce system, with nearly all of them having direct access to a system. There is a significant relationship between accessibility and perceived usefulness, suggesting that its functionality is better qualified once a manager has access to an e-commerce system. Inconsistent with previous studies (e.g., Karahanna and Straub, 1999), the perceived ease of use is not strong; a more accessible e-commerce system does not mean that less effort is needed to use it.

Implementation Process

A positive relationship was found between the construct implementation process and perceived usefulness and perceived ease of use. This means that a manager who was

involved in the definition of the requirements and the e-commerce system implementation will use the system more than those who were not involved.

The presence of a person in the organization who fiercely advocates and encourages the use of the e-commerce contributes to its success. We conclude that management involvement in the e-commerce project is necessary but not sufficient by itself to secure full use of all the capabilities of the e-commerce. Or to rephrase it negatively, if there is no management involvement in the selection and implementation of an e-commerce system, and e-commerce is imposed on them, it is highly unlikely that the e-commerce system will be optimally used. Management culture should be built around the need to sponsor an e-commerce system, allowing IT investment and organizational effort to be fully leveraged.

5.4.4 Non-significant constructs

The constructs that showed no significant relationships are described in Table 5-9

Table 5-9 Non-significant constructs

No.	Construct
H.A.7	User Involvement
H.B.4	Organizational Usage
H.B.5	Social Pressure
H.B.6	Environmental Uncertainty
H.B.7	Competitor Behaviour

Of all 18 constructs examined, 5 did not affect the two belief, the attitude, or the usage constructs

Inconsistent with prior research, user involvement had no influence on beliefs, attitude, or use. One reason for this might be that SME managers feel that the use of an e-

commerce system is forced upon them. Hartwick and Barki (1994) confirm that mandatory system use does not generate a significant relationship between attitudes and use.

A number of variables in the organizational characteristics category did not affect the beliefs. The most surprising finding was the lack of significance of the social pressure construct. As noted in Section 2.3, subjective norm, a person's perception that most people who are important to them think he should or should not perform the behaviour in question (Fishbein and Ajzen, 1975), is not included in the original TAM. Several researchers posit that TAM doesn't account for social influence in the adoption and utilization of new information systems. Davis (1989) and Davis et al. (1989) noted that it is important to account for subjective norm, the construct denoting social influence. However, they observed that the conceptualization of subjective norm has theoretical and psychometric problems. Recent work from Venkatesh and Davis (2000), however, included subjective norm as one of the social influence processes, and found significant influence on user acceptance. A number of recent studies (Lucas and Spitler, 1999, Malhotra and Galletta, 1999, Venkatesh and Morris, 2000) have been conducted on the important variable subjective norm; these studies also found strong direct relationships between subjective norms and usage.

The rationale for including the social pressure construct, similar to subjective norm, in my study was given in the conceptualization of hypothesis H.B.5 (see Section 3.6.1). Moreover, the role of the social influence processes in IT acceptance and usage is important, because usage behaviours caused by one's own attitude are more sustainable in the absence of external influences, such as peer pressure. The measures of social pressure used in this study were found not to have any significant effect on any of the intermediate

or dependent variables. One reason for this might be that managers are appointed for their ideas, style, and personality and hence are not likely to be highly influenced by peers or subordinates. Any mandate imposed on them about using IT for their job is doomed to fail. Also, it is likely that the influence of peers and superiors will diminish to non-significance over time with increasing experience with the target system. It is also highly likely that our results are due to the fact that managers do not really have visible superiors. They are also not required by subordinates to use IT, and are obliged to decide themselves how they will use IT. The effect of social environment on managers' perceptions and use of IT is therefore very low.

Finally, the constructs of Environmental Uncertainty and Competitor Behaviour had no significant relationship. Although the explosive growth of the Internet, the impact of the European Union, and growing need to expand markets would suggest otherwise, no environmental influences were found to be important with respect to manager beliefs, attitude or usage. The argument that the competitive nature of the business environment forces organizations to consider developing e-commerce is therefore questionable, since respondents did not rate this as a factor.

5.4.5 Mediating variables

The results of the hypotheses testing for the intermediate variables are summarized in Table 5-10

Table 5-10 Hypotheses results of the mediating variables

No.	Construct	Supported?
H.M.1	Perceived ease of use is positively related to the perceived usefulness	Yes
H.M.2	Perceived ease of use is positively related to the attitude towards use	Yes
H.M.3	Perceived usefulness is positively related to the attitude towards us	Yes
H.M.4	Attitude towards use of IT is positively related to the existing usage of the e-commerce system	Yes

As hypothesized, attitude toward use was determined jointly by perceived usefulness and perceived ease of use; these two variables explained, 63% of the variance in attitude. The relative importance of perceived usefulness and perceived ease of use has been shown to be different in prior work. For instance, Davis (1993) found that usefulness dominated ease of use, while Adams et al. (1992) found ease of use to be more influential than usefulness. A possible explanation is that usefulness and ease of use are relative concepts and not innate attributes of the system, and can be perceived differently by different individuals (Agarwal et al., 1996).

Consistent with most research in TAM, perceived usefulness and perceived ease of use exhibit influence on the acceptance and use of an e-commerce system (see

Table 5-5). In agreement with TAM, both beliefs have a significant effect, which may suggest that managers are relatively pragmatic and tend to focus on the usefulness of the technology and at the same time assimilate a new technology quickly.

As found in Davis'study (1989), ease of use operates through usefulness, but also has a direct link to attitude. In the original TAM and in later studies, the relationship between perceived ease of use and perceived usefulness was found to be significant only after prolonged use (Browne and Cudeck, 1993, Adams et al., 1992, Davis et al., 1989, Jackson et al., 1997). One of the prerequisites of the participating organizations was a stable information system in use for at least one year. A possible explanation in this study is that ease of use only has a high impact during the early stages of a e-commerce systems use and becomes less important with increased exposure to the technology (Subramanian, 1994). Managers have to get used to a new system, so an easy-to-use interface is probably beneficial in determining their perceptions about the system's functionality. Another plausible explanation is that managers want to spend as little time as possible learning about the e-commerce system to be able to use it properly. Ease of use is not perceived to them to be related to the functionality of the e-commerce system–i.e., its usefulness-because it interferes with their daily routine and managerial tasks. Empirical evidence for this explanation was identified by Mathieson and Keil (1998), whose study found that the task/technology fit affects perceived ease of use.

5.4.6 Actual use

The dependent variables perceived usefulness and perceived ease of use were, by means of attitude towards use, used to assess e-commerce system use. As explained earlier, they were positively correlated. Although not all variables were significant, nevertheless

they were relevant to make the model fit. The final model explains much of the variance, independent variables explain 45% of the perceived ease of use, 55% of the perceived attitude, 63% of the attitude towards use and 49% of the actual use.

5.4.7 Concluding remarks

As highlighted age, education, professional experience, computer experience, computer training, computer anxiety, perceived fun/enjoyment, organizational size, IT maturity, organizational support, accessibility and the implementations process have a direct and statistically significant relationship with the actual usage construct. All these variables appear to be important in affecting the individual's decision to use the e-commerce system. Nonetheless, a number of these relationships have not escaped criticism in the previous sections.

Based on our results, several general and important inferences can be made. First, the core TAM model is applicable in this study. Second, all three categories identified in Section 3.5 play an important role in the model. Third and finally, it was surprising to see that most significant variables were aimed at the individual level.

In this chapter, the second objective of the research was highlighted: Which of the factors identified in Chapter 3 influence the actual use of an e-commerce system, either directly or indirectly through user beliefs and attitudes? The results of the third alternative model answer this question and show what factors and relationships are statistically relevant for this IT tool, an e-commerce system. The next chapter will address the third research objective by building a model to be used in assessing managers' use of IT. The results as obtained in this chapter are used to develop this concise yet comprehensive

model. Although some remarks regarding the applicability of these results are made in the next chapter, the final conclusion of the study results is presented in Chapter 6.

6 e-Tam model[4]

6.1 Introduction

In the previous chapters, the first two objectives of the research study were described. The third objective was to develop a parsimonious model that can predict the use of information technologies by managers. Coined the e-Tam model, the model was developed using the results of this study specifically aimed at managers and e-commerce systems. Based upon the results of the previous chapters, the overall goal for this model is twofold:

a. to achieve parsimony in the number of constructs used as external variables, and
b. to provide a theoretically and practically sound explanation why a construct and its relations are considered.

The model should also help in emphasizing what interventions should be used to increase use of information technology, because the Technology Acceptance Model explains usage in terms of individual beliefs and attitude, but does not address how managers can proactively influence users' attitudes and actions toward desired organizational goals.

6.2 Modelling the antecedents

The models described in the previous chapter validate the notion that perceived usefulness, perceived ease of use, and attitude toward use are instrumental in promoting managements' use of the e-commerce. Hence, the core TAM should be part of the e-Tam Model, where all core variables exhibit a positive relationship with one another. However, external variables, as divided over the various categories, are also an important consideration with respect to the process of using information systems for managers. Both the indirect and direct effects of these external variables on actual use need to be

[4] The name e-Tam model was first introduced by Van der Heijden (2000), a revised version of TAM, explaining website revisits.

considered. Although the results of the hypotheses expounded in this study will be used to a large extent, a number of considerations influenced the actual selection of the constructs as well as their relationships with the intermediate and dependent variables. As the sample size may conceal significant relationships that from a theoretical point of view were expected, a number of constructs will be used based solely on the findings of comparable studies. In Chapter 3 all relevant factors (variables) were described and supported with evidence taken from literature. This resulted in the theoretical research model as depicted in Figure 3-2. Chapter 5 examined the statistical significance of these relevant variables for the intermediate and dependent variables of the theoretical research model. In this chapter, both the relevance and significance of the variables are re-assessed and used to define of a new model. Furthermore, the following starting points also apply to the definition of the e-Tam Model.

First, it is assumed that all external variables are not correlated and have an equal weight towards the belief and attitude constructs. Similar TAM studies found equivocal evidence for the interdependency of a number of external variables used in this study. Others found compelling evidence that key constructs (e.g., computer experience) predicted external variables (e.g., computer self-efficacy) that in turn influence beliefs and attitude. In this study, for instance, results indicate that there is a strong relationship between age on the one hand, and professional experience and computer experience on the other.

Second, the type of information system involved influences the importance that an individual attaches to a set of antecedents of his beliefs. It might be argued that one set of belief antecedents might be more salient than another for different types of information systems or information technologies. Similarly, there is no variable that measures the

complexity of the technology used. Users' attitudes to multipurpose integrated systems with a range of features are different to simple systems such as word processors.

Third, the research did not use longitudinal data, which might reveal other relevant relationships between the constructs in the model. Over-time-changes (Straub et al., 1995) in behaviour or intention are not included in TAM. Taylor and Todd (1995) contend that different variables of the TAM model may have different influences on intention and usage based on experience. Bajaj and Nidumolu (1998) found that past usage significantly affects current ease of use. Furthermore, it can be argued that a significant relationship between ease of use and usefulness can only exist after prolonged use of the information system (Adams et al., 1992, Davis et al., 1989, Jackson et al., 1997, Venkatesh and Davis, 1996, Venkatesh and Davis, 2000). It seems reasonable that perceptions of ease of use are not necessarily constant, and may change as a function of the user's interaction with the system. This might also suggest that the determinants of perceived ease of use change over time.

Fourth, in the interest of parsimony, those external variables of the various categories were identified that are instrumental in explaining a large proportion of the variance in the two belief constructs. Consistent with the reasoning of Compeau and Higgins (1995a) and Harris (1999), the lower limit of significance for regression coefficients is set at 0.05. Furthermore, as reported by AMOS, the direct and indirect effects of the external variables were used to determine whether a relationship should be present.

Fifth and finally, a number of relationships found in the previous chapter were not used in the e-Tam Model. The rationale for this, further building on the conclusion in the various sections in 5.5, will be explained per variable and its relationship with one of the intermediate or dependent variables.

In the final evaluation as to which of the variables and relationships should be included in the e-Tam Model, three sets of variables and relationships were identified.

The first set represents the variables of gender, education, user involvement, organisational size, organisational usage, social pressure, environmental uncertainty, and competitor behaviour. These constructs were not used further, as they do not meet the fourth criteria, the lower limit of significance, mentioned above.

The second set consists of the variables' accessibility and implementation process, which are in fact prerequisites for effective use of an IT tool. It is my expectation that in the very near future every manager will have access to the necessary IT tools, because he will lack the luxury of dedicated staff to perform all related tasks for him. Furthermore, increasingly information is only available electronically (e.g., the proliferation of e-mail systems) and business processes are more and more automated. Finally, because of the nature of the manager's work, it is essential that the manager is involved in selecting and implementing the individual use of the e-commerce system. Hence, involvement in the implementation of an e-commerce system largely is a necessary. In sum, this set of variables is not to be used in the e-Tam Model, but serves as prerequisites when applying the model.

The third set of variables used to build the e-Tam Model is further subdivided in uncontrollable and controllable variables. The first group consists of the first three external variables of Figure 6-1, whereas the controllable group takes the next four external variables. Uncontrollable means that a number of factors or external variables, such as age or professional and computer experience, cannot be easily manipulated. All relationships of the uncontrollable group variables found in the field study were incorporated in the e-Tam

Model. Controllable variables mean that one can influence or even manipulate factors as part of a goal or objective to improve knowledge, change perceptions or increase use. The four variables of the controllable variables group deserve separate attention.

6.2.1 Computer training

Computer Training, as shown in the previous chapter, has a positive influence on the perceived ease of use. This is in accordance with the findings of Venkatesh and Davis (2000) that training mechanisms aimed at improving the computer self-efficacy of users is more likely to be effective in gaining user acceptance. Igberia et al. (1997) also concluded that external training had a significant effect on perceived ease of use.

6.2.2 Computer self-efficacy

The results as described in the previous chapter indicate that feelings of anxiety toward an e-commerce system negatively influence system use. Several other researchers (Compeau and Higgins, 1995a, Igbaria and Iivari, 1995) obtained similar findings, although their studies suggested that computer anxiety has computer self-efficacy as an important determinant. On the other hand, the self-efficacy theory postulates another relationship with computer anxiety predicting computer self-efficacy, which in turn predicts usage (Brosnan, 1999). There is a vast array of empirical evidence showing that computer self-efficacy significantly impacts and guides beliefs and IT behaviour (Compeau and Higgins, 1995b, Gist and Mitchell, 1992, Gist et al., 1989, Marakas et al., 1998, Venkatesh and Davis, 1996). Compeau et al. (1999) describe the difference between the concepts of computer self-efficacy and computer anxiety. Computer self-efficacy reflects an individual's belief about his or her capabilities to use computers, whereas computer anxiety, a negative affective response, represents the feelings of apprehension or anxiety that one experiences

when using computers. Because successful and increased use and, as a result, improved performance is the objective of an e-commerce system, one should concentrate more on users who are confident in their ability to use an e-commerce system rather than users who are anxious about using computers or an e-commerce system. Consistent with the study of Venkatesh and Davis (1996), computer self-efficacy is determined to have a positive relationship with perceived ease of use, replacing the negative relationship of computer anxiety and perceived ease of use found in section 5.4.1

6.2.3 Perceived fun/enjoyment

The key role of perceived fun/enjoyment in this model is illustrated by the three relationships of this construct. When managers have great fun using a system, they like both the ease of use and the utility of the system. Although the third alternative model has produced equivocal results regarding the relationship of perceived fun/enjoyment with usage, it is assumed that there is a positive influence of perceived fun/enjoyment on actual usage. In addition, Webster and Martocchio (1992) made the suggestion that computer playfulness, which is similar to perceived fun/enjoyment, may be a more meaningful construct than computer anxiety (see also previous section) given the increasing exposure to computers and related technology in society today.

6.2.4 Organizational support

In the context of technology acceptance and usage in the workplace, evidence indicates that providing support staff is a key organizational response to help managers overcome barriers and hurdles to technology use, especially during the early stages of learning and use (Venkatesh and Morris, 2000). Organizational support is able to ensure sufficient resource allocations and act as change agents to create a more conducive

environment for information system success. Consistent with the study findings, organizational support directly affects actual system use. Several researchers (Kanter, 1995) have consistently advocated that most people need proper support: a qualified advisor, mentor, friend, spouse, or peer. One could argue that support is only helpful during the initial usage of the e-commerce system and its importance declines with continued use. However, as practice shows, new releases of software packages or new ways of using existing software tools make it necessary to have help at first hand to ensure the best use of IT.

6.3 The e-Tam model

As described above, the development of the e-Tam Model results in seven external variables divided into three categories: demographics, personality, and company (Figure 6-1). This categorization is to a large extent based on existing literature (Alavi and Joachimsthaler, 1992; Anandarajan et al., 2000; Dillon and Morris, 1996). It is worth noting that the variables included in this model can also be grouped as individual differences (age), user-situational (professional experience, computer (IT) experience, computer training, computer self-efficacy, perceived fun/enjoyment) or organizational environment (organizational support). Table 6.1 shows the relationships depicted in the e-Tam Model. These relationships highlight the direct effects between the variables concerned.

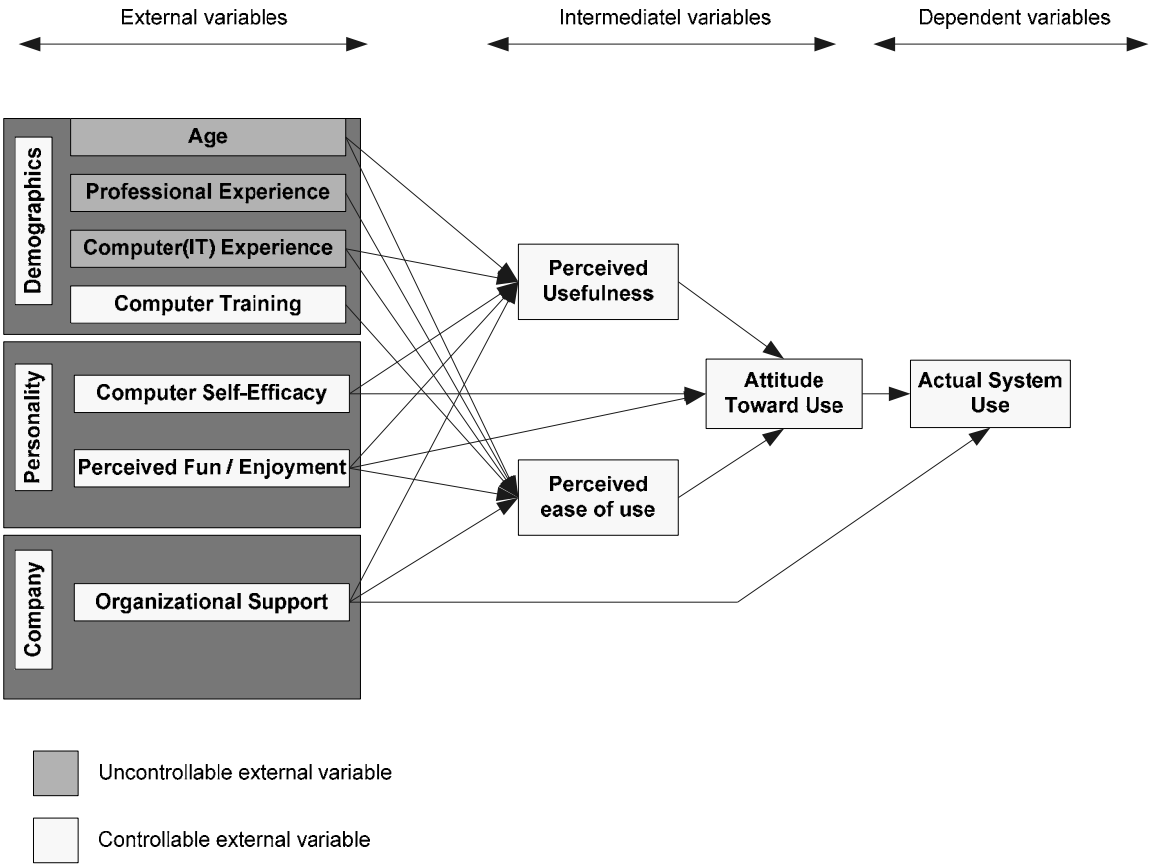

Figure 6-1 e-Tam model

We can gain an understanding of the variables and relationships affecting the acceptance and use of an IT tool from the model above and Table 6-1 below. The characteristics of both the controllable and the uncontrollable variables are described in the next sections. At this point it is important to note that four external variables can be manipulated in order to change beliefs and attitude, or improve usage. As Table 6-1 shows, computer self-efficacy influence two internal variables, yet perceived fun/enjoyment and organizational support can have a positive effect on three internal variables. In fact, perceived fun / enjoyment and organizational support are the key indicators, suggesting that a significant component of the utility of the IT tool is derived from the way a manager perceives it as fun. Combined with the identification of an effective support organization as

a key element in the acceptance and use of an IT tool, the e-Tam Model indicates that only a few factors need to be addressed to improve managers' use of IT. Furthermore, for computer self-efficacy, the emphasis is not on the functions or capabilities of the IT tool, but the ease of use with how the manager interacts with the IT tool. The support organization can be of great benefit in helping managers improve computer self-efficacy by giving advice on which interface to use. Section 6.4 introduces a program aimed at improvements in IT use by managers.

Table 6-1 Relationships with the e-Tam model

	To / From	Perceived Usefulness	Perceived Ease of Use	Attitude Toward Use	Actual System Use
Uncontrol label	Age	negative	negative		
	Professional Experience		positive		
	Computer (IT) Experience	positive	positive		
Control label	Computer Training		positive		
	Computer Self-Efficacy	positive		positive	
	Perceived Fun/Enjoyment	positive	positive	positive	
	Organizational Support	positive	positive		positive
	Perceived Usefulness			positive	
	Perceived Ease of Use	positive			
	Attitude Toward Use				positive

It is also important to note the target audience of the e-Tam Model as well as the type of IT tool, because the goal of most organizationally based IT tools is effective implementation and use leading to improved job performance. In this study the user population was restricted to managers, although other levels also use an e-commerce system. The target audience can thus be qualified as managers. Initially the e-Tam Model was based on an e-commerce system dedicated to management, which is an individual level. However, it seems reasonable to assume that the usage of any IT tool targeted at the

individual manager can be evaluated using the e-Tam Model, although the model is not to be used with generic IT tools such as word processors or e-mail systems. The main reason is the lack of compelling evidence at the moment, indicating that this model is applicable for these generic IT tools.

When using the e-Tam Model, a number of prerequisites are applicable. First, two prerequisites follow directly out of the research results: accessibility and involvement with the implementation. Accessibility means the manager must use the IT tool and, preferably, must be involved actively in the implementation process of the system. Second, the starting points of the field study are also applicable as prerequisites: a stable environment (stable in terms of money, resources, organizational change, etc.) and the system that has been implemented and in use for some time (the system must not be in its infancy). The prerequisites need to be assessed prior to employing the e-Tam Model.

IT is increasingly permeating all aspects of organizational life and individual managers from a wide variety of backgrounds, with different experiences and personalities, need to use these technologies for organizational work. This leads to a number of implications: (1) responsible management can provide appropriate training and other situational experiences or they can specifically target individuals for IT implementation through recruitment, development, and selection, and (2) management can proactively influence beliefs, attitude, and use through appropriate actions on the external variables that, as was made clear in the previous chapters, directly or indirectly impact IT use. The external variables were divided into two categories: controllable and uncontrollable; the latter category can be used to assess what type of manager one is dealing with. The characteristics of the three external variables belonging to uncontrollable category are

summarized in Table 6-2. It should be noted that the values of the external variables are on a continuum instead of only two discrete values.

Table 6-2 Characteristics of the uncontrollable external variables

External Variable	Values	Perceived Usefulness	Perceived Ease of Use	Attitude Toward Use	Actual System Use
Age	- young - old	high low	high low		
Professional Experience	- < 3 year - >10 year		low high		
Computer (IT) Experience	- novice - expert	low high	low high		

The importance of influencing user perceptions, attitude, and usage has been highlighted in previous chapters. The role of the four controllable variables is important, because they are the only ways to manipulate effective use of an IT tool. Agarwal and Prasad (1998a) stated that external variables are the only ways for influencing beliefs and behaviour so as to encourage system use, because the intermediate and dependent variables in this model, as in TAM, are an internal psychological process. As Figure 6-1 shows, two individual external variables, computer self-efficacy and perceived fun/enjoyment, influence the two belief constructs and attitude toward use, that channel their effect on usage. One organizational external variable, organizational support, has a direct effect on usage. Table 6-3 shows the characteristics of the three external variables belonging to the controllable category.

Table 6-3 Characteristics of the controllable variables

External Variable	Values	Perceived Usefulness	Perceived Ease of Use	Attitude Toward Use	Actual System Use
Computer Training	- low - high		low high		
Computer Self-Efficacy	- low - high	low high		low high	
Perceived Fun/Enjoyment	- low - high	low high	low high	low high	
Organizational Support	- low - high	low high	low high		low high

In summary, from the previous chapter we gained an understanding of what variables and relationships are significant for evaluating e-commerce system use. Based on these findings and relevant variables from Chapter 3, the e-Tam Model was developed in the previous sections. There are a number of factors that play a role in the IT acceptance process (Table 6-2), yet they serve as a starting point in evaluating the background of the manager. In order to promote effective use of IT tool we identified four variables that can be used to increase system use (Table 6-3). In accordance with the goal of the e-Tam Model, one can predict use and, as a consequence, intervene with appropriate measures to steer use in the desired direction. The next section elaborates on the practical application of the e-Tam Model by giving a program that gives guidance when organizations want to influence or improve managers' use of IT.

6.4 Practical application of the e-Tam model

Many managers are subject to time and interest constraints when it comes to using IT tools. Having to perform a series of keystrokes to receive the information they need is often

regarded as a task they would prefer to do without. However, once familiar with the practicalities of a particular IT tool, they rarely question whether the task involved is being done effectively. A periodical review of how management uses IT for their information needs would appear to be a useful way of gauging whether managers are conversant and comfortable with IT.

The rationale for providing an assessment program is so that organizations can execute their own intervention programs aimed at ensuring the effective use of IT tools by all managers. The main objective of the program is the improvement of manager usage of IT. This in turn will lead to better information, improved decision-making, greater worker productivity, or other benefits (Bhattacherjee, 1998). Although a great deal more can be said about the relationship between more and longer use compared to effective use (see Section 7.3), in the following sections it is assumed that systems and IT tools that are better utilized will result in efficiency and effectiveness gains.

Such a program would provide a valuable assessment tool for organizations introducing new IT to management or organizations seeking to improve management usage of existing IT tools. Often such programs come about because existing tools are underutilized or not used at all. Any program aimed at improving manager IT literacy should also include managers already using certain tools, yet lacking the latest tips and tricks to become IT savvy users. As will be shown later, support mechanisms can also be put in place to help these managers. Once this has been recognized, a person responsible for the assessment program needs to be appointed. Generally speaking, all managers with the right amount of authority can initiate a program that either forms part of or leads to an organizational change process or overall improvement program. The target audience of the

assessment program is all managers who recognize and acknowledge the need for improvements in IT use.

The assessment program has two main functions: (1) to identify deficiencies in IT use by managers and (2) to improve current IT use. Having identified the deviations from normative or optimal usage, a number of interventions can be applied to improve manager use of IT. In practice, imposing a mandate on how managers use IT is doomed to fail, as was already discovered in Section 5.5.5. One should, therefore, put more emphasis on the perceptions and attitude toward use as well as the benefits gained from increased IT use, than on IT use as such. After all, it is not computers that make the difference, it is what people do with them (Strassmann, 1997).

Finally, the goal of the assessment program is not time-consuming activity, but a quick scan resulting in a number of dedicated actions. This will serve as the basis for improving how IT is used. Using the e-Tam Model as the theoretical foundation, the next section describes the various phases of the assessment program.

6.4.1 An e-Tam model assessment program

As with all programs, a number of steps have to be followed. These steps will eventually result in a number of organizational interventions, targeted at the individual manager. Manager have to keep in mind that he assessment program by itself does not guarantee success, but is a tool that will certainly help managers in achieving their objectives. To arrive at an appropriate and concise set of interventions, four steps must be carried out, as illustrated in Figure 6-2:

1. Understand the context of the IT tool
2. Understand the uncontrollable variables

3. Analyze the controllable variables
4. Determine necessary interventions.

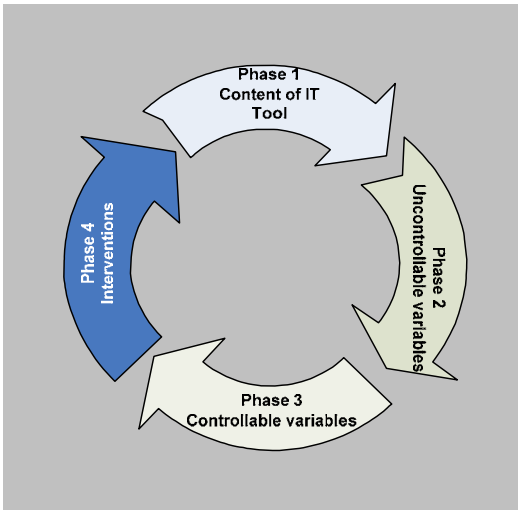

Figure 6-2 An e-Tam model assessment program

As the above figure implies, various phases are part of a recurring and iterative process. For example, the context of the IT tool will not change dramatically over time, yet the interventions are dynamic and will reflect increased IT knowledge and the experience of the people in an organization. In any case, the program must be coherent and give managers a proper understanding of what they can expect and what is expected from them.

Phase 1: Context of the IT tool

Before any assessment or evaluation is performed, it should be clear what IT tool is under review, what the tool's target group is, and what is its main functionality. The starting points of the field study are also applicable: a stable environment (stable in terms of money, resources, organizational change, etc.) and a system that has been implemented and in use for some time (the system must not be in its infancy). Furthermore, any results from previous assessment programs, satisfaction surveys, and, more importantly, information on

the tool's future application in the organization should be available. The reason for this phase is to establish what IT tool is being scrutinized for what kind of users. In this phase, an evaluation is also made of the prerequisites for the organization and the IT tool under review. A number of questions, typically corresponding to the prerequisites, accessibility and involvement should be evaluated (see Table 6-4). Because the aim is improved use, current use of the IT tool should also be evaluated. The questions used in the field study (e.g., questions J-29-30 in Appendix B.IV) may also serve as reference material. Next, a number of key persons are interviewed.

Table 6-4 Example questions phase 1

Example questions	Answer				
I can get data using the IT tool quickly and easily when I need it	1	2	3	4	5
It is easy to get access to data that I need using the IT tool	1	2	3	4	5
Are/were you, as a manager, involved in the implementation of IT tool?	1	2	3	4	5
Does/did the implementation of IT tool cover positive and negative issues (e.g. high costs, executives' time, learning time)?	1	2	3	4	5
Does/did the implementation of IT tool meet your requirements?	1	2	3	4	5
Do/did the implementers of IT tool provide you with an understanding of the technology and the functionality?	1	2	3	4	5

1 Strongly disagree, 2 Disagree to some extent, 3 Uncertain, 4 Agree to some extent, 5 Strongly agree

The primary goal is to acquire new background information for the assessment program manager. These questions concern general information about the user, such as type of computer user and information style type.

The answers to these questions will help the program manager understand why certain managers have a low score with respect to IT usage. Certainly those managers who do not even have access to the IT tool need, first and foremost, to start using the tool before any further assessment or intervention can take place. To summarize, the collected

information should give the program manager a good understanding of the organizational and technical context of the IT tool and its current use.

Phase 2: Uncontrollable Variables

In this phase, the conditions that cannot be influenced-i.e., the uncontrollable variables in the e-Tam Model-need to be assessed. The analysis of the first three, age, professional experience, and computer (IT) experience is relatively simple (see Table 6-5 and Table 6-6).

Table 6-5 Example questions phase 2

Example questions	
What is your age?	
What is the highest level of formal education you have attained tot date?	
• High School Diploma	☐
• Bachelor Degree	☐
• Graduate Degree	☐
• Post Master study	☐
• Doctoral Degree	☐
How long have you worked with your present firm? (In years)	
How long have you worked in your present position? (In years)	
How long have you worked in a managerial position, including previous employers? (In years)	

Table 6-6 Example questions phase 2

Example questions	**Answer**				
How do you rate your general computer skills?	**1**	**2**	**3**	**4**	**5**
How do you rate your keyboard skills?	**1**	**2**	**3**	**4**	**5**
How do you rate your skills with regard to Windows, Apple, Linux technology (e.g. pull-down menus, icons, clicking)?	**1**	**2**	**3**	**4**	**5**
How do you rate your skills with regard to PC software such as for example word-processing, spreadsheet?	**1**	**2**	**3**	**4**	**5**
How do you rate skills with regard to the IT tool	**1**	**2**	**3**	**4**	**5**

1 Very low, 2 Low, 3 Moderate, 4 High, 5 Very high

Table 6-2 shows the effect of the uncontrollable variables on actual usage. For example, highly experienced managers are more positive about the perceived usefulness and perceived ease of use of the IT tool than less experienced managers.

Phase 3: Controllable Variables

As in the previous phase, each manager has to be investigated on the four controllable variables. The questions used to assess these variables are the same as those of the field study (e.g., computer training: questions D.19 and D.20 perceived fun/enjoyment: questions K.3 and K.4; computer self-efficacy: Section H; organizational support: questions F.10-17; all in Appendix B.IV). Table 6-3 shows how to interpret the answers.

Based on the results of this and previous phases, the assessment program manager should by now have a thorough understanding of the values of the prerequisites, the uncontrollable and the controllable variables of the e-Tam Model, as well as the attributes of the users. The analysis should provide an understanding of how the typical managerial user utilizes the IT tool. If applicable, one could categorize these users based on salient attributes, such as young versus old, or less experienced versus more experienced, or high computer self-efficacy versus low computer self-efficacy, or a combination of attributes. This categorization can help the assessment program manager determine the best combination of interventions (see phase 4).

Phase 4: Interventions

The final phase will result in a number of concrete actions, aimed at the individual manager. As mentioned in Section 6.4, the main goal is to improve manager usage of IT, particularly as concerns the IT tool under review. Key aspects in this respect are the actions and interventions required in changing managers' beliefs, attitude, and use. The question

arises as to whether some form of incentive will have to be employed to influence managers' use. Incentives might be directed at reducing goal incongruence, i.e., the different goals for the manager on the one hand, and the organization on the other.

Several key questions need to be asked to establish whether using the system as such will be effective or whether additional incentives are needed, especially with respect to these types of users. The major questions are:

- Are the results received satisfactory enough to start using the IT tool?
- Do time or money constraints apply with respect to using the IT tool?
- Do managers take usage opinions of peers into account when using the IT tool?

The answers could lead to additional positive and negative incentives. The organization could, for instance, disseminate certain information using a specific IT tool (e.g., clippings via the Intranet or e-mail), or the organization could install usage monitoring systems, make available dedicated budgets and people, or appoint IT ambassadors/champions. Although there is a general tendency to increase the amount of variable income for managers, much less is known on whether these outcome-based and behaviour-based incentives (Bhattacherjee, 1998) regarding IT use are effective.

In sum, of the four external variables used to influence beliefs and usage, organizational support is the easiest to affect, whereas computer self-efficacy requires continuous attention by management so that uneasy and ambivalent opinions about IT can change for the better. Again, one should bear in mind that only a limited number of interventions are possible.

The previous phases resulted in a number of values for the variables that were investigated as part of the assessment program. Any categorization is helpful in

determining what interventions are needed for a number of managers. If, for instance, the assessment indicates that two or three fairly distinct groups can be formed on the basis of the organizational support variable, interventions can also be differentiated for these three groups (e.g., variations in guaranteed response time for a manager, or the number of hours a dedicated employee is available to assist a manager in resolving a problem or to coach him in the proper use of IT tools). A few potential interventions will be described in the next section. These merely serve as a starting point, yet at the same time highlight the importance of the interventions.

Organizational support has a direct effect on usage (Table 6.3) and is the easiest to effect. Moreover, support employees can indeed help to increase computer self-efficacy among managers by explaining and demonstrating the fun element of IT tools. Support staff should focus on encouraging anxious individuals to use IT. The reverse training mechanism, whereby young people in effect train senior, mostly older, colleagues, is a good example of an organizational support intervention. This solution helps managers overcome barriers and hurdles to IT use. It is also in line with the recommendations of Agarwal et al. (1996), who purport that highly educated individuals become frustrated with structured learning experiences, and, hence, need a more informal training mechanism combined with self-training. Some organizations employ a reverse mentoring approach, similar to the qualified advisor mentioned in Section 6.2, with one-to-one sessions. It should be intensely personal and the advisors should be preferably company insiders. Rogers (1995) argues that managers learn best from peers, who act as change agents. These interventions can also deal with the limited time most managers have available and, at the same time, the speed and capacity with which they familiarize themselves with new ideas

or situations. Of course, the reverse training and the reverse mentoring approaches must fit the corporate culture and organizational structure.

Next to providing staff, special attention could be given to the fun factor of IT. For this intervention, the Internet and its huge amount of fun information is a good starting point. By combining this with business information, e.g., daily or weekly e-mail newsletters with interesting links, the role of IT and the IT tool in the specific area of the manager could be given the right focus. And although the Internet is often viewed as a source of entertainment rather than as directly related to work (Teo et al., 1999), this view is changing rapidly as e-business initiatives multiply. Another intervention method is to give various managerial levels access to the latest real-time business information through the company's Intranet via an easy-to-use interface. Recent developments in business provide managers with information and IT tools to satisfy their information needs for decision-making.

A final intervention is aimed at the perception level of managers who are increasingly concerned about understanding the value of information and information technology. To change their mindsets they need to improve their self-confidence and IT literacy before they positively embrace IT. Venkatesh and Davis (1996) already noted that millions of dollars have been wasted on systems that are rejected, often attributed to usability issues, while a key part of the problem could well be the users, who do not possess a good, positive computer self-efficacy belief. It should be kept in mind that computer self-efficacy is not about basic IT tasks, but refers to the ability to apply IT skills to broader tasks (Compeau and Higgins, 1995a). As noted in Section 6.2, computer self-efficacy in this respect is about influencing ease of use perceptions, rather than emphasizing the

functions of the IT tool. To reinforce computer self-efficacy, Torkzadeh et al. (1999) emphasized the importance of continuous improvement programs so that executives will not fall behind so much that they cannot catch up. Measures to improve managers' self-efficacy would be instrumental in this respect. Marakas et al. (1998) argue that any manipulation or intervention aimed at changing computer self-efficacy should be directed at changes within the person rather than between persons, as a number of other factors also influence the degree of change in computer self-efficacy, e.g., level effects, variability, and controllability.

Based on the e-Tam Model, an e-Tam Model assessment program was developed in this section. It describes a number of possible interventions, based on the four controllable variables. The program itself is not a measure to change the minds and behaviour of managers in one fell swoop. It merely serves as a starting point for making them aware of the opportunities and possibilities information technology can offer.

6.5 Summary

I believe that managers need to muster the courage to face the reality that they will soon be obsolete unless they use IT properly. Moreover, managers' attitudes toward information and information technology are still seen as the barometer of the company's information culture. Managers do not have to be IT-literate or IT-experienced, but IT-oriented and IT-savvy. They have to be conversant and comfortable with IT (Earl and Feeny, 2000). New IT tools are used to run businesses and access information the manager needs to know how to use. His mindset, behaviours, and practices regarding IT can lead to increased credibility among his employees (Marchand, 2000a). In addition to investing in and deploying IT, the manager must also encourage employees to embrace the right

behaviours and values for working with information (Marchand et al., 2000). So if they believe in using IT, they should practice what they preach. If managers do not embrace IT, how can they expect other people to embrace it?

The third research objective was elaborated in this chapter: Is there a parsimonious model to predict managers' usage of IT? The e-Tam Model was developed using the results of the previous chapter. The model has implications for understanding the use of an e-commerce system, or any IT tool, designed for managers. To obtain the full benefits from the e-Tam Model, several organizational interventions that demonstrate how the manager might use the IT tools differently, were discussed in the previous section. The next and final chapter presents an overview of the result obtained with this study and the theoretical and practical limitations and contributions.

7 Summary, limitations and future research

7.1 Introduction

Although the previous chapter gave a practical application of the research results, the bulk of this thesis deals with the three main research objectives as described in Section 1.3. This concluding chapter summarizes the results, the theoretical and practical contributions, and limitations of the study. A number of suggestions for future research are also presented.

7.2 Summary of research objectives

The primary objective of the study was to identify key factors and relationships that are likely to influence the acceptance and usage of IT by SME managers. Acceptance in this respect means adoption and use, where IT is the mechanism through which the SME managers receive qualified information for the commercial process for which they are responsible and accountable. The general objective was divided into three research objectives.

The first research objective, “What are the major factors that influence SME managers' use of IT, and in particular an electronic commerce system?” was addressed in Chapter 3. An extensive literature review was conducted to determine key variables suggested in IT innovation and adoption theories and studies. Figure 3-2 delineates the theoretical research model that was developed using the core TAM model and the hypothesized 18 variables, divided into three categories and six subcategories, and their relationships that were found in literature and assessed as important for the model (Table 3-2). For every external variable the rationale for inclusion in the theoretical research model was described. As noted in Section 1.4, a complete and all-embracing model was not pursued. On the other hand, because the model definition process used studies aimed at

managers, one can reasonably assume that every important factor influencing IT usage was identified.

In Chapter 5 the second objective of the research was investigated: Which of the factors from the theoretical research model influence the actual use of an e-commerce system, either directly or indirectly through user beliefs and attitude? Of the models investigated, the one that evaluated all possible relationships between every variable concerned proved to have the best fit with the data gathered in the field study.

Table 5-1 and Figure 5-2 show these results. Also, Section 5.4 describes the results of the hypothesis testing, including explanations for those relationships that exhibited no significant effect. This research demonstrated that the link between the two beliefs and attitude as well as between attitude and actual usage is strong. This study also demonstrates that external variables influence usage behaviour, but the results suggest that the belief constructs do not fully mediate this influence. A number of external variables have also a direct effect upon usage behaviour. Contrary to expectations, it was found that 5 of the 18 variables identified had no influence whatsoever. Furthermore, none of the subcategories showed a significant relationship. In order to improve the original model, all second order variables were trimmed, using straight path models only.

Most of the remaining categories and variables are all related to the individual SME manager. One variable, organizational support, clearly has strong business background implications, although management can actually influence the quality and quantity of this type of support. Two other variables of the category of characteristics of the IT resource, accessibility and implementation process, also have a strong link with the SME manager. Accessibility means access to a PC with a number of applications. The SME managers in

the study population were generally of the opinion that you need to have access to an information system or IT tool if you want to use it. Furthermore, most of them believed that they should be involved when the implementation of an IT tool or information system is being carried out. Whether they favoured it because they could have their information needs satisfied or because they favour it because they had managerial control over the implementation process was outside the scope of this study.

We are led to the conclusion that most factors influencing actual use are of an individual nature. The effects of individual characteristics on the acceptance and use of IT does not come as a surprise, as these SME managers have achieved the managerial position they are in because of their ability to make far-reaching decisions on a daily basis based on trust in their own capability and knowledge.

However, one key observation has to be made here. Although the response rate of the study was good, access to and willingness of the right managerial level was also a key issue in this study. The average age of respondents was just above forty. There may well be a general tendency in the sample data indicating that only the younger generation of managers answered the questionnaire. Yet these managers were certainly not brought up with PCs or IT tools, as their children are today, so the results still apply. The results may even be regarded as conservative, as the really gray-haired managers were certainly not in the majority in the population under review.

The third research objective was elaborated in the previous chapter: Is there a parsimonious model to predict SME managers' use of IT? The developed model, the e-Tam model as depicted in Figure 6-1, implies that system use will be influenced by a number of demographic, personal, and company-related factors through a number of relationships and

variables. In the definition of this model, special attention was paid to the controllable variables, because one variable, computer anxiety, was replaced by the positively oriented variable computer self-efficacy. As Table 6-1 shows, only a limited number of independent variables can be influenced by interventions aimed at improving actual use. Although the e-Tam model was developed using a dedicated tool for SME managers, an e-commerce system, it is assumed that any IT tool targeted at the individual managerial level can be evaluated with this model.

In summary, this research has corroborated the core TAM model as a foundation for understanding managerial user behaviour with Information Technology. The findings of this study validate the notion that beliefs and attitude are instrumental in promoting user acceptance and use of IT. But external variables, individual and organizational, are also an important consideration with respect to the process of adopting and using IT. The main purpose of this study, to identify the factors that explain the use of an e-commerce system by SME managers and incorporate them in a parsimonious model, has been reached. A key assumption that was taken into account in every chapter was the use of IT at the level of the individual. The e-Tam model as presented in the previous chapter is very valuable when introducing new or re-using existing information technologies at management level. Once the present situation has been assessed, only a few measures need to be taken to achieve more effective use of existing IT investments.

7.3 Contributions of the study

This study makes a number of contributions to the current body of knowledge regarding use of IT by SME managers and extends available research on the Technology Acceptance Model. Specifically, it proposes an extension to TAM with a limited number of

key external variables by providing a new framework, the e-Tam model, to be used for gaining better acceptance and usage of IT tools aimed at management. In the next sections, these theoretical and practical implications will be presented.

7.3.1 Implications for theory

There appear to be many factors that cause information systems and IT tools to be accepted or rejected. I presented a fairly complete picture of the theoretical research model of the antecedents of the key constructs of TAM. Based on an extensive literature review of the Technology Acceptance Model, empirical findings were integrated with those of research on personal computing, innovation theories, and management support systems. The study also confirms social science theories that user perceptions of IT are important in e-commerce's acceptance and use. The model of the determinants of perceived usefulness, perceived ease of use, attitude, and use developed in this research can be considered to be robust from a theoretical standpoint as it draws from existing research in the above-mentioned areas. The study results provide support for the core TAM model as an adequate and parsimonious conceptualization of acceptance behaviour and the salience of usefulness and ease of use beliefs. However, where TAM assumes that the influence of external variables on use is channelled through the two beliefs, this research study also found variables that directly influence attitude and use. The study illustrates the importance of organizational support in directly influencing indicators of e-commerce system usage. Furthermore, for SME managers there appears to be no influence of user involvement, organizational usage, social pressure, environmental uncertainty and competitor behaviour on actual use of e-commerce.

A better understanding of the various factors that may impede or increase effective utilization of IT can facilitate the design of programs or interventions that address these issues on the implementation of a new IT tool or information system. The e-Tam model has been developed based on the results of the theoretical research model. The e-Tam model contributes to knowledge by providing a greater understanding of the factors that influence IT acceptance and use. In addition, it explains the relationships between these factors and the core constructs of the TAM model, on which the e-Tam model is based. In the e-Tam model, it is hypothesized that actual system use is directly and indirectly influenced by seven external variables divided into three categories: demographics, personality, and company.

Many studies found additional factors in these categories that actually did play a role. However, the combination of SME managers and dedicated IT tools for these managers resulted in a limited number of variables influencing their beliefs, attitude, and use. Therefore, it is likely SME managers constitute a separate category in IT acceptance and use. Although compelling evidence other than that obtained from an e-commerce system is not available, I assumed that these factors play a significant role in the use of any tool on a individual managerial level.

7.3.2 Implications for practice

Perhaps the most significant finding is the key role that perceived fun/enjoyment and organizational support play as external variable in influencing beliefs, attitude, and usage. Historically, the rationale behind the development of most information systems has been to provide as much functionality as possible. Usability and ease of use capabilities came later. Our research corroborates the general tendency to focus on a system's fun

component, which the rapid growth of the Internet appears to have encouraged. An investigation of the fun component of the Technology Acceptance Model appears to be a very promising line of research as today most information systems aimed at managers are built around Internet technology and appearance. Moreover, by emphasizing the entertainment value of managerial IT tools, computer anxiety can be diminished and computer self-efficacy improved. The organizational support variable directly influences usage, consistent with most empirical research.

Another finding, closely related to the research objectives, is that we can now identify certain management actions that can be instrumental in facilitating technology acceptance and use through their positive influence on usefulness and ease of use beliefs. One of the key limitations of TAM is that while it provides information that is valuable to predict acceptance and use, it does not tell us how such perceptions are formed or how they can be manipulated to foster acceptance and increased usage. This study found a number of antecedents that can be manipulated with the proper organizational interventions.

By understanding the antecedents of perceived usefulness, perceived ease of use, attitude, and use, it is now possible to design interventions that manipulate these key determinants. As was shown in the previous chapters, only four variables that are under the direct control of an organization need to be taken into account in defining intervention programs. Any intervention aimed at improving the use of an IT tool should optimize these key controllable variables. As an example, one can design interventions to focus on enhancing the computer self-efficacy of a manager, or, similarly, on reducing the computer anxiety of this person. Moreover, as suggested in Section 6.2.4, organizational support, one

of the key controllable variables, is pivotal in enhancing better use by means of reverse training and reverse mentoring mechanisms.

It is important for organizations to understand that managers will use IT tools when they understand the benefits technology can bring to their tasks. Successful implementation and use of an information system for management should therefore introduce intervention programs for the key controllable variables. This research suggests that when the fun component of the IT tool is highlighted, together with a good support organization, management's fears of the technology will diminish. Moreover, if the study's results are extended to any IT tool for management, they suggest that one of the prime tasks of an organization is to build a good supporting organization that can help the manager. This results in more self-confident, IT literate managers. IT tools are then able to do what they are supposed to do: support managerial tasks. On the other hand, the hard reality of business life only serves to emphasize the usefulness of IT tools rather than any pleasure that can be derived by using them. At any given moment, SME managers will have to weigh up the amount of effort required to use an IT tool against its anticipated usefulness.

By focusing on the individual user as the key actor in the actual use of an IT tool, this study provides a way of understanding what factors influence actual usage.

As was mentioned in Section 1.1, large investments in IT often may not translate into large performance returns. Few organizations derive full value from IT investments, either because people have not learned how to use technology well or because managers have not learned how to manage its benefits (Lynn Markus, 2000). If a larger percentage of IT investments was targeted on improving managers with better information and reducing

uncertainty in the decision-making process, the use of IT tools would improve, leading to enhanced performance.

7.4 Limitations

In retrospect, I believe that every facet of the research undertaken in the course of this study has proved to be the most effective choice in the realization of the research objectives. However, no research is without limitations and this study is no exception to the rule. In no particular order, these limitations relate to the research methodology, model constraints and some considerations on the dependent variable, system usage.

7.4.1 Research methodology

A number of methodological issues need to be reviewed. First, the use of structural equation modelling turned out to be effective for the study (Chin and todd, 1995, Hair et al., 2005), although the sample size did not meet the minimum recommended values. To test the robustness of the model the Expected Cross Validation Index was calculated and with 1.693 proved to be satisfactory. To further validate the model, a bootstrap procedure was performed. Both the Bollen-Strine bootstrap and the conventional bootstrap against 2000 samples showed that the model could not be rejected, thus the fit of the model is robust. Nevertheless, future research with the collection of more data should fully validate the model.

Second, the reliability of the answers to the questions was not questioned. Several control techniques were incorporated into the questionnaire (e.g., control questions, reverse answer categories), but because management was the target population, it is assumed they would give the right answers. Moreover, due to the nature of the research design,

triangulation, in which different sources are used to obtain relevant information, was not possible and, as a consequence, data was collected using a single source.

Third, the study relied on single item measures including self-reported use. While single item measures are common in many TAM studies, the statistical reliability of such measures cannot be assessed (Gefen and Keil, 1998). Although validated measures from previous research were taken for the use items, Hufnagel and Conca (1994) point out that the original verbal frequency scale of TAM usage items is prone to ambiguity as users may experience difficulty deciding what to check in the various response categories.

Fourth, the nature of managerial work is such that the tasks of any SME manager are complex, highly fragmented, often taking place in an ambiguous context, and that verbal communication is paramount. In a field study that is aimed at understanding and explaining the behaviour of these managers, one should define precisely what is being investigated and what the goal of the study is. SME managers as a rule have little patience with unclear instructions in a questionnaire that they are supposed to complete or terminology that is unfamiliar to them. It is precisely because of the latter that I conducted a pretest and a pilot test of the questionnaire, yet it still may be possible that the respondents did not fully understand some of the questions.

Fifth, the study would have benefited from a longitudinal approach, as it would probably have provided richer insights into the explanation of IT acceptance factors and confirm causal linkages. Time and resource limitations, however, made a longitudinal study infeasible.

7.4.2 Model constraints

When building the theoretical research model (Figure 3-2) a number of starting-points were taken into account. To a large extent they were determined by the amount of time available to complete the study and the intended parsimony of the model, yet at the same time it is acknowledged that some of these points could well have resulted in a completely different model. First, as already noted earlier (Section 6.2), all external variables are not correlated and have an equal weight with respect to beliefs, attitude and use constructs. Various TAM studies have shown that this assumption could not be corroborated as far as their study results are concerned. Apart from a sequential order of the various external variables, these studies also found a time-dependent order and lagged effects.

Second, as Seddon (1997) posits, the importance of learning needs to be explicitly recognized in a model that predicts IS use, most likely in a feedback loop (Bajaj and Nidumolu, 1998; Dillon and Morris, 1999). In my opinion this is a very valid statement, as SME managers will gain experience once they use the system, which in turn leads to revised beliefs and attitude towards the system. Future research could deal with this issue.

Third, perceived usefulness and perceived ease of use appear to be almost equally important in this study. Various authors found compelling evidence that perceived usefulness is the key belief in TAM-related models. Agarwal and Prasad (1999) suggest that for different types of information technologies, one belief might be more salient than the other. Szajna (1996) argues that beliefs may have differential relative importance, being most important for first adoptions (e.g,. PCs), but less important in explaining the adoption of additional information systems (e.g,. the Internet). Furthermore, there may be reason to believe that the relative strength of the two beliefs is a consequence of the time at which

data is collected. In line with the previous argument, future studies of beliefs might need to explicitly acknowledge the timing issue.

Fourth, a number of studies extended the number of beliefs in their model (Anandarajan et al., 2000, Chin and Gopal, 1995, Li et al., 2005). Although the explained variance for the two beliefs constructs is high, additional models could have been investigated using some external variables as belief constructs (e.g., perceived fun / enjoyment, computer self-efficacy). In TRA, salient beliefs should ideally be elicited anew for each context (Ajzen and Fishbein, 1980). The original TAM comprises of only two salient beliefs that determine attitude towards using the system. It is likely that a number of other beliefs exist that influence SME managers' attitude towards behaviour. And although the two TAM beliefs are undoubtedly significant, other beliefs such as perceptions about the managerial role, perceptions about the (personal) benefits of using computers (IT) as management tools, personal innovativeness, and perceived drawbacks because of time needed to learn IT tools and lost time for socializing, could be instrumental.

Fifth, the goal of this study was to use the existing core TAM model to identify and evaluate external variables and their relationships with all internal variables. The theoretical research model has remained unchanged throughout the period of the thesis. It is likely that improvements of the fit to data are possible, although appropriate theories or theory building should, first and foremost, guide any respecified theoretical model. Section 7.5 provides some practical guidelines in this respect.

The sixth and final point is that the attitude construct plays a significant role as mediating variable in virtually all TAM-based models. In all such models, there is only one attitude object that influences the user behaviour toward the technology. Recent research on

Internet consumers (Modahl, 2000) found attitude toward technology a key variable influencing their computer behaviour. Yet it may well be that the attitude construct also depends on the technology used. One could argue that the user's attitude towards a system or technology is formed through a process where the outcomes of several alternatives (including not using the system and asking subordinates for information) are compared to attitudes towards the specific system or technology.

7.5 Suggestions for future research

Several avenues for future research emerge from this study. First, the confirmatory model should be tested against a larger dataset to further confirm its robustness.

Second, the findings of this study in some cases indicate that a number of external variables are not independent components in the theoretical research model, but are dependent on one another. Identifying these external variables and the directionality of their relationships is also a promising avenue for further research, although at all times variables and their intended relationships should be guided by theory.

Third, the proposed approach and model in this thesis can be useful for research focusing closely on IT use by SME managers by selecting IT tools that are now being developed or already available. The questionnaire that was developed can easily be transferred to new situations, because most questions are generic and do not deal with the specific technology under review. Organizations continue to invest very large sums in information technology in the expectation that performance will improve. An understanding of the use of IT and its impact on performance are prerequisites for obtaining a return from these investments. Also, future research in diverse organizations in which

there is a focus on diverse IT tools and applications is necessary to establish the generalizability of the findings of this study.

Fourth, the e-Tam model is intended to diagnose and predict the use of dedicated IT tools for SME managers. The next question is what impact the IT tool has on the users and the organization. The implicit assumption of this study is that higher usage of an e-commerce system will result in better individual and organizational performance. However, this may not always be true. A valid question for future studies would be to investigate whether a dependent variable could be defined that more closely relates to the net benefits and improved performance by management.

Fifth, another perspective that should be investigated is the individual and organizational interventions aimed at helping the SME manager become sufficiently IT literate for his job. Taking use seriously requires managers to dedicate resources to help users build effective use habits and to have resources available over time to support not just the evolving technology but also people's evolving use (Orlikowski, 2000). Further, experimental research is needed to design interventions to successfully manipulate the key controllable interventions to foster favourable perceptions, and eventually create better acceptance and increased usage. In addition, an assessment of whether a SME manager is motivated by intrinsic or extrinsic motivation may help explain the relative influence of user perceptions of usefulness and ease of use for that individual. Future research can attempt to further examine extrinsic motivation (i.e., perceived usefulness) and intrinsic motivation (i.e., perceived fun/enjoyment), which directly and indirectly influence actual usage.

Finally, the role of perceived fun/enjoyment could also prove promising ground for further research. As was shown, perceived fun/enjoyment is a central element affecting beliefs, attitude and use. Comparisons between IT tools and systems considered fun to use and those which are less fun to use might help researchers understand this fact. Davis et al. (1992) were the first to recognize the impact of enjoyment on usage intentions in the original TAM model. Perceived enjoyment is a form of intrinsic motivation, which refers to the performance of an activity for no apparent reinforcement other than the process of performing the activity per se (Teo et al., 1999). A number of authors using an extended or modified TAM, all confirmed the notion that perceived fun/enjoyment, next to perceived usefulness and perceived ease of use, acts as a mediating variable in the core TAM. Whereas the belief constructs influenced usage, in most cases the extrinsic motivator, perceived usefulness, was a better indicator than the intrinsic motivator, perceived fun / enjoyment. Table 7.1 shows that early research on the role of intrinsic motivation concentrated on PCs, as opposed to the recent focus on the acceptance of the Internet in the work environment.

Authors	Type of IT resource	Intermediate variables
Davis, Bagozzi and Warshaw (1992)	Computers	Perceived usefulness, perceived enjoyment
Igberia, Schiffman and Wieckowski (1994)	Microcomputers	Perceived usefulness, perceived fun
Igberia, Iivari and Maragahn (1995b)	Computers	Perceived usefulness, perceived enjoyment
Chin and Chopal (1995)	Group supported systems	Relative advantage, ease of use, compability, enjoyment
Igberia, Parasuraman and Baroudi (1996)	Microcomputers	Perceived usefulness, perceived fun/enjoyment
Atkinson and Kydd (1997)	World wide web	Usefulness, enjoyment, ease of use, playfulness
Al-Gahtani and King (1999)	Spreadsheets	Relative advantage, enjoyment, ease of use
Teo, Lim and Lai (1999)	Internet	Perceived usefulness, perceived enjoyment, perceived ease of use
Anandarajan, Simmers and Igberia (2000)	Internet	Perceived usefulness, perceived enjoyment, perceived ethical beliefs, social pressure
Roberts and Henderson (2000)	Microcomputers	Perceived usefulness, perceived fun
Heijden (2004)	Hedionic information systems	Perceived usefulness, perceived ease of use, perceived enjoyment
Li, Chau and Lau (2005)	Instant messaging	Perceived usefulness, perceived enjoyment, perceived critical mass

Based on existing research, albeit limited, research and the results of this study, we predict that the influence of perceived fun/enjoyment is key in the e-Tam model, because it plays a significant role in shaping user perceptions and behaviour. However, future research needs to confirm this, also in investigating the importance of perceived fun/enjoyment as an additional belief variable in the core TAM model. Moreover, it might be appealing to investigate the role and importance of perceived fun/enjoyment across cultures and, hence, gain a better understanding of IT acceptance and use. This is especially important as

managerial IT tools, using for example Internet technologies, are becoming increasingly international and cross-cultural.

7.6 Final thoughts

Trends in society and business organizations indicate the emergence of different perspectives on how we deal with information on the one hand, and the facilitating role of information technology on the other. In the new economy SME managers must begin thinking about how people use information, not how they use IT tools. In other words, the new, open network economy is focused much more on people and how they use information than on IT. Having the right managerial IT tools in place is necessary, but not sufficient for good information and information use. Too many managers still believe that once the right technology is in place, appropriate information use will follow. The ability of an organization to deal with a changing environment depends on the flexibility and dedication of their managers in leveraging information and IT for improved business performance. As a result, it is not the IT investments that are important, but how IT is used by every employee from the top to the bottom of a company. Also, if the company is becoming more dependent on sharing and using information and knowledge, managers should pay particular attention to the values and behaviours associated with information and IT use in their company. Changing a company's information culture requires altering behaviour, attitudes, and incentives that relate to information (Davenport, 1994).

Managers must use IT so that they can serve the needs of the members of their organization. Above all this involves communicating with one another. New technologies such as the Internet can serve this goal. Moreover, the computer is invisible within the Internet. Even the PC, primarily used to date to access the Internet, is being rapidly

replaced with information appliances with dedicated functions. Interestingly enough, the PC was the front end of the e-commerce system investigated in this research. Gershenfeld (1999) and Norman (1999) argue that the PC is perhaps the most frustrating technology ever produced in that it is not task-specific. They advocate that any IT tool should be designed in such a way that it fits the task it is supposed to support. Perhaps this explains why most managers are quick to take to new gadgets such as mobile phones, personal digital assistants (PDAs), and electronic organizers, all of which have dedicated functions. Gradually, new task-specific tools, using intelligent interfaces alongside the tried and trusted keyboard and mouse, will fully connect the manager to his organizational infrastructure. Finally, it is worth noting that although the Internet may only be one of many communications channels, it undoubtedly has been the driver behind the change in attitudes by many managers regarding the opportunities IT offers. As with the telephone, the Internet is ubiquitous, has no switch to turn it off, is easy to use, is designed as always active, and is likely to be used by every SME manager in the near future. Any intervention or support either by support staff or personal secretary then becomes superfluous, because there are a range of carrots and sticks to help persuade even reluctant managers to use IT actively. After all, valuable IT tools are still just tools; new technologies alone will not change the attitude and behaviour of the SME manager.

Appendix A Tam literature

No.	Author(s)	IS applications	Research context	Subjects	Research methods	Perceived Usefulness (PU)	Findings
1	Davis et al 1989	Word processing program WriteOne	University .of Michigan, MBA program	107 full time MBA students	Experiment 14 weeks longitudinal study	Improve performance Increase productivity Enhance effectiveness Find WriteOne useful	TRA and TAM comparison. PU scale 0.95 and 0.92 reliability for time 1 time 2 PU-BI 0.48 and 0.61 for time1 time 2 PU-A, 0.61 and 0.50 respectively PEOU indirect effect to BI through PU in time 2 SN no effect on intentions
2	Davis 1989	Study 1: PROFS-email XEDIT file editor (IBM mainframes accessible through 327X terminals) Study 2: IBM PC-based graphic system—Chart-Master & Pendraw	Study 1: IBM Canada's Toronto Development Laboratory Study 2: MBA at Boston University	Study 1: 120 knowledge workers Study 2: 40 evening MBA students	Experiment	Study 1: 1 Quality of Work; 2 Control over work; 3 Work more quickly; 4 Critical to my job; 5 Increase Productivity; 6 Job performance; 7 Accomplish more work; 8 Effectiveness; 9 Makes job easier; 10 Useful Study 2: 3,6,5,8,9,10	Study 1: PU correlated .56 to PROFS mail usage; .68 to XEDIT usage; PEOU correlated PU .56 for electronic mail, .69 for XEDIT, .64 for overall. Effects of PU on electronic mail usage b=.55, XEDIT b=.69, pooled b=.57 Study 2: PU reliability 0.98; Chart-Master, PU-self predicted usage r=0.71 Pendow, PU-usage r=.59, PEOU-PU r=.38 Pooled: PU-Usage r=0.85, PEOU-PU r=0.56 (p<.001)
3	Mathieson 1991	Spreadsheet or calculator	A western university. juniors and seniors students in an management course	TAM program 149, TPB 113	Experiment	Same as Davis 1989 study 2	TAM: PU= PEOU b=0.667; PU-A b=.0.694; PU-BI b=0.481 TAM is successful in explaining intention, having a slightly empirical advantage, easier to apply, only supply general information on user's opinions about a system
4	Moore and Benbasat 1991	PWS- personal work station	First pilot: business faculties of two university Second pilot: head office of a utility company Field Test: 7 companies from a variety of industries	First pilot: 20users and nonusers Second pilot: 75 individuals, 66 usable Field test: 800 questionnaires, 540 usable	Experiment, field survey	Relative advantage:(Perceived characteristics of innovation--PCI)	Instrument development procedures, to measure the perception of adopting an IT innovation. To be a tool for the study of the initial adoption and eventual diffusion of IT innovation within organization.
5	Adams et al 1992	Study 1: voice and email	Study 1: 10 different organisations	Study 1: 118 respondents	Survey Experiment (study 2)	Same as Davis 1989 study 2	Davis instruments validation and replication

		Study 2:WordPerfect, Lotus 1-2-3, Harvard Graphics	Study 2: undergraduate and MBA students	Study 2: Of 73 returned, 64 WordPerfect, 67 Lotus 1-2-3, 54 Harvard Graphics after three quarter usage.			Study 1: (homogen PEOUs technology, heterogen PEOUs user group) Email: PU-usage r=.347, PEOU-PU r=.0.600; Vmail: PU-usage r=.445, PEOU-PU r=.625; pooled, PU-usage r=.0.413, PEOU-PU r= 0.688 LISREL structural equation analysis, Email PU-usage r=.36, Vmail r=.31. Study 2: (homogen PEOUs user groups, heterogen PEOUs technologies) Structural equation analysis: WordPerfect: PU-usage not significant, r=-0.03, Lotus: PU-usage r=0.85 significant, Harvard Graphics PU-usage r=0.06 not significant, PEOU importance to use. Captive usage (no alternative to complete the job) explained WordPerfect low significant PU-usage; PEOU is an important determination of the intention only significant early in the use (Harvard Graphics, users have 13 months average experiences, twice lower than use WordPerfect 28 months and Lotus 33 months)
6	Adams et al 1992	Spreadsheet and database	Undergraduate students in a major Midwestern university	Spreadsheet, 51, database 72	Experiment	Same as Davids 1989 study 2	Test-retest the reliability of PU and PEOU. Initial admin, T1, 3days second admin. T2. Spreadsheet reliability .89 TI, .95 T2, Database .94, & .96.Correlation T1-T2, spreadsheet, .85 PU; database .81 PU
7	Segars and Grover 1993	Segars and Grover 1993	Same as Adams et al 1992 Using Adams' et al data			Spilt Davis 1989 PU into PU and effectiveness (effectiveness, job performance)	LISREL Confirmatory factor analysis: Adams et al 1992 do not appear well-modeled by the two factor structure; Effectiveness seems the third underlying construct; eight indicators, three factor model seems well-suited to the underlying pattern of correlations.
8	Subramanian1994	Voice mail and	An organization	Vmail: 75 of 102; dial	Survey	Increase productivity	PU and PEOU measurement

		customer dial up system		up: 104 of 200		Enhance effectiveness Makes it easier to do job	method through structural equation modelling, build better structural model, PU is a determinant of predicted future usage. Vmail: PU-predicted usage r=.562, Dial up, .437 significantly
9	Szajan 1994	Database management systems (choose packages to build bibliographic database)	MBA students in MIS course	Sample 231based on 47 subjects, 6 selection of DBMSs,	Experiment	Same as Davis 1989	Discriminant analysis (Chi Square), predictive validity. PU/PEOU instrument can predict the choice behaviour of subjects in a software evaluation project, it is a logical candidate for use in the evaluation and choice of software package.
10	Igbria et al 1995	Microcomputer	Part-time MBA students at an eastern university	280, 236returned, 214 usable	Survey	Improve performance Increase productivity Enhance effectiveness Find Micro computer useful	Test of measurement model (sample 1): PU reliability .82, user training .09, EUC support .35 management support .23 system quality .12 PEOU .50 have direct effects on PU, explain 48% variance. PU-perceived usage .33, variety of use .16. Assessing the revised measurement model (sample 2): PU reliability .82; User training and system quality strong direct and indirect effects on PU. Computer experiences, EUC support effects on PU. PU positive effect on perceived usage and variety of use.
11	Taylor and Todd, 1995	Various systems available at computing resource centre-CRC	Business school students	786 users, 3,780 visits, 12-weeks period	Survey	The CRC will be of no benefit to me; Using the CRC will improve my grades; The advantages of the CRC will outweigh the disadvantage; Overall, using the CRC will be advantage PEOUs.	PU-A path coefficients .79, to BI 1.56, total effects to behaviour .54, to BI 1.41. TAM, TPB and decomposed TPB comparison.
12	Straub et al 1995	Voice mail	A large financial institution in America (final data)	870 randomly users, 458responded	Field interview Survey	Voice mail is very important in performing my job; Because of information I now get through voice-mail, my decision-making is far more effective.	LISREL, nomological network analysis, subjective (self report or predict) and objective (computer-recorded)measures of system usage Nomological net model: PU-self reported system usage r=0.623, PU –Computer- recorded system usage r=0.173 Rely on subjective measures of

							system usage may be artifactual.
13	Taylor and Todd, 1995b	CRC	Business school students	430 experienced and 35inexperienced users	6 Survey	Same as Taylor and Todd 1995 a	PU was a stronger predictor of intention (BI) for inexperienced users, it did not differ between the two groups in its impact on A
14	Montazemi etal 1996	30 softwarepackage (29microcomputer application package, 1mainframe)	A large Canadian integrated steel company	24 information centre product specialists, (ICPS) 22 end users	Survey	Same as Davis 1989 study 2	The selection of packages by ICPS can compromise end users' usage, but whether they are able to correctly evaluate PU and PEOU than end users are questioned. ICPS and end users have different assessment of PU. None of the covariates of gender, educational background, level of computer literacy, years of computer experience, the level of computer anxiety had a significant effect on PU and PEOU of the software package.
15	Igbaria et al 1996	Micro computer	Companies in North America	766 of 62 companies, 519 from 52 companies returned, focus on managerial usage	Survey	1 Using a microcomputer improves my productivity on the job; 2 Using a microcomputer helps me make better decisions by giving me access to higher quality information; 3 Using a computer allows me to be more innovative by providing the opportunities for more creative analysis and output; 4 Using a microcomputer gives me the opportunity to enhance my managerial image	Skills .13 organizational support .16 perceived complexity -.38 have significant effects on PU.PU has the strongest direct effect on usage (b=.26) PU is a principal motivator, perceived complexity is a key intervening variable. Skills promote usage
16	Chau 1996	Word and Excel, WordPerfect and Lotus as alternatives	An organization	285 of 330 returned, 192 use Word, 176 use Excel	Survey	Perceived near-term usefulness, same as Davis 1989, Perceived long-term usefulness 1 Knowledge of ..can increase my flexibility of changing jobs; 2 Knowledge of .. can increase the opportunity for more meaningful work; 3 Knowledge of .. can increase the opportunity for preferred future job assignments; 4 Knowledge of ..can increase the opportunity to gain job security.	Accomplish tasks more quickly, enhance effectiveness AND increase opportunity for preferred future job assignments omitted in the final data. PEOU influences the user's intention to use indirectly via perception of near-term usefulness. Perceived near-term usefulness was found to be the most significant factor affecting intention to use. Also, has a significant and positive influence on perceived long-term usefulness. A user fins a technology useful in current work is predisposed to believe it will help in the future career.

							Perceived long-term usefulness has direct and statistically significant influence on BI. No significant, direct relationship between PEOU-perceived long-term usefulness.
17	Szajna 1996	Email	University	61 graduate business students	Experiment, 15 weeks longitudinal study	Same as Davis 1989	Pre-implementation: PU has a significant direct effect (b=.72) on intentions, PEOU does not, and no effect on PU. Post-implementation: PU has a direct and significant effect on intentions (b=.31), PEOU to PU b=.29, no direct effect on intention. PU has a direct and significant relationship with self-reported usage .23. When an individual becomes more experienced with the IT, usefulness directly determines not only intentions to use but also the usage behaviour.
18	Venkatesh and Davis 1996	Experiment 1: IBM PC-based graphics system, ChartMaster, Pendraw Experiment 2:Word Perfect, Lotus Experiment 3: PINE for Email, Gopher for information access (UNIX-based)	E1: Boston University E2: Temple University, Philadelphia E3: University of Minnesota	E1: 40 MBA students E2: 36 undergraduate students E3: 32 part-time MBA students	Experiment	Study PEOU and its antecedents	E1: Training effects on BI fully mediated by TAM. Direct-interaction with system has an effect on PEOU, and form system-specific PEOU perceptions. After hands-on experiences, system characteristics became significant in explaining PEOU perception. The possibility of computer self-efficacy serves as an anchor for PEOU perceptions. E2: Before direct experience, computer self-efficacy b=.57 was significant in determining PEOU. After direct experience, both computer self-efficacy b=.51 and objective usability b=.25 were significant. Moderation test, computer self-efficacy determines PEOU b=.48, but the effect of objective usability is moderated by direct experience. E3: Similar results as E2. Two systems are found to be harder than users had expected.

19	Agarwal and Pradad 1997	WWW services available on the Internet-Web	University	73 Part-time MBA students-professionals	Experiment	Innovation characteristics, current and future use intentions (Moore and Benbasat 1991 25 instruments)	Current usage: Visibility b=.29, compatibility b=.31 and Trialability b=.19 to acceptance, voluntariness b=-.27. Compatibility b=.31, the most important predictor of current usage. Lack of significance of relative advantage. Future intention: relative advantage (b=.49) and result demonstrability (b=.34) are significant. The two work in tandem. Current usage(initial use) is not instrumental in predicting future use. PEOU was not significant, since Web is inherently ease of use.
20	Jackson et al 1997	A wide range of IS (financial system) development projects	6 large accounting firms, involved in IS projects with regional system development firms	585, 139returned, 111 usable	Survey	Situational, intrinsic involvement. PU items same as Davis et al 1989	PEOU, situational involvement, prior usage and argument for change no correlation to PU. Only intrinsic involvement r=.628 significantly related to PU. PU no effects to A and BI. PEOU to A and BI are significant. Situational involvement to BI and A, intrinsic involvement to A, and prior usage to BI, these relationship are significant.
21	Gefen and Straub 1997	Email	US. Swiss and Japan three airline companies	392 usable	Survey	Gender, SPIR (social presence and information richness of the medium) PU as Davis 1989	Gender on SPIR b=-.1429, on PU b=-.1088, on PEOU b=.1306 significant at .05 level, not significant on use Gender has an impact on ht IT diffusion process. SPIR and culture as antecedents to PU in the case of email. SPIR to PU .2863, SPIR and covariate of culture on PU is respectable R square is .59.
22	Agarwal and Prasad 1998	WWW information services on the Internet	University	175 MBA students-business professionals	Survey	PIIT(personal innovativeness in the domain of IT) PU similar as Davis 1989, without useful item.	PIIT to BI .47 significant. PIIT moderates effects of compatibility perceptions, not PU and PEOU. PIIT could be used as a control variable in individual level studies
23	Doll et al 1998	Spreadsheets, Word	Two large universities	Of 902, 244	Lab experiment	Confirmatory and Multi-group invariance	PU-type of applications

		processing, database, graphics		spreadsheet, 156 database, 292 word processing, 210 graphics. Of 581, 105 no experiences, 244 novices, 232 experienced. 355 females, 371 males	(Initial exposure situation)	analysis. PU and PEOU same as Davis 1989	(rejected): the word processing subgroup had poor data fit. PU is invariant across other three applications. PU –experience (rejected): no experience subgroup had poor model data fit. PU is invariance across novice and experienced users. PU –gender accepted: PU instrument is invariant across gender. PEOU-types of applications invariance accepted. PEOU – experience invariance accepted. PEOU-gender (rejected): Both male and female subgroups had good model data fit. PEOU scores are not comparable, the scale differences are probably inconsequential for most practical decision making purpose
24	Parthasarathy and Bhattacherjee 1998	Online services	Online service firm	This sample, 214 continuing adopters and 229 discontinuers	Field Survey	Innovation diffusion theory, post-adoption behaviour: continuous usage, discontinuance usage (replacement and disenchantment), relative advantage (PU), PEOU, compatibility as perceived services attributes	PU and compatibility measured at the time of initial adoption, can be significant predictors of subsequent discontinuance behaviour. PEOU did not have a continuing impact on subsequent discontinuous decisions. Network externality (use of complementary products) during the initial adoption process is a significant predictor of future discontinuance. Early adopters are more likely to be replacement discontinuers, later adopters are more likely to be disenchantment discontinuers.
25	Agarwal and Prasad 1999	PC	A Fortune 100 corporation, It vendor	Of 468, 230 usable	Survey	Individual differences(Role with regard to technology, tenure in workforce, level of education, prior similar experiences, participation in training) PU: 1 accomplish tasks quickly, 2 improve performance, 3 greater control over work, 4 improve the quality of the work,	A+PU-BI 26% variance. PU+PEOU-A 63% variance. PEOU-PU, b=.74;. PU and PEOU had an equivalent total effect on BI (.39 and .40) PEOU +Participation in Training have a significant and positive effect on PU, 57% variances. Other individual differences have

						5 improve productivity, 6 enhance effectiveness, 7 easier to do job 8 useful	indirectly effects through PEOU. Role with technology, prior experiences, level of education were all significant determinants for PEOU, collectively 18% variance. Beliefs mediated the external variables' effects on attitude toward and behaviour intentions to use.
26	Lucas and Spitler 1999	Broker workstations (Sun workstation, windowed interface with Unix operating system, networked to servers and to corporate mainframe computer, includes three main applications: market data, office software, and mainframe access)	An investment bank	Final sample 49 brokers, 58 sales assistants	Survey	Perceived system quality, Norm-Use/intended use, performance, PU: Workstation improves performance, productivity, effectiveness, is useful Two control variables: workload and Job	Perceived quality is an important predictor of PU in the full sample and for sales assistance, not for brokers. PEOU is predictor of PU. In the field setting of broker workstations, the individual perception variables PU and PEOU in TAM do not approach significance in predicting use. PU and PEOU correlated at .62. Combining the two to be a single variable, it is a significant predictor of use for the full sample and sales assistance. TAM does not support it. Norms are predictor of use for all groups, not broker. Low performance (of prior performance of similar system) is associated with higher levels of use and intended use for brokers and full sample. Performance of prior systems is the best predictor of performance of new systems. Job differences or tasks may be an important predictor of use.
27	Venkatesh1999	Virtual workplace system(Internet-based telecommuting application)	Organizations	Study 1: Of 320, 69 attended; Study 2: Of 500,146 usable, knowledge workers	Survey	Game-based training vs. traditional lecture-based training, intrinsic motivation (playfulness) PU Davis 1989	Game-based training intervention has higher levels of PEOU. PEOU leads to enhanced BI to use in comparison with users in the traditional training interventions. Game-based methods will potentially allow users to scale initial hurdles to acceptance and usage, also create higher-level of intrinsic motivation, which is more likely

							to lead to sustained usage behaviour. PU is not statistically different across interventions
28	Karahanna et al 1999	Windows 3.1software package	A large financial institution	Final sample, 77 potential adopters, 153 users	Survey	Pre-adoption and post- adoption. Instruments based on Moore and Banbaset 1991. PU: accomplish task more quickly, improve quality of work, enhance effectiveness, make job easier	PU (.42 and .82) is the only belief underlying A to adopting and to continuing to use. Image .32 is significant for users. Visibility, result demonstrability .35, PEOU.06, Trialability -.40 are significant for potential adopters. Prior to adoption, behavioural and normative beliefs influence A to adoption. Post-adoption, only PU and Image enhancements influence A.
29	Hu et al 1999	Telemedicine technology	Public tertiary hospitals in Hong Kong	Physicians, of 1728, 42returned, 408 usable	1 Survey	PU: enable to complete patient care more quickly; CANNOT improve patient care and management; increase productivity in patient care; CANNOT enhance effectiveness; Make patient care and management easier; Not useful for patient care and management.	PU has a significant and strong influence on physicians' BI to the technology .36, to A.45. PU total effects on BI is .47 PEOU has no significant influence on PU and A. Reflect limitations of TAM's applicability with respect to technologies, user populations or both. The explanatory power of TAM, particularly the PEOU factor, may weaken as the competency of the users increase, like physicians.
30	Agarwal and Karahanna 2000	WWW	A large state university	288 junior students	Experiment	PU: using the web enhances effectiveness in college, enhance productivity, improve performance in college, using web useful in my college activities. PEOU, self efficacy (SE), playfulness (CPS), PIIT, Cognitive Absorption (CA)	Without CA direct impact on BI: CPS-CA b=.360, PIIT-CA b=.408, CA-PU.517, CA-PEOU .587, SE-PU.057, SE-PEOU.230. PEOU-PU not significant. PU-BI .475, PEOU-BI .307. Totally explained 48% variances With CA direct impact on BI: PU-BI .367, PEOU-BI .208, CA-BI .246, totally explained 50.7% variances. Neither PIIT or CPS are statistically significant predictor of PU and PEOU, CA mediated the effects with respect to beliefs about IT.
31	Venkatesh2000	Study 1: a new interactive online help desk system	Study 1: a medium-sized retail electronic store	Study 1: Of 70, 58 usable Study 2a:	Survey (voluntary use, initial training T1, 1 month T2, 3 months T3)	PEOU and its antecedents. Anchors (computer self-efficacy, perception of external control, computer anxiety, computer	PU and PEOU explained 35% variances in BI. PEOU fully mediated the proposed

		Study 2: a new multi-media system for property management Study 3: PC-based (windows 95) payroll application	Study 2: a large real estate agency Study 3: a medium-sized financial services firm	Of 49, 41 usable, 2b: of 107, 104 usable Study 3: Of 52. 43 usable		playfulness); adjustments (perceived enjoyment, objective usability). Experience is moderating variable	antecedents to BI. PEOU has a direct and indirect (via PU) to BI. At T1, the proposed anchors were only determinants of PEOU, explain 40% variances. With increasing experience, adjustments play a key role in determining system-specific PEOU, 60% variances explained. The general anchors continued to be important factors, e.g., computer self-efficacy and facilitating conditions were stronger determinants than were adjustments resulting from the user-system interaction.
32	Venkatesh and Moriis 2000	Data and information retrieval system	5 organization	Of 445, 324 usable response, 156 female, 186 male	Survey	Gender, experience, five months period. PU: improve performance, increase productivity, enhance effectiveness, useful	After initial exposure: men placed a greater emphasis on U-BI than women, women weighted PEOU-BI more strongly, not significant for men. There were no gender difference in the role of PEOU to U. SN was a significant factor influencing BI for women, not significant to men Long term: men were more strongly influenced by U to BI, than women. Women continued to weight PEOU as a direct determinant of BI more strongly than men. No difference in the PEOU-U relationship between men and women. SN did not influence men in the long term. women were still influenced by SN after one month sustained technology use. SN is not significant to women after 3 months.
33	Venkatashand Davis 2000	Study 1: a proprietary system (floor and machine scheduling and personnel assignment) Study 2: System project (move current mainframe operations to a	Study 1: a medium-sized manufacturing firm Study 2: A large financial services firm Study 3: A small accounting services firm	Study 1: Of 48 floor supervisors, 38 usable Study 2: Of 50, 39 usable Study 3: Of 51, 43 usable Study 4: Of 51, 36 usable	Survey, longitudinal field studies	PU and its antecedents, two processes: social influence processes (SN, voluntariness and image) and cognitive instrumental processes (job relevance, output quality, result demonstrability, and PEOU). Scales of PU, PEOU, BI same as Davis 1989 and Davis et al 1989.	Results of pooled across studies and time periods (n=468) Consistent with theory, the basic TAM relationships, BI—use .52, PU-BI .55,PEOU—BI.17, PEOU-PU.30, were well supported, with full mediation by intention and no moderation by either voluntariness or

		Windows-based environment) Study 3: Windows-based customer account management system Study 4: Stock management system	Study 4: A small international investment banking firm				experience. SN-BI was significantly moderated by both experience and voluntariness. SN significantly affects intention directly only when usage is mandatory and experience in the early stages. SN-PU (internalization) was significantly moderated by experience. Image –PU (identification) no significant. Job relevance and output quality –PU are interactive. .40 TAM2 explained 60% variance of PU, SN exerts a significant direct effect on BI over and above PU and PEOU for mandatory (not voluntary) systems.
34	Venketeshand Brown 2001	PC use in Household	American households	733 completed response at phase 1, 87.9% follow up response in phase 2 (after 6 months)	Mail survey, telephone interview	Attitudinal beliefs(utilitarian outcomes, hedonic outcomes, social outcomes); normative belief SN (social influences); Control beliefs (PBC)	Utilitarian outcome, hedonic outcome and social outcome drive adoption. Rapid technology changes and fear of obsolescence drive non adoption.
35	Plouff et al 2001	Exact Smart card-based payment system	Canadian merchants involving in system trial	Of 379, 176 usable response	Survey	TAM & PCI comparison PU similar with Davis 1989, PCI as Moore and Benbasat 1991	TAM: PEOU-PU .531 28.2% variances explained, PU-BI.507, PEOU-BI .108, 32.7% variance explained. PCI: relative advantage .291, PEOU .005, compatibility .167…BI, 45.0% variance explained. Full set of PCI adds significantly to predict BI.
36	Chau and Hu 2001	Telemedicine technology	Public tertiary hospitals in Hong Kong	Physicians, of 1728, 42returned, 408 usable	1 Survey	TAM, TPB &decomposed TPB comparison PU: Using telemedicine technology cannot improve my patient care and management, cannot enhance my effectiveness, not useful	TAM 40%, TPB 32% and DTPB 42% variances explained. PU was a significant determinant of A &BI in both TAM & DTPB. PEOU not in all models. Compatibility –PU .70 (DTPB) is significant, not PEOU. PU exhibited the strongest direct and total effects on BI. PEOU was not found to have any effects on PU or A. Compatibility has greater indirect effect on BI than direct effect.

37	Koufaris 2002	B2C e-commerce web-based store	Booksamillion.com customers	Online users, 300 complete first part, and 280 of those filled out the second part	Online survey, questionnaire ran for one week	TAM and flow theory. PU: usingbooksamillion.com can improve my shopping performance, increase shopping productivity, increase shopping effectiveness, useful.	Shopping enjoyment b=.345 and PU .415 have significant effect on intention to return. Product involvement .280, challenges .216 and skills .142 have significant effect on customer concentration. Involvement .218, challenges .338, skills .180 and value-added use .207 have significant effect on customer shopping enjoyment Confirm the dual nature of the online consumer as a traditional shopper and a computer user.
38	Hong et al 2001-2002	Digital Library: E-library	The open University of Hong Kong	Non-traditional students, 1244 interviewed, 585 retained	Telephone interview (17min)	Individual differences (computer self-efficacy, knowledge of search domain), systems characteristics (relevance, terminology, screen design) PU: Using the E-library would enable me to accomplish my study more effectively, improve my performance, make it easier for me to do my assignments and prepare for the examination, useful in my study	PEOU=computer self-efficacy .18+knowledge of search domain.11+relevance .14-terminology.37+screen design.29, 69% variances explained PU=PEOU.39+relevance.61, 57% variances explained BI=PU.51+PEOU.17, 52% variances explained
39	Venkatesh et al 2002[3]	database and virtual work place	Same as Venkatesh 1999 and Venkatesh and Speier 1999	Same asVenkatesh 1999 and Venkatesh and Speier 1999	Same asVenkatesh 1999 (add longitudinal study) and Venkatesh and Speier 1999	User acceptance enablers (UAE), (training environment, Pre-training mood, control), intrinsic motivation IM, extrinsic motivation (PU), PEOU, BI, short-term use, continued use	IM-PEOU .45, IM-PU .27, PEOU-PU .27. PEOU-BI.23, PU-BI .44 have significant effect on BI. IM no direct effect on BI, only through PEOU and PU. BI-immediate use (short term) .59, fully mediating the influence of IM,PEOU,PU; Short-term use-continued use .59, it is the sole predictor of continued usage. All other variables measured at t1 and t2 were non-significant predictors of continued use.
40	Chau and Hu 2002	Telemedicine technology	Public tertiary hospitals in Hong Kong	Physicians, Of 1728, 408 usable response	Interview and survey	PU same as Chau and Hu 2001. PEOU, Compatibility, peer influence, perceived technology control, attitude, BI	Proposed a three-layer hierarchical framework for professionals acceptance of technology. Individual context at the inner core, the implementation context on the outermost layer, the technological context in the middle Model results: 43% variance explained. PU determines A and

							BI. PEOU influences perceived technology control, not PU and A. Compatibility determines PU, not PEOU, has strong indirect effects on BI through PU. Peer influences no effects on A or BI. A has direct effects on BI, weaker than PU, greater than perceived technology control to BI.
41	Gefen et al 2003	Online shopping, E-commerce (B2C, low-touch low risk items)	Business school in the mid-Atlantic region	Of 400 students, 213 usable (experienced online shopper)	Field survey	Same as Davis 1989. Trust (Calculative-based, institution-based, i.e., structural assurances, situational normality, knowledge based familiarity)	Consumer's intention to transact with an e-vendor depends on trust, PU and PEOU. PU is stronger direct predictor than trust. The effect of familiarity on trust was fully mediated by PEOU. Institution-based beliefs of structural assurances and situational normality have the most effect on trust.
42	Summan and Siegal 2003	Information adoption	A multinational public accounting firm (North American operations)	46 interviewed, Of 178 survey, 63 usable	Interview, survey	PU transferred as information usefulness (information is valuable or worthless, informative or uninformative, helpful or harmful), Argument quality, source credibility as antecedents for usefulness, recipient expertise and involvement as moderators	Integration ELM with TAM. Argument quality and source credibility are significantly associated with usefulness. Usefulness associated with information adoption highly. Usefulness mediated effects of argument quality and source credibility on adoption. Recipients expertise and involvement moderated effects of argument quality on usefulness significantly, but only marginally for source credibility External validity of knowledge(usefulness for problems at hand) is more important than internal validity of that knowledge.
43	Wixom and Todd 2005	Data warehousing predefined reporting software	Members of The Data Warehousing Institute	Overall response rate of 21%, yielding 465 completed surveys	Survey	Strong significant relationships between information satisfaction and PU and between system satisfaction and ease of use demonstrate object-based attitudes on behavioural beliefs	System and information characteristics explain 75% of the variance for system and quality. There is a need to differentiate between object-based beliefs and attitude, and behaviour-based beliefs and attitudes
44	Fang et al 2006	Wireless Technology	The majority of the	One hundred and one	Survey.	Perceived usefulness and perceived ease of	Theoretical contributions: (1)

			participants were working adults.	participants		use were shown to be important to user intention to perform general tasks that do not involve transactions and gaming on wireless handheld devices. Perceptions of playfulness appear to influence user intention to play games using wireless technology. Perceived usefulness and perceived security affect user intention to transact on handheld devices.	introduction of task type as a moderator on the determinants of wireless technology adoption, (2) study of task/technology fit using a profiling approach, and (3) extension of TAM to the adoption of wireless technology outside the workplace for a variety of tasks. Study provides a more practicable approach for investigating various user tasks and how technology can support them.

Appendix B I Survey questionnaire

This appendix contains all the letters used to communicate with respondents as well as the questionnaire sent to SME managers.

Introduction

Researchers and practitioners stress the importance of e-commerce systems as such. However, they hardly take into account the IT environment needed for SME manager in order to be able to use this e-commerce system adequately. Organizational, individual and environmental characteristics might influence actual usage of an e-commerce system.

Objective

The objective of my doctoral study, a dissertation leading to a DBA, is to develop and test the factors explaining SME managers' acceptance and use of e-commerce systems. Acceptance has been conceptualized as an outcome variable in a psychological process that users go through in making decisions about Information Technology (IT). Theoretically, Davis' Technology Acceptance Model will be used, adapted to the specific environment. The subjects of the study are the managers of SMEs.

IT Tool

The study uses an e-commerce system as the IT tool to be used by managers of SMEs.

Research Process

An important part of the research is the field test of the hypothesized relations of the research model. A questionnaire has been composed which should, ideally, be administered to all

managers in the selected companies. The results will be analyzed statistically and will probably elicit common factors in SME managers' usage of an e-commerce system.

Questionnaire Administration

Through a contact person in the selected organizations, the questionnaires will be distributed to all managers. The questionnaire is self-explanatory and takes approximately 30-40 minutes to fill out. The provided information is of course completely confidential and full anonymity will be maintained, although every respondent can indicate if he is willing to participate in a follow up interview.

Marc Castricum

Heemkerk, 2005

Appendix B II Cover letter contact person

Heemskerk, date

<Company> Attn. Mrs/Mr. XYZ

Dear Mrs/Mr. XYZ,

Referring to our telephone conversation of <month, year>, I have enclosed n copies of the e-commerce questionnaire. As you agreed to participate in my research project, I would like to ask you to distribute the questionnaires among the target group, i.e. owners and managers, at <company>.

The questionnaire and the covering letter should be handed out or sent to each managers as soon as possible. My research project would greatly benefit from as many completed questionnaires as there are managers at your company that use an e-commerce system. Therefore, if you need additional copies, kindly let me know, so I can send you more. Please notice that the time for the participants to fill in the questionnaire is two weeks at the most.

When you have collected all completed questionnaires, would you please return them to me as soon as possible, preferably before <date> to the address given below? You may use the enclosed address sticker. If there are any questions on your side, do not hesitate to contact me.

Thank you for helping me in this project. I greatly appreciate your assistance.

Yours sincerely,

Marc Castricum

Enclosures

Appendix B III Questionnaire Covering letter

Heemskerk, date

Dear Manager,

As part of a doctoral study at Bradford University, United Kingdom, I am conducting a survey on the usage of e-commerce systems by managers of Small and Medium-sized Enterprises (SMEs). My study uses a PC with the e-commerce system as the tool under review. I would like to request your participation in this study.

Your organization is one of a number in which manager(s) are being asked to address issues related to using a PC with the e-commerce system The attached questionnaire investigates the factors that may influence your usage of these Information Technology tools. In order that the results will truly represent how SME managers feel about using a PC with the e-commerce systems, it is important that each questionnaire be fully completed and returned.

I therefore respectfully ask you to answer all the questions (this should take no longer than 35 minutes). As your participation will be a valuable contribution to my doctoral study, it is extremely important to me. It would be very helpful to respond as soon as possible.

You may be assured of complete confidentiality. Your information will be saved only for the duration of my study and I will guarantee full anonymity. The responses from all organizations will be grouped together, and no individual, company, or organization will be identifiable. The results of this research will be made available to all interested respondents through your contact person.

Prior to sending you this questionnaire, I made sure that your organization uses an e-commerce system.

I will be happy to answer any questions you may have pertaining to the study. You can reach me via your contact person.

Thank you for your time and co-operation.

Yours sincerely,

Marc Castricum

Enclosures

Appendix B IV Questionnaire

E-commerce questionnaire

Information Technology and electronic commerce systems

1 Introduction

This questionnaire is an important part of a doctoral study set up to assess the usage of electronic commerce systems by Dutch SMEs. Your participation in this survey will be a valuable contribution to my doctoral study. All your responses will be treated completely confidentially. I will save your information only for the duration of my study and I will guarantee full anonymity.

Instruction

In this questionnaire you are asked to fill in numbers (e.g. years), tick the appropriate boxes, and tick numbers on scales. Please choose (check or circle) the number that best describes **your reaction** to the statement or question concerned.

Please try to answer **all** the items, even if they do not seem to apply to you. Furthermore, never mark more than one single number on a scale, unless otherwise instructed.

This questionnaire should take no more than **30** minutes to complete. If you wish to comment on any of the questions or qualify your answers, please feel free to use the space at the end of this questionnaire.

2 e-commerce system definition

Please read carefully

e-commerce is defined here as "the process of buying and selling products or services using electronic data transmission via the Internet and the www." Examples that do not fit this definition include electronic publishing to promote marketing, advertising, and customer support. The mere use of electronic mail or the use of a web site for electronic publishing purposes does not constitute e-commerce to the definition above

1 Do you or your organization use any type of e-commerce system, **as defined above**, like a website, e-billing, electronic data interfaces with customers and/or suppliers, etc

Yes ☐

No ☐

IF YOU DO NOT USE E-COMMERCE CONTINUE WITH SECTION 13 CLOSING.

Section A Personal Information

Please respond to the next group of questions on personal information

2 What is your age?

☐ Younger than 25
☐ Between 25 and 35
☐ Between 36 and 45
☐ Between 46 and 55
☐ Between 56 and 65
☐ Older than 65

3 What is your gender?

Male ☐
Female ☐

4 What is the highest level of formal education you have attained to date?

☐ High School Diploma
☐ Bachelor Degree
☐ Graduate Degree
☐ Post Master Study
☐ Doctoral Degree
Other (please specify) _____

5 What is your current job title? _____

6 For what function and/or department do you work?

☐ General Management
☐ Finance
☐ Sales and Marketing
☐ Planning
☐ Manufacturing/Production
☐ Human Resources
☐ MIT (IT)
☐ Engineering
☐ R&D
☐ Other (please specify)

7 How long have you worked with your present firm? (years) _____

8 How long have you worked in your current position (years) _____

9 How long have you worked in a managerial position, including previous employers? _____

Section B Company Information

Please respond to the next group of questions about your company.

10 Industry in which your firm operates

- ☐ Manufacturing
- ☐ Finance
- ☐ Healthcare
- ☐ IT / Telecom
- ☐ Education
- ☐ Wholesale
- ☐ Construction
- ☐ Government
- ☐ Retail
- ☐ Transportation
- ☐ Other (please specify)

11 Total number of employees _____

12 Specify last year's sales of the organization as a whole (in €)

- ☐ less than € 1.000.000
- ☐ between € 1.000.000 and € 4.999.999
- ☐ between € 5.000.000 and € 10.000.000
- ☐ more than € 10.000.000

13 Specify percentage of last year's sales generated by e-commerce (e-commerce is defined here as "the process of buying and selling products or services using electronic data transmission via the Internet and the www.")

- ☐ less than 10 %
- ☐ between 10 % and 20 %
- ☐ between 21 % and 30 %
- ☐ between 31 % and 40 %
- ☐ more than 40%

14 How much does your company on an average invest in e-commerce systems per year? (in % of sales)

- ☐ less than 1 %
- ☐ between 1 and 5 %
- ☐ between 6 and 10 %
- ☐ more than 10 %

Section C Environmental Information

15 **Please respond to the next group of statements concerning the environment of you business**

1=Very low
2=Low
3=Moderate
4=High
5=Very High
6=Not Applicable

A	The rate at which products/services become obsolete in your industry	1	2	3	4	5	6
B	The predictability of the action or the actions of your competitors	1	2	3	4	5	6
C	The predictability of demand and customer tastes	1	2	3	4	5	6
D	The rate at which the product process technology changes in your industry	1	2	3	4	5	6
E	The frequency at which marketing practices need to be changed to keep pace with the market and competitors	1	2	3	4	5	6

16 **Where would you rank the "threat" level to your firm for the following factors**

1=Very low threat
2=Low threat
3=Moderate threat
4=High threat
5=Very High threat
6=Not Applicable

A	Price competition	1	2	3	4	5	6
B	Product quality/novelty competition	1	2	3	4	5	6
C	Dwindling markets for products	1	2	3	4	5	6
D	Scarce supply of materials	1	2	3	4	5	6

17 **Are there noticeable differences amongst your company's products/services with regard to:**

1=The same for all products
2=Nearly the same for all products
3=Average between all products
4=Wide variations between products
5=Very wide variation between products
6=Not Applicable

A	Customer's buying habits?	1	2	3	4	5	6
B	The nature of competition?	1	2	3	4	5	6
C	Market dynamism and uncertainty?	1	2	3	4	5	6

18 **Please indicate how much you agree or disagree with the following statements:**

1=Strongly disagree
2=Disagree to some extent
3=Uncertain
4=Agree to some extent
5=Strongly agree
6=Not Applicable

1	It is easy for our customers to switch to another company for similar products/services without much difficulty	1	2	3	4	5	6
2	The rivalry among companies in the industry my company is operating in is very intensive	1	2	3	4	5	6
3	There are many products/services in the market which are different from ours but perform the same function	1	2	3	4	5	6

Section D Information Technology Training

		1=None or little 2=Some 3=Consistent with job requirements 4=Intensive 5=Extremely intensive 6= Not Applicable					
19	**Please indicated if you have had training in the use of Information Technology**						
1	General courses at an educational institute	1	2	3	4	5	6
2	In-house company courses	1	2	3	4	5	6
3	External courses	1	2	3	4	5	6
4	Self-teaching	1	2	3	4	5	6

		1=None or to a very little extent 2=To a little extent 3=To some extent 4=To a great extent 5=To a very great extent 6=Not Applicable					
20	**Please indicate to what extent you have had training for the following subjects**						
1	Using the personal computer and its peripherals (as per our definition: printers, scanners, external drives, etc.)	1	2	3	4	5	6
2	Word processor, spreadsheet, presentations software (for example: Microsoft Word, Corel Wordperfect; Excel or Powerpoint)	1	2	3	4	5	6
3	E-mail, internet usage	1	2	3	4	5	6
4	Company specific software (for example: in-house developed, SAP, etc)	1	2	3	4	5	6
5	Other software (for example: Market research software, Finance/Accounting software, Human Resource software, Computer Application Design software, etc)	1	2	3	4	5	6
6	Please specify other software	_____					

Section E Information Technology Experience

		1=Very low 2=Low 3=Moderate 4=High 5=Very high 6=Not Applicable					
22	**Please rate your experience in working with Information Technology**						
1	How do you rate your general computer skills?	1	2	3	4	5	6
2	How do you rate your keyboard skills?	1	2	3	4	5	6
3	How do you rate your skills with regard to Windows, Apple, Linux technology (e.g. pull-down menus, icons, clicking)?	1	2	3	4	5	6
4	How do you rate your skills with regard to PC software such as for example word-processing, spreadsheet?	1	2	3	4	5	6
5	How do you rate skills with regard to e-commerce	1	2	3	4	5	6

23 **Please find below five computer end user types. How would you rate yourself? (please, tick only one box)**

☐ No user. No computer use

☐ Novice user. Plain use of word processing and e-mail
☐ Intermediate user. Moderate use of up to four different packages, including word processing, spreadsheets, e-mail
☐ Advanced user. Extended use of computer and software packages, including graphics and presentation programs
☐ Expert user. IT specialist, highly competent in using computer and solving problems

Section F Information Technology Implementation

24 **Please indicate how much you agree or disagree with the following statements**

1=Strongly disagree
2=Disagree to some extent
3=Uncertain
4=Agree to some extent
5=Strongly agree
6=Not Applicable

Information Technology planning at my company is formalized	1	2	3	4	5	6
Information Technology planning takes my company's business plans into consideration	1	2	3	4	5	6
Top management is involved in Information Technology planning	1	2	3	4	5	6
Every function at my company is supported by Information Technology	1	2	3	4	5	6
PCs minicomputers, word processors etc., are installed throughout my company	1	2	3	4	5	6
Information Technology performance evaluation is based on minimizing cost	1	2	3	4	5	6
Information Technology performance evaluation is based on contributing to business objectives	1	2	3	4	5	6
Top management is well informed about Information Technology	1	2	3	4	5	6
Information Technology has a large impact on my company	1	2	3	4	5	6
There is always a person in the organization that we can turn to for help in solving problems with the computer system	1	2	3	4	5	6
A central support (e.g. information center, help desk) is available to help out with problems	1	2	3	4	5	6
Training courses are readily available for us to become more skilled in using computers	1	2	3	4	5	6
We are constantly updated on new software that can help us to use computers more effectively	1	2	3	4	5	6
Management is really keen to see that we are happy using our computers	1	2	3	4	5	6
Management has provided most of the necessary help and resources to get us used to the computers quickly	1	2	3	4	5	6
I am always supported and encouraged by my boss to use computers performing my tasks	1	2	3	4	5	6
I am convinced that management is sure as to what benefits can be achieved with the use of computers	1	2	3	4	5	6

Section G e-Commerce implementation

Please respond to the next group of questions concerning the implementation of e-commerce

1=Very little
2=Little
3=Moderate
4=Much
5=Very much
6=Not Applicable

25 e-commerce is defined here as "the process of buying and selling products or services using electronic data transmission via the Internet and the www." Examples that do not fit this definition include electronic publishing to promote marketing, advertising, and customer support. The mere use of electronic mail or the use of a web site for electronic publishing purposes does not constitute e-commerce to the definition above

1	Are/were you, as a manager, involved in the implementation of e-commerce?	1	2	3	4	5	6
2	Does/did the implementation of e-commerce cover positive and negative issues (e.g. high costs, executives' time, learning time)?	1	2	3	4	5	6
3	Does/did the implementation of e-commerce meet your requirements?	1	2	3	4	5	6
4	Do/did the implementers of e-commerce provide you with an understanding of the technology and the functionality?	1	2	3	4	5	6

1=Strongly Disagree
2=Disagree
3=Neutral
4=Agree
5=Strongly agree
6=Not Applicable

26 **I feel that e-commerce**

1	is important to my business	1	2	3	4	5	6
2	is relevant to my work	1	2	3	4	5	6
3	is important to my work	1	2	3	4	5	6

Section H Information Technology Confidence

Often in our jobs we are told about software packages that are available to make work easier. For the following questions, imagine that you were given a new software package for some aspect of your work. It doesn't matter specifically what this software package does, only that it is intended to make your job easier and that you have never used it before

27 The following questions ask you to indicate whether you could use this unfamiliar software package under a variety of conditions. For each of the conditions, please circle the number that best describes you reaction to indicate how confident you would be completing the task using the software package.

1=Not at all confident
2=Slightly confident
3=Moderate confident
4=Highly confident
5=Totally confident
6=Not Applicable

I could complete the task using the software package

1	if there was someone around to tell me what to do as I go	1	2	3	4	5	6
2	if I had never used a package like it before	1	2	3	4	5	6
3	if I had only the software manuals for reference	1	2	3	4	5	6
4	if I had seen someone else using it before trying it myself	1	2	3	4	5	6
5	if I could call someone for help if I got stuck	1	2	3	4	5	6
6	if someone else had helped me get started	1	2	3	4	5	6
7	if I had a lot of time to complete the job for which the software was provided	1	2	3	4	5	6
8	if I had just the built-in help facility for assistance	1	2	3	4	5	6
9	if someone showed me how to do it first	1	2	3	4	5	6

Section I Information Technology Feelings

28 **Please indicate how much you agree or disagree with the following statements**

1=Strongly disagree
2=Disagree to some extent
3=Uncertain
4=Agree to some extent
5=Strongly agree
6=Not Applicable

1	I am confident that I could learn computer skills	1	2	3	4	5	6
2	I am sure of my ability to learn computer application software such as Excel or Powerpoint	1	2	3	4	5	6
3	I will be able to keep up with important technological advances in computers	1	2	3	4	5	6
4	I feel apprehensive about using a computer	1	2	3	4	5	6
5	If given the opportunity to use a computer, I am afraid that I might damage it in some way	1	2	3	4	5	6
6	I have avoided computers because they are unfamiliar to me	1	2	3	4	5	6
7	I hesitate to use a computer for the fear of making mistakes that I cannot correct	1	2	3	4	5	6
8	I am sure of my ability to interpret a computer printout	1	2	3	4	5	6
9	I have difficulty understanding most technical matters	1	2	3	4	5	6
10	Computer terminology sounds like confusing jargon to me	1	2	3	4	5	6

Section J Information Technology Use

29 **Please indicate the way you use e-commerce at work (more options are possible)**

☐ Do not use
☐ Own PC
☐ Through staff assistant (direct subordinate)
☐ Through managerial colleagues
☐ Through the IT department (on request)

30 **Do you make voluntary use of e-commerce**

☐ Yes
☐ No

31 **Please indicate how much you agree or disagree with the following statements**

1=Strongly disagree
2=Disagree to some extent
3=Uncertain
4=Agree to some extent
5=Strongly agree
6=Not Applicable

My superiors use PCs	1	2	3	4	5	6
My peers use PCs	1	2	3	4	5	6
My subordinates use PCs	1	2	3	4	5	6
My superiors use e-commerce	1	2	3	4	5	6
My peers use e-commerce	1	2	3	4	5	6
My subordinates use e-commerce	1	2	3	4	5	6
My superiors think that I should use e-commerce	1	2	3	4	5	6
My peers think that I should use e-commerce	1	2	3	4	5	6
My subordinates think that I should use e-commerce	1	2	3	4	5	6
In general, I want to do what my superiors think that I should do	1	2	3	4	5	6
In general, I want to do what my colleagues think that I should do	1	2	3	4	5	6
In general, I want to do what my subordinates think that I should do	1	2	3	4	5	6
In general, I want to do what my IT-manager think that I should do	1	2	3	4	5	6

Section K Perception about e-commerce

The following questions ask you about your perceptions of adopting e-commerce. Please indicate your agreement with the next set of statements using the same rating scale above

32 **Please indicate your agreement**

1=Strongly disagree
2=Disagree
3=Neutral
4=Agree
5=Strongly agree
6=Not Applicable

Our organization has the financial resources to adopt e-commerce	1	2	3	4	5	6
Our organization has the technological resources to adopt e-commerce	1	2	3	4	5	6
Using the e-commerce system is enjoyable	1	2	3	4	5	6
Using the e-commerce system in my job is fun	1	2	3	4	5	6
Our organization perceives that e-commerce is consistent with the	1	2	3	4	5	6

company's preferred work practices						
E-commerce would be consistent with our existing technology infrastructure	1	2	3	4	5	6
Top management is enthusiastic about the adoption of e-commerce	1	2	3	4	5	6
Competition is a factor in our decision to adopt e-commerce	1	2	3	4	5	6
Social factors are important in our decision to adopt e-commerce	1	2	3	4	5	6
We depend on other firms that are already using e-commerce	1	2	3	4	5	6
Our industry is pressuring us to adopt e-commerce	1	2	3	4	5	6
Our organization is pressured by the government to adopt e-commerce	1	2	3	4	5	6
Learning to operate e-commerce would be easy for me	1	2	3	4	5	6
I would find e-commerce to be flexible to interact with	1	2	3	4	5	6
My interaction with e-commerce would be clear and understandable	1	2	3	4	5	6
It would be easy for me to become skillful at using e-commerce	1	2	3	4	5	6
I would find e-commerce easy to use	1	2	3	4	5	6
Using e-commerce would enable my company to accomplish specific tasks more quickly	1	2	3	4	5	6
Using e-commerce would make it easier to do my job	1	2	3	4	5	6
The risk involved limit our e-commerce efforts						
Our e-commerce efforts are mainly influenced by our large suppliers	1	2	3	4	5	6
Our e-commerce efforts are mainly influenced by our large clients	1	2	3	4	5	6
Our e-commerce efforts are driven by our growth objectives	1	2	3	4	5	6

Section L Closing

33 If you would like to make remarks on the questionnaire, e-commerce or Information Technology in general, or if you missed certain items, please use the space below or the back of this questionnaire.

34 As I may want to discuss preliminary research findings I would like your permission to contact you for this purpose. If you are willing to participate, please enter your e-mail address were you can be contacted.

Thank you for responding to the questionnaire. I greatly appreciate your assistance. If wish to receive a copy of the results or if you have any questions, please send me an e-mail to mcastricum@netaffairs.nl

Marc Castricum

Please fax your questionnaire to

M. Castricum +31 (0)251 216175

or mail it to

M. Castricum
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1967 EE Heemskerk
Holland

Appendix C Descriptive data

Table C - 8 Respondents by Industry Type

Industry Type	Frequency	Percentage
Manufacturing	19	16,7
Finance	7	6,1
Healthcare	3	2,6
IT / Telecom	26	22,8
Education	8	7,0
Wholesale	14	12,3
Construction	8	7,0
Government	4	3,5
Retail	18	15,8
Transportation	5	4,4
Other	2	1,8
Total	114	100,0

Table C - 9 Respondents by Functional Work Area

Functional Work Area	Frequency	Percentage
General Management	51	44,7
Finance	33	28,9
Sales and Marketing	12	10,5
Planning	1	0,9
Manufacturing/Production	5	4,4
Human Resources	6	5,3
MIT (IT)	2	1,8
Engineering	1	0,9
R&D	3	2,6
Other	114	100,0

Table C - 10 Respondents Gender

Gender	Frequency	Percentage
Male	101	88,6
Female	13	11,4
Total	114	100,0

Table C - 11 Respondents Age

Age	Frequency	Percentage
Younger than 25	0	0,0
Between 25 and 35	27	23,7
Between 36 and 45	67	58,8
Between 46 and 55	16	14,0
Between 56 and 65	4	3,5
Older than 65	0	0,0
Total	114	100,0

Table C - 12 Computer End User Type

Computer End User Type	Frequency	Percentage
No user.	0	0,0
Novice user.	6	5,3
Intermediate user.	91	79,8
Advanced user.	17	14,9
Expert user.	0	0,0
Total	114	100,0

Table C - 13 Respondents Education

Age	Frequency	Percentage
High School Diploma	28	24,6
Bachelor Degree	46	40,4
Graduate Degree	36	31,6
Post Master Study	3	2,6
Doctoral Degree	1	0,9
Other	0	0,0
Total	114	100,0

Table C - 14 Respondents by Industry Type

Total Organization	Frequency	Percentage
Manufacturing	19	16,7
Finance	7	6,1
Healthcare	3	2,6
IT / Telecom	26	22,8
Education	8	7,0
Wholesale	14	12,3
Construction	8	7,0
Government	4	3,5
Retail	18	15,8
Transportation	5	4,4
Other	2	1,8
Total	114	100,0

Table C - 15 Access Type of Electronic Commerce System

Access Type	Frequency	% of responses
Via own pc	111	79.2
Through staff assistant	13	8.2
Through managerial colleagues	9	6.5
Through IT department	7	
Other	0	0
Total	140	100.00

Appendix D Structural Equation Modelling

Structural Equation Modelling (SEM) is a very general, chiefly linear, primarily cross-sectional statistical modelling technique. SEM describes relationships between variables. Factor analysis, path analysis, and regression all represent special cases of SEM (see also Arbuckle and Wothke, 1999; Hair et al., 1998; Schumacker and Lomax, 1996). SEM is a largely confirmatory, rather than exploratory, technique. That is, researchers are more likely to use SEM to determine whether a certain model is valid, rather than using SEM to "find" a suitable model, although SEM analyses often involve a certain exploratory element.

Structural equation modelling incorporate several different approaches or frameworks representing these models. In applied work, however, structural equation models are most often represented graphically. The mathematical description of the model consists of three equation types:

1. Equations that describe the relationships between the endogenous and exogenous latent variables.
2. Equations that describe the relationships between observations and endogenous latent variables.
3. Equations that describe the relationships between observations and exogenous latent variables.

The key variables of interest in structural equation modelling are usually the latent variables, which include two types:

(1) the exogenous latent variables (exogenous common factors, indicated as ξ, and (2) the endogenous latent variables (endogenous common factors, indicated as η. The observations (the

observed variables, the questions in this study) influencing ξ are called the X variables and the observations influencing η are called the Y variables.

The two types of latent variables are distinguished on the basis of whether or not they are dependent variables in any equation in the system of equations represented by the model. Exogenous constructs are independent variables in all equations in which they appear, while endogenous constructs are dependent variables in at least one equation, although they may be independent variables in other equations in the system. In graphical terms, each endogenous construct is the target of at least one one-headed arrow, while an exogenous construct is starting point of an arrow.

Parameters representing regression relations between latent constructs are typically labelled with γ for the regression of an endogenous variable on an exogenous variable (the total matrix is denoted by Γ), and with β for the regression of one endogenous variable on another endogenous variable (the total matrix is denoted by B).

SEM recognizes that their measures are imperfect, and attempts to model this imperfection. Thus, structural equation models include terms representing measurement error. The structural model typically includes a structural error term, labelled with ζ In the context of the measurement model, these measurement error terms are unique factors associated with each measure. Measurement error terms associated with X variables are labelled with δ (equation type 2, unique factors), while terms associated with Y variables are labelled with ε (equation type 3, unique factors). The error terms as well as the unique factors are assumed to be normally distributed.

Finally, the relationships between the observed variables and the latent variables (typically referred to as factor loadings) are denoted by the matrix $\Lambda\gamma$ for the Y variables and matrix Λx for the X variables.

In sum, the notation of the complete model is:

[1] $\eta=B\eta + \Gamma\xi + \zeta$

[2] $x = \Lambda x\xi + \delta$

[3] $y + \Lambda y\eta + \varepsilon$

Equation type 1 describes the structural model, whereas equation types 2 and 3 describe the measurement model.

Assumptions:

- Variables are measured from their means
- Common and unique factors are uncorrelated
- Unique factors and errors in equations are uncorrelated across equation
- Exogenous variables and errors in equations are uncorrelated
- None of the structural equations is redundant.

Appendix E Fit indices Confirmatory factor analysis

Table E - 5 Summary Fit Indices CFA

Variable	Chi-square/DF < 3	NFI > 0,90	CFI >0,90	RMSEA <0,05
Age	N/A			
Gender	N/A			
Education	N/A			
Professional experience	0,60	1,00	1,00	0,00
Computer (IT) Experience	1,24	0,93	0,98	0,05
Computer (IT) Training	1,22	0,92	0,98	0,04
Computer Anxiety	1,89	0,90	0,95	0,89
User Involvement	0,83	0,92	1,00	0,00
Perceived Fun/Enjoyment	0,80	1,00	1,00	0,00
Organizational Size	0,20	1,00	1,00	0,00
IT Maturity	1,33	0,93	0,98	0,05
Organizational Support	1,79	0,91	0,96	0,08
Organizational Usage	1,00	0,90	1,00	0,01
Social Pressure	1,69	0,94	0,97	0,04
Environmental Uncertainty	1,04	0,90	0,99	0,02
Competitor Behaviour	0,61	0,92	1,00	0,00
Implementation Process	1,33	0,92	0,98	0,05

Table E - 6 Confirmatory factor analysis Individual Characteristics

		Chi-square	df	Δ Chi-square	Δ df	NFI	CFI	RMSEA
Professional experience	Original model	40,00	2			0,88	0,88	0,41
	Adjustment 1	0,60	1	39,40	-1	1	1	0,00
Computer (IT) Experience	Original model	6,20	5			0,93	0,98	0,04
Computer (IT) Training	Original model	103,20	20			0,60	0,64	0,19
	Adjustment 1	86,60	19	16,60	-1	0,67	0,71	0,18
	Adjustment 2	97,50	22	-10,90	3	0,62	0,67	0,17
	Adjustment 3	61,50	21	36,00	-1	0,76	0,83	0,13
	Adjustment 4	48,00	20	13,50	-1	0,82	0,88	0,11
	Adjustment 5	36,90	19	11,10	-1	0,86	0,92	0,09
	Adjustment 6	22,00	18	14,90	-1	0,92	0,98	0,04
Computer Anxiety	Original model	110,60	20			0,62	0,65	0,20
	Adjustment 1	59,30	19	51,30	-1	0,80	0,85	0,13

	Adjustment 2	48,40	18	10,90	-1	0,83	0,88	0,12
	Adjustment 3	42,20	17	6,20	-1	0,85	0,90	0,11
	Adjustment 4	33,50	16	8,70	-1	0,88	0,99	0,09
	Adjustment 5	28,30	15	5,20	-1	0,90	0,95	0,89
User Involvement	Original model	9,30	5			0,77	0,86	0,88
	Adjustment 1	3,30	4	-6	-1	0,92	1,00	0,00
Perceived Fun / Enjoyment	Original model	Unidentified				0,73	0,75	0,17
	Adjustment 1	Unidentified			0	0,00	0,00	0,00
	Adjustment 2	0,00	1			0,00	0,00	0,00

Table E - 7 Confirmatory factor analysis Organizational Characteristics

		Chi-square	df	Δ Chi-square	Δ df	NFI	CFI	RMSEA
Organizational Size	Original model	0,00	0			1,00	1,00	0,00
	Adjustment 1	0,20	1	-0,20	1	1,00	1,00	0,00
IT Maturity	Original model	29,30	14			0,89	0,94	0,98
	Adjustment 1	31,60	15	-2,30	1	0,69	0,73	0,19
	Adjustment 2	21,90	14	9,70	-1	0,91	0,97	0,07
	Adjustment 3	17,30	13	4,60	-1	0,93	0,98	0,05
Organizational Support	Original model	103,10	20			0,68	0,72	0,19
	Adjustment 1	69,60	19	33,50	-1	0,78	0,83	0,15
	Adjustment 2	46,60	18	23,00	-1	0,86	0,90	0,12
	Adjustment 3	38,00	17	8,60	-1	0,88	9,28	0,11
	Adjustment 4	32,10	16	5,90	-1	0,90	0,95	0,94
	Adjustment 5	26,10	15	6,00	-1	0,92	0,96	0,08
	Adjustment 6	28,70	16	-2,60	1	0,91	0,96	0,08
Organizational Usage	Original model	0,00	0			1,00	1,00	0,21
	Adjustment 1	2,00	2	2,00	2	0,90	1,00	0,01
Social Pressure	Original model	82,70	20			0,49	0,83	0,17

	Adjustment 1	61,90	19	20,80	-1	0,84	0,88	0,14
	Adjustment 2	52,90	18	9,00	-1	0,86	0,90	0,13
	Adjustment 3	42,00	17	10,90	-1	0,89	0,93	0,11
	Adjustment 4	32,80	16	9,20	-1	0,92	0,95	0,10
	Adjustment 5	25,40	15	7,40	-1	0,94	0,97	0,04
Environmental Uncertainty	Original model	38,60	20			0,69	0,81	0,09
	Adjustment 1	30,30	19	8,30	-1	0,76	0,88	0,07
	Adjustment 2	31,40	20	-1,10	1	0,75	0,88	0,07
	Adjustment 3	25	19	6,40	-1	0,80	0,94	0,05
	Adjustment 4	18,70	18	6,30	-1	0,90	0,99	0,02
Competitor Behaviour	Original model	28,40	14			0,75	0,84	0,10
	Adjustment 1	29,02	16	0,62	2	0,74	0,86	0,09
	Adjustment 2	17,80	15	-11,22	-1	0,84	0,96	0,04
	Adjustment 3	8,60	14	-9,20	-1	0,92	1,00	0,00

Table E - 8 Confirmatory factor analysis Characteristics of the IT resource

		Chi-square	df	Δ Chi-square	Δ df	NFI	CFI	RMSEA
Accessibility	Original model	0,00	0			1,00	1,00	0,00
	Adjustment 1	0,20	1	-0,20	1	1,00	1,00	0,00
Implementation Process	Original model	94,70	35			0,83	0,88	0,12
	Adjustment 1	64,70	34	-30,00	-1	0,88	0,94	0,09
	Adjustment 2	53,30	33	-11,40	-1	0,91	0,96	0,07
	Adjustment 3	46,60	32	-6,70	-1	0,92	0,97	0,06

Appendix F Relationship factors and questions

Construct			
Individual characteristics			
Demographics			
	Age	What is your age?	
	Gender	What is your gender?	
	Education	What is the highest level of formal education you have attained to date?	
Managerial and IT knowledge			
	Professional experience	For what function and/or department do you work?	
		How long have you worked with your present firm? (years)	
		How long have you worked in your current position (years)	
		How long have you worked in a managerial position, including previous employers?	
	Computer (it) training	General courses at an educational institute	
		In-house company courses	
		External courses	
		Self-teaching	
		Using the personal computer and its peripherals (as per our definition: printers, scanners, external drives, etc.)	
		Word processor, spreadsheet, presentations software (for example: Microsoft Word, Corel Wordperfect; Excel or Powerpoint)	
		E-mail, internet usage	
		Company specific software (for example: in-house developed, SAP, etc)	
		Other software (for example: Market research software, Finance/Accounting software, Human Resource software, Computer Application Design software, etc)	
	Computer (it) experience	How do you rate your general computer skills?	
		How do you rate your keyboard skills?	
		How do you rate your skills with regard to Windows, Apple, Linux technology (e.g. Pull-down menus, icons, clicking)?	
		How do you rate your skills with regard to PC software such as for example word-processing, spreadsheet?	
		How do you rate skills with regard to e-commerce	
Individual characteristics			
	Computer Anxiety	If there was someone around to tell me what to do as I go	

				If I had never used a package like it before
				If I had only the software manuals for reference
				If I had seen someone else using it before trying it myself
				If I could call someone for help if I got stuck
				If someone else had helped me get started
				If I had a lot of time to complete the job for which the software was provided
				If I had just the built-in help facility for assistance
				If someone showed me how to do it first
				If there was someone around to tell me what to do as I go
			Computer self-efficacy	
				I am confident that I could learn computer skills
				I am sure of my ability to learn computer application software such as Excel or Powerpoint
				I will be able to keep up with important technological advances in computers
				I feel apprehensive about using a computer
				If given the opportunity to use a computer, I am afraid that I might damage it in some way
				I have avoided computers because they are unfamiliar to me
				I hesitate to use a computer for the fear of making mistakes that I cannot correct
				I am sure of my ability to interpret a computer printout
				I have difficulty understanding most technical matters
				Computer terminology sounds like confusing jargon to me
			User involvement	
				Own PC
				Do you make voluntary use of e-commerce
				In general, I want to do what my superiors think that I should do
				In general, I want to do what my colleagues think that I should do
				In general, I want to do what my subordinates think that I should do
			Perceived fun/enjoyment	
				Do you make voluntary use of e-commerce
	Organizational characteristics			

Company characteristics				
	Organizational size			
		Industry in which your firm operates		
		Total number of employees		
		Specify last year's sales of the organization as a whole (in €)		
	It maturity			
		Information Technology planning at my company is formalized		
		Information Technology planning takes my company's business plans into consideration		
		Top management is involved in Information Technology planning		
		Information Technology performance evaluation is based on minimizing cost		
		Information Technology performance evaluation is based on contributing to business objectives		
		Top management is well informed about Information Technology		
		Information Technology has a large impact on my company		
	Organizational support			
		There is always a person in the organization that we can turn to for help in solving problems with the computer system		
		A central support (e.g. Information center, help desk) is available to help out with problems		
		Training courses are readily available for us to become more skilled in using computers		
		We are constantly updated on new software that can help us to use computers more effectively		
		Management is really keen to see that we are happy using our computers		
		Management has provided most of the necessary help and resources to get us used to the computers quickly		
		I am always supported and encouraged by my boss to use computers performing my tasks		
		I am convinced that management is sure as to what benefits can be achieved with the use of computers		
Social factors				
	Organisational usage			
		My superiors use pcs		
		My peers use pcs		
		My subordinates use pcs		
	Social pressure			
		Competition is a factor in our decision to adopt e-commerce		

				Social factors are important in our decision to adopt e-commerce
				We depend on other firms that are already using e-commerce
				Our industry is pressuring us to adopt e-commerce
				Our organization is pressured by the government to adopt e-commerce
				Our e-commerce efforts are mainly influenced by our large suppliers
				Our e-commerce efforts are mainly influenced by our large clients
				Our e-commerce efforts are driven by our growth objectives
			Environmental uncertainty	
				The rate at which products/services become obsolete in your industry
				The predictability of the action or the actions of your competitors
				The rate at which the product process technology changes in your industry
				The frequency at which marketing practices need to be changed to keep pace with the market and competitors
				Dwindling markets for products
				Scarce supply of materials
				Customer's buying habits?
				Market dynamism and uncertainty?
			Competitor behaviour	
				The predictability of demand and customer tastes
				Price competition
				Product quality/novelty competition
				The nature of competition?
				It is easy for our customers to switch to another company for similar products/services without much difficulty
				The rivalry among companies in the industry my company is operating in is very intensive
		Characteristics of the IT resource		
			Accessibility	
				Every function at my company is supported by Information Technology
				Pcs minicomputers, word processors etc., are installed throughout my company
			Implementation process	
				Are/were you, as a manager, involved in the implementation of e-commerce?

	Does/did the implementation of e-commerce cover positive and negative issues (e.g. High costs, executives' time, learning time)?
	Does/did the implementation of e-commerce meet your requirements?
	Do/did the implementers of e-commerce provide you with an understanding of the technology and the functionality?
	Our organization has the financial resources to adopt e-commerce
	Our organization has the technological resources to adopt e-commerce
	Our organization perceives that e-commerce is consistent with the company's culture
	Our organization perceives that e-commerce is consistent with the company's values
	Our organization perceives that e-commerce is consistent with the company's preferred work practices
	E-commerce would be consistent with our existing technology infrastructure
Perceived usefulness	
	Using e-commerce would enable my company to accomplish specific tasks more quickly
	Using e-commerce would improve my job performance
	Using e-commerce in my job would increase my productivity
	Using e-commerce would enhance my effectiveness on the job
	Using e-commerce would make it easier to do my job
	I would find e-commerce useful in my job
Perceived ease of use	
	Learning to operate e-commerce would be easy for me
	I would find e-commerce to be flexible to interact with
	My interaction with e-commerce would be clear and understandable
	It would be easy for me to become skillful at using e-commerce
	I would find e-commerce easy to use
Attitude towards Use	
	Is important to my business
	Is relevant to my work
	Is important to my work
	Top management is enthusiastic about the adoption of e-commerce
Actual system use	

				My superiors use e-commerce
				My peers use e-commerce
				My subordinates use e-commerce
				My superiors think that I should use e-commerce
				My peers think that I should use e-commerce
				My subordinates think that I should use e-commerce

References

ADAMS, D. A., NELSON, R. R. & TODD, P. A. (1992) Perceives usefulness, ease of use and usage of information technology: A replication. *MIS Quarterly,* 16**,** 227-247.

AGARWAL, R. & PRASAD, J. (1997) The role of innovation characteristics and perceived voluntariness in the acceptance of information technologies. *Decision Sciences,* 28**,** 557-582.

AGARWAL, R. & PRASAD, J. (1999) Are individual differences germane to the acceptance of new information technologies? *Decision Sciences,* 30**,** 361-391.

AGARWAL, R., PRASAD, J. & ZANINO, M. C. (1996) Training experiences and usage intentions: a field study of a graphical user interface. *International Journal of Human-Computer Studies,* 45**,** 215-241.

AJZEN, I. (1991) The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes,* 50**,** 179-211.

AJZEN, I. & FISHBEIN, M. (1980) *Understanding attitudes and predicting social behavior,* Englewood Cliffs, Prentice-Hall.

AL-GAHTANI, S. S. & KING, M. (1999) Attitudes, satisfaction and usage: factors contributing to each in the acceptance of information technology. *Behaviour & Information Technology,* 18**,** 277-297.

AL-GAHTANI, S. S. & OLUSEGUN WALLACE, R. S. (1999) The influence of attitudes on personel computer utilization among knowledge workers the case of Saudi Arabia. *Information & Management,* 36**,** 185-204.

ALAVI, M. & JOACHIMSTHALER, E. A. (1992) Revisiting DSS implementation research: A meta-analysis of the literature and suggestions for researchers'. *MIS Quarterly,* 16**,** 95-116.

ALBRECHT, C. C., DEAN, D. L. & HANSEN, J. V. (2005) Marketplace and technology standards for B2B e-commerce: Progress, challenges, and the state of the art. *Information & Management,* 42**,** 865-875.

ANANDARAJAN, M., SIMMERS, C. & IGBARIA, M. (2000) An exploratory investigation of the antecedents and impact of internet usage: An individual perspective. *Behaviour & Information Technology,* 19**,** 69-85.

APPLEGATE, L. M., FARLAN, F. W. & MCKENNEY, J. L. (2002) *Corporate information systems management: Text and cases,* Homewood, McGraw-Hill/Irwin Book.

ARAGÓN-SANCHEZ, A. & SÁNCHEZ-MARÍN, G. (2005) Strategic orientation, management characteristics, and performance: a study of spanish SMEs. *Journal of Small Business Management,* 43**,** 287–308.

ARBUCKLE, J. L. & WOTHKE, W. (2004) *AMOS 5.0 User's Guide,* Chicago, SmallWaters Corporation.

AUDRETSCH, D. B. & KEILBACH, M. (2004) Does entrepreneurship capital matter?, Entrepreneurship Theory and Practice 419–429.

AVLONITIS, G. J. & KARAYANNI, D. A. (2000) The impact of Internet use on business-to-business marketing: Examples from American and European companies. *Industrial Marketing Management,* 29**,** 441-459.

AZJEN, I. (1991) Theory of planned behavior. *Organisation Behavior Human Decision Process***,** 179-211.

BAGOZZI, R. P., DAVIS, F. D. & WARSHAW, P. R. (1992) Development and test of a theory of technological learning and usage. *Human Relations,* 45**,** 659-686.

BAJAJ, A. & NIDUMOLU, S. R. (1998) A feedback model to understand information system usage. *Information & Management,* 33**,** 213-224.
BAJWA, D. S., RAI, A. & RAMAPRASAD, A. (1998b) The structural context of executive information system adoption. *Information Resources Management Journal,* 11**,** 28-38.
BARKI, H. & HARTWICK, J. (1994) Measuring user participation, user involvement, and user attitude. *MIS Quarterly,* 18**,** 59-82.
BERGERON, F., RAYMOND, L., RIVARD, S. & GARA, M.-F. (1995) Determinants of EIS use: Testing a behavioral model. *Decision Support Systems,* 14**,** 131-146.
BHATTACHERJEE, A. (1998) Managerial influance on intraorganizational information technology use: A principal-agent model. *Decision Sciences,* 29**,** 139-162.
BHATTACHERJEE, A. (2001) An emperical analysis of the antecedents of electronic commerce service continuance. *Decision Support Systems,* 32**,** 201-214.
BOOMSMA, A. & HOOGLAND, J. J. (1998) On the robustness of maximum likelihood estimation agains small sample size and non-normal data. *Sociological Methods & Research,* 26**,** 329-367.
BOYATZIS, R. R. (1982) *The competent manager: A model for effective performance,* New York, New York, Wiley.
BRANCHEAU, J. C. & WETHERBE, J. C. (1990) The adoption of spreadsheet software: Testing innovation diffusion theory in the context of end-user computing. *Information Systems Research,* 1**,** 115-143.
BRIGMAN, S. & CHERRY, K. E. (2002) Age and skilled performance: Contributions of working memory and processing speed. *Brain and Cognition,* 50**,** 242-256.
BROSNAN, M. J. (1999) Modeling technophobia: a case for word processing. *Computers in Human Behavior,* 15**,** 105-121.
BROWNE, M. W. & CUDECK, R. (Eds.) (1993) *Alternative ways of assessing model fit,* Newburry Park, California, Sage Publications.
BYRNE, B. M. (2001) *Structural equation modeling with amos: Basic concepts, applications, and programming,* London, Lawrance Erlbaum, Associates, Mahwah.
CAO, M., ZHANG, Q. & SEYDEL, J. (2005) B2C e-commerce web site quality: an empirical examination. *Industrial Management + Data Systems,* 105**,** 645.
CASH, J. I., ECCLES, R. G., N., N. & NOLAN, R. L. (1994) *Building the information-age organization: Structure, control and information technologies,* Reading, Richard d Irwin.
CBS (2006) Bedrijven, per bedrijfstak en grootteklasse. Heerlen, Centraal Bureau voor de Statistieken.
CHAN, C. & SWATMAN, P. (2000) From EDI to Internet commerce: the BHP Steel experience. *Internet Research - Electronic Networking Applications and Policy,* 10.
CHAU, P. Y. K. (1997) Reexaming a Model for Evaluating Information Center Success Using a Structural Equation Modeling Approach. *Decision Sciences,* 28**,** 309-334.
CHIN, W. W. & GOPAL, A. (1995) Adoption Intention in GSS: Relative Importance of Beliefs. *The Data Base for Advances in Information Systems,* 26**,** 42-63.
CHIN, W. W. & TODD, P. A. (1995) On the Use, Usefulness, and Ease of Use of Structural Equation Mondeling in MIS Research: A Note of Caution. *MIS Quarterly,* 19**,** 237-246.
CHUAN-CHUAN LIN, J. & LU, H. (2000) Towards an understanding of the behavioural intention to use a web site. *International Journal of Information Management,* 20**,** 197-208.
CHUNG, J. & TAN, F. B. (2004) Antecedents of perceived playfulness: an exploratory study on user acceptance of general information-searching websites. *Information & Management,* 41**,** 869-881.

CIAVARELLA, M. A., BUCHHOLTZ, A. K., RIORDAN, C. M., GATEWOOD, R. D. & STOKES, G. S. (2004) The Big Five and venture survival: Is there a linkage? *Journal of Business Venturing,* 19**,** 465-483.

COMMISSION OF THE EUROPEAN COMMUNITIES (1994) The European Dimension in Management Education: Interim Report. *Commission of the European Communities*.

COMPEAU, D., HIGGINS, C. A. & HUFF, S. (1999) Social Cognitive Theory and Individual Reactions to Computing Technology: A Longitudinal Study. *MIS Quarterly,* 23**,** 145-158.

COMPEAU, D. R. & HIGGINS, C. A. (1995a) Computer Self-Efficacy:Development of a Measure and Initial Test. *MIS Quarterly,* 19**,** 189-211.

COMPEAU, D. R. & HIGGINS, C. A. (1995b) Application of Social Cognitive Theory to Training for Computer Skills. *Information Systems Research,* 6**,** 118-143.

CURRIE, W. L. (1996) Organizational structure and the use of information technology: Preliminary findings of a survey in the private and public sector. *International Journal of Information Management,* 16**,** 51-64.

CZAJA, S. J., HAMMOND, K., BLASCOVICH, J. J. & SWEDE, H. (1989) Age related differences in learning to use a text-editing system. *Behaviour & Information Technology,* 8**,** 309-319.

CZAJA, S. J. & LEE, C. C. (Eds.) (2003) *Designing computer system for older adults,* New York, Lawrance Erlbaum, Associates, Mahwah.

DAGADA, R. (2005) The impact of the technology acceptance model (TAM) in determining the success or failure of computer-integrated education. *Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications 2005* Montreal.

DAMBROT, F. H., WATKINS-MALEK, M. A., SILLING, M. S., MARSHALL, R. S. & GARVER, J. A. (1985) Correlates of Sex Differences in Attitudes toward and Involvement with Computers'. *Journal of Vocational Behavior,* 27**,** 71-86.

DAVENPORT, T. H. (1994) Saving IT's Soul: Human-Centered Information Management. *Harvard Business Review,* March-April**,** 119-131.

DAVIS, F. D. (1989) Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly,* 13**,** 319-339.

DAVIS, F. D. (1993) User acceptance of information Technology: system characteristics, user perceptions and behavioral impacts. *International Journal of Man-Machine Studies,* 38**,** 475-487.

DAVIS, F. D., BAGOZZI, R. P. & WARSHAW, P. R. (1989) User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. *Management Science,* 35**,** 982-1003.

DAVIS, F. D., BAGOZZI, R. P. & WARSHAW, P. R. (1992) Extrinsic and Intrinsic Motivation to Use Computers in the workplace. *Journal Applied Social Psychology,* 22**,** 1111-1132.

DAVIS, F. D. & VENKATESH, V. (1996) A critical assessment of potential measurement biases in the technology acceptance model: three experiments. *international Journal of Human-Computer Studies,* 45**,** 19-45.

DAVIS, L. D. & DAVIS, D. F. (1990) The Effect of Training Techniques and Personal Characteristics on Training End Users of Information Systems. *Journal of Management Information Systems,* 7**,** 93-110.

DAY, D. L. & MAKIRINNE-CROFTS, P. (Eds.) (1997) *Computer Anxiety and the Human-Computer Interface,* Berlin, People and Computers XII, Proceedings of HCO'97, Springer-Verlag.

DE WULF, K., SCHILLEWAERT, N., MUYLLE, S. & RANGARAJAN, D. (2006) The role of pleasure in web site success. *Information & Management,* 43**,** 434-446.

DELONE, W. H. & MCLEAN, E. R. (1992) Information Systems Success: The Quest for the Dependent Variable. *Information Systems Research,* 3**,** 60-95.
DELONE, W. H. & MCLEAN, E. R. (2003) The DeLone and McLean Model of Information Systems Success: A Ten-Year Update. *Journal of Management Information Systems,* 19**,** 9-31.
DILLMAN, D. A. (2001) *Mail and Internet Surveys, the tailored design approach (2nd ed.)* New York, New York, John Wiley & Sons.
DOLL, W. J., HENDRICKSON, A. & DENG, X. (1998) Using Davis's Perceived usefulness and Ease-of-use Instruments for Decision Making: A Confirmatory and Multigroup Invariance Analysis. *Decision Sciences,* 29**,** 839-869.
DUFFY, G. & DALE, B. G. (2002) E-commerce processes: a study of criticality. *Industrial Management and Data Systems,* 102**,** 432.
EARL, M. & FEENY, D. (2000) How To Be a CEO for the Information Age. *Sloan Management Review,* 41**,** 11-23.
EUROPEAN COMMISSION (2004) SME definition: Commission Recommendation of 06 May 2003. Brussel.
EUROSTAT (2002) Enterprises in Europe. *Commission of the European Communities.,* Second Report.
EUROSTAT (2006) European Business, Facts and figures. IN EUROSTAT (Ed.) Brussel, Eurostat.
FAVIER, J. & BOUQUET, M. (2006) Europe's eCommerce Forecast: 2006 To 2011. Forrester.
FELTHAM, T. S., FELTHAM & BARNETT, G. G. (2005) The dependence of family businesses on a single decision-maker. *Journal of Small Business Management* 43**,** 1-15.
FINKELSTEIN, S. & HAMBRICK, D. C. (1996) *Strategic Leadership: Top Executives and Their Effects on Organization,* St. Paul, West Publishing Company.
FISHBEIN, M. & AJZEN, I. (1975) *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research,* Reading, Addisson-Wesley.
FITZGERALD, B. & MURPHY, C. (1994) 'Introducing executive information systems into organisations: separating fact from fallacy'. *Journal of information Technology,* 9**,** 288-296.
GARTNER, W. B. (1989) "'Who is an entrepreneur?' is the wrong question",. *Entrepreneurship Theory and Practice,* 13**,** 47-68.
GATTIKER, U. E., PERLUSZ, S. & BOHMANN, K. (Eds.) (2003) *Using the Internet for B2B activities: a review and future directions for research*, Emerald Group Publishing Limited.
GEFEN, D. (2003) TAM or just plain habit: A look at experienced online shoppers. *Journal of End User Computing,* 15**,** 1-13.
GEFEN, D., KARAHANNA, E. & STRAUB, D. (2003) Trust and TAM in online shopping: An integrated model. *MIS Quarterly,* 27**,** 51-90.
GEFEN, D. & KEIL, M. (1998) The Impact of Developer Responsiveness on perceptions of Usefulness and Ease of Use: An Extension of the Technology Acceptance Model. *The Data Base for Advances in Information Systems,* 29**,** 35-49.
GEFEN, D. & STRAUB, D. W. (1997) Gender Differences in the Perception and Use of E-Mail: An Extension to the Technology Acceptance Model. *MIS Quarterly,* 21**,** 389-400.
GEFEN, D., STRAUB, D. W. & BOUDREAU, M. (2000) Structural Equation Modeling and Regression: Guidelines for Research Practice. *Communications of the Association for Information Systems,* 4.

GHANI, J. A. (1992) Task uncertainty and the use of computer technology. *Information & Management,* 22**,** 69-76.
GIBB, A. A. (1993) Enterprise culture and education: understanding enterprise education and its links with small business entrepreneurship and wider educational goals. *International Small Business Journal,* 11**,** 11-34.
GIMENO, J., FOLTA, T. B., COOPER, A. C. & WOO, C. Y. (1997) Survival of the fittest? Entrepreneurial human capital and the persistence of underperforming firms,. *Administrative Science Quarterly,* 42**,** 750–783.
GIST, M. E. & MITCHELL, T. R. (1992) Self-Efficacy: A Theoretical Analysis of Its Determinants and Malleability. *Academy of Management Review,* 17**,** 183-211.
GIST, M. E., SCHWOERER, C. & ROSEN, B. (1989) Effects of Alternative Training Methods on Self-Efficacy and Preformance in Computer Software Training. *Journal of Applied Psychology,* 74**,** 884-891.
GOODHUE, D. L. (1998) Development and Measurement Validity of a Task-Technology Fit Instrument for User Evaluations of Information Systems. *Decision Sciences,* 29**,** 105-138.
GOSS, D. & JONES, R. (1992) Organisation structure and SME training provision. *International Small Business Journal,* 10**,** 13-25.
GRANDON, E. & PEARSON, J. M. (2003) Strategic value and adoption of electronic commerce: An empirical study of Chilean small and medium businesses. *Journal of Global Information Technology Management,* 6**,** 22.
GRANDON, E. E. & PEARSON, J. M. (2004) Electronic commerce adoption: an empirical study of small and medium US businesses. *Information & Management,* In Press, Corrected Proof.
GRIFFITH, T. L. & NORTHCRAFT, G. B. (1996) Cognitive Elements in the Implementation of New Technology: Can Less Information Provide More Benefits? *MIS Quarterly,* 20**,** 99-110.
GRIMM, L. G. & YARNOLD, P. R. (Eds.) (2000) *Reading and Understanding Multivariate factor analysis,* Washington, DC, American Psychological Association.
GROOVES, R. M., FOWLER, F. J., COUPER, M. P., LEPKOWSKI, J. M., SINGER, E. & TOUREANGEAU, R. (2004) *Survey methodology,* New York, Wiley.
GROVER, V. & GOSLAR, M. D. (1993) The Initiation, Adoption and Implementation of Telecommunications Technologies in U.S. Organizations. *Journal of Management Information Systems,* 10**,** 141-163.
GROVER, V. & TENG, J. (2003) E-commerce and the information market. *Communication of the ACM,* 44**,** 79-86.
HACKBARTH, G., GROVER, V. & YI, M. Y. (2003) Computer playfulness and anxiety: positive and negative mediators of the system experience effect on perceived ease of use. *Information & Management,* 40**,** 221-232.
HAIR, J. F., BABIN, B., ANDERSON, R. E., TATHAM, R. L. & BLACK, W. C. (2005) *Multivariate Data Analysis,* New Jersey, Prentice-Hall, Upper Saddle River.
HARRIS, R. W. (1999) Attitudes towards end-user computing: a structural equation model. *Behaviour & Information Technology,* `18**,** 109-125.
HARRISON, A. W. & KELLY RAINER, R. (1992) The Influence of Individual Differences on Skill in End-user Computing. *Journal of Management Information Systems,* 9**,** 93-111.
HARTWICK, J. & BARKI, H. (1994) Explaining the Role of User Participation in Information System Use. *Management Science,* 40**,** 440-465.
HENDRICKSON, A. R. & COLLINS, M. R. (1996) An Assessment of Structure and Causation of IS Usage. *The Data Base for Advances in Information Systems,* 27**,** 61-67.

HOPE, J. & HOPE, T. (1997) *Competing in the third wave,* Boston, Harvard Business School Press.

HORST, M., KUTTSCHREUTER, M. & GUTTELING, J. M. (2006) Perceived usefulness, personal experiences, risk perception and trust as determinants of adoption of e-government services in The Netherlands. *Computers in Human Behavior,* In Press, Corrected Proof.

HU, P. J., CHAU, P. Y. K., LIU SHENG, O. R. & TAM, K. Y. (1999) Examing the Technology acceptance Model using Physician Acceptance of Telemedicine Technology. *Journal of Management Information Systems,* 16**,** 91-112.

HUBONA, G. S. & BLANTON, J. E. (1996) Evaluating system design features. *international Journal of Human-Computer Studies,* 44**,** 93-118.

HUBONA, G. S. & GEITZ, S. (1997) *External Variables, Beliefs, Attitudes and Information Technology Behavior, in: Proceedings of the 30th Annual Hawaii International Conference on System Sciences,* Los Alamitos, IEEE Computer Society Press.

HUBONA, G. S. & KENNICK, E. (1996) *The impact of External Variables on Information Technology on System Sciences,* Los Alamitos, IEEE Computer Society Press.

IGBARIA, M. (1990) End-User Computing Effectiveness: A Structural Equation Model. *OMEGA International Journal of Management Science,* 18**,** 637-652.

IGBARIA, M. (1993) User Acceptance of Microcomputer Technology: An Empirical Test. *OMEGA International Journal of Management Science,* 21**,** 73-90.

IGBARIA, M. (1994) An examination of the factors contributing to microcomputer technology acceptance. *Accounting, Management and Information Technologies,* 4**,** 205-224.

IGBARIA, M. & CHAKRABARTI, A. (1990) Computer anxiety and attitudes towards microcomputer use. *Behaviour & Information Technology,* 9**,** 229-241.

IGBARIA, M., GUIMARAES, T. & DAVIS, G. B. (1995a) Testing the Determinants of Microcomputer Usage via a Structural Equation Model. *Journal of Management Information Systems,* 11**,** 87-114.

IGBARIA, M. & IIVARI, J. (1995) The effects of Self-efficacy on Computer Usage. *OMEGA International Journal of Management Science,* 23**,** 587-605.

IGBARIA, M., IIVARI, J. & MARAGAHH, H. (1995b) Why do individuals use competer technology? A Finnish case study. *Information & Management,* 29**,** 227-238.

IGBARIA, M. & NACHMAN, S. A. (1990) Correlates of user satisfaction with end user computing. *Information & Management,* 19**,** 73-82.

IGBARIA, M. & PARASURAMAN, S. (1989) A Path Analytic Study of Individual Characteristics, Computer Anxiety and Attitdes toward Microcomputers. *Journal of Management,* 15**,** 373-388.

IGBARIA, M., PARASURAMAN, S. & BAROUDI, J. (1996) A Motivational Model of Microcomputer usage. *Journal of Management Information Systems,* 13**,** 127-143.

IGBARIA, M., SCHIFFERMAN, S. & WIECKOWSKI, T. (1994) The respective roles of perceived usefulness and perceived fun in the acceptance of microcomputer technology. *Behaviour & Information Technology,* 13**,** 349-361.

IGBARIA, M., ZINATELLI, N., CRAGG, P. & CAVAYE, A. L. M. (1997a) Personal Computing Acceptance Factors in Small Firms: A Structural Equation Modeling. *MIS Quarterly,* 21**,** 279-305.

IGBARIA, M., ZINATELLI, P., CRAGG, P. B. & CAVAYE, A. (1997b) Personal Computing Acceptance Factors in Small Firms: A Structural Equation Model. *MIS Quarterly,* 21**,** 279-305.

IM, K. S., GROVER, V. & SHARMA, S. (1998) *The Use of Structural Equation Modeling in IS Research, in : Proceedings of the Decision Sciences Institute Annual Meeting,* Las Vegas, Nevada.

IVES, B., OLSON, M. H. & BAROUDI, J. J. (1983) The measurement of user information satisfaction. *Communications of the ACM,* 26**,** 785-793.

JACKSON, C. M., CHOW, S. & LEITCH, R. A. (1997) 'Issues and Opinions on Structural Equation Modeling'. *Decision Sciences,* 28**,** 357-389.

JARVENPAA, S. L. & IVES, B. (1991) Executive Involvement and Participation in the Management of Information Technology. *MIS Quarterly,* 15**,** 205-227.

JEFFCOATE, J., CHAPPELL, C. & FEINDT, S. (2002) Best practice in SME adoption of e-commerce. *Benchmarking: An International Journal,* 9**,** 122-132.

JOHNSON, A. M. (2005) The technology acceptance model and the decision to invest in information security. *Proceedings of the 2005 Southern Association of Information Systems Conference.* Savannah, GA.

JUDD, C. M., SMITH, E. R. & KIDDER, L. H. (1991) *Research methods into social sciences: Sixth edition.* , Forth Worth: Harcourt, College Publishers.

KAASINEN, E. (2005) User acceptance of mobile services - value, ease of use, trust and ease of adoption. *International Conference on Mobile Business.*

KANTER, J. (1995) Computer-Information Literacy for Senior Management. *Information Strategy: The executive's Journal,* 11**,** 6-12.

KARAHANNA, E. & STRAUB, D. W. (1999) The psychological origins of perceived usefulness and ease-of-use. *Information & Management,* 35**,** 237-250.

KARAHANNA, E., STRAUB, D. W. & CHERVANY, N. L. (1999) Information Technology Adoption Across Time: A Cross-Sectional Comparison of Pre-Adoption and Post-Adoption Beliefs. *MIS Quarterly,* 23**,** 183-213.

KAYNAK, E., TATOGLU, E. & KULA, V. (2005) An analysis of the factors affecting the adoption of electronic commerce by SMEs: Evidence from an emerging market. *International Marketing Review,* 22**,** 623-640.

KELLY RAINER, R. & WATSON, H. J. (1995a) The Keys to Information System Succes. *Journal of Management Information Systems,* 12**,** 83-98.

KEMPF, D. S. (1999) Attitude formation from product trial: distinct roles of cognition and affect for hedonic and functional products. *Value creation in E-business,* 16**,** 35-50.

KHALIFA, M. & LIU, V. (2003) Determinants of satisfaction at different adoption stages of internet-based services. *Journal of the Association for Information Systems* 4**,** 206-232.

KHALIL, O. E. M. & ELKORDY, M. M. (1997) The Relationship of Some Personal and Situational Factors to IS Effectiveness: Empirical Evidence from Egypt. *Journal of Global Information Management,* Spring**,** 22-34.

KING, W. R. & SABHERWAL, R. (1992) The factors affecting strategic information systems application: an empirical assessment. *Information & Management,* 12**,** 217-235.

KLEIJEN, M., RUYTER DE, K. & WETZELS, M. G. M. (2003) Mobile commerce: technology, theory, and applications. *Factors influencing the adoption of mobile gaming services,* 2003**,** 202-217.

KLENKE, K. (1994) *Information Technologies as Drivers of Emergent Organizational Form: A Ledership Perspective, in: Baskerville, R. S. Smithson, O. Ngwenyama & J.I. DeGross (Eds), Transforming Organizations with Information Technology,* Amsterdam, Elsevier Science.

KLINE, R. B. (2005) *Principles and Practice of Structural Equation Modeling,* New York, The Guilford Press.

KRAEMER, K. L., DANZIGER, J. N., DUNKLE, D. E. & KING, J. L. (1993) The Usefulness of Computer-Based Information to Public Managers. *MIS Quarterly,* 17**,** 129-148.

KWON, T. H. & ZMUD, R. W. (1987) *Unifying the fragmented models of information systems implementation, in: Boland, R.J. & R. Hirschheim (Eds.),* New York, Critical issues in information systems research.

LAKHANPAL, B. (1994) Assessing the Factors Related to Microcomputer usage by Middle Managers. *international Journal of Information Management,* 14**,** 39-50.

LARSEN, K. R. T. & BLONIARZ, P. A. (2000) A cost and performance model for Web service investment. *Communications of the Acm,* 43**,** 109-116.

LARSEN, T. J. (1993) Middle managers' Contribution to Implemented Information Technology Innovation. *Journal of Management Information Systems,* 10**,** 155-176.

LAWSON, R., ALCOCK, C., COOPER, J. & BURGESS, L. (2003) Factors affecting adoption of electronic commerce technologies by SMEs: an Australian study. *Journal of Small Business and Enterprise Development,* 10**,** 265-276.

LAZARUS (1991) *Emotion and Adaption,* New York, Oxford University Press.

LEE, T. & JUN, J. (2005) Contextual Perceived Usefulness? Toward an Understanding of Mobile Commerce Acceptance *International Conference on Mobile Business.*

LEFEBVRE, L.-A., LEFEBVRE, E., ELIA, E. & BOECK, H. (2005) Exploring B-to-B e-commerce adoption trajectories in manufacturing SMEs. *Technovation,* 25**,** 1443-1456.

LEGRIS, P., INGHAM, J. & COLLERETTE, P. (2003) Why do people use information technology? A critical review of the technology acceptance model. *Information & Management,* 40**,** 191-204.

LEIDNER, D. G. & ELAM, J. J. (1995) The impact of Information Systems on Organization Design, Intelligence, and Decision Making. *Organization Science,* 6**,** 645-664.

LI, D., CHAU, P. Y. K. & LOU, H. (2005) Understanding individual adoption of Instant messaging: An emperical investigation. *Journal of Association for Information Systems,* 6**,** 102-129.

LUCAS, H. C. & SPITLER, V. K. (1999) Technology use and Performance: A Field Study of Broker Workstations. *Decision Sciences,* 30**,** 291-311.

MACGREGOR, R. C. & VRAZALIC, L. (2005) A basic model of electronic commerce adoption barriers: A study of regional small businesses in Sweden and Australia. *Journal of Small Business and Enterprise Development,* 12**,** 510-527.

MALHOTRA, Y. & GALLETTA, D. F. (1999) *Extending the Technology Acceptance Model to Account for Social Influence: Theoretical Bases and Empirical Validation, in: Proceedings of the Thirty-second Hawaii International Conference on System Sciences,* Los Alamitos, IEEE Computer Society Press.

MANO, H. & OLIVER, R. L. (1993) Assessing the dimensionality and structure of the consumption experience: evaluation, feeling, and satisfaction. *Journal of Consumer Research,* 20**,** 451-466.

MARAKAS, G. M., YI, M. Y. & JOHNSON, R. D. (1998) The Multilevel and Multifaceted Character of Computer Self-Efficacy: Towar Clarification of the Construct and an Integrative Framework for Research. *Information Systems Research,* 9**,** 126-163.

MARCHAND, D. A. (2000a) *Using Information to Channel human Energy, in: Strebel, P.(Ed), Focusing Energy-Mastering Bottum-up Organization,* London, John Wiley & Sons.

MARCHAND, D. A., KETTINGER, W. J. & ROLLINS, J. D. (2000) Information Orientation: People, Technology, and the Bottom Line. *Sloan Management Review,* 41**,** 69-80.

MATHIESON, K. (1991) Predicting User Intentions: comparing the Technology Acceptance Model with the Theory of Planned Behavior. *Information Systems Journal,* 2**,** 173-191.

MATHIESON, K., PEACOCK, E. & CHIN, W. W. (2001) Extending the technology acceptance model: the influence of perceived user resources. *SIGMIS Database,* 32**,** 86-112.
MAURER, M. M. (1994) Computer Anxiety Correlates and What They Tell Us: A Literature Review. *Computers in Human Behavior,* 10**,** 369-376.
MAWHINNEY, C. H. & LEDERER, A. L. (1990) A study of Personal Computer Utilization by Managers. *Information & Management,* 18**,** 243-253.
MCCALL, T. (2004) Worldwide business-to-business Internet commerce to reach $ 13.5 trillion in 2008. *Gartner, W.B.*, Garter Group.
MCFARLAND, D. J. & HAMILTON, D. (2006) Adding contextual specificity to the technology acceptance model. *Computers in Human Behavior,* 22**,** 427-447.
MEHRTENS, J., CRAGG, P. B. & MILLS, A. M. (2001) A model of Internet adoption by SMEs. *Information & Management,* 39**,** 165-176.
MENDO, F. A. & FITZGERALD, G. (2005) A multidimensional framework for SME e-business progression. *Journal of Enterprise Information Management,* 18**,** 678-696.
MINTZBERG, H. (1983) *Structure in Fives: Designing Effective Organizations,* London, Prentice-Hall.
MODAHL, M. (2000) *Now or Never: How Companies Must Change Today to Win the Battle for the Internet Consumers,* New York, Harper Business.
MONEY, W. & TURNER, A. (2005) "Application of the Technology Acceptance Model to a Knowledge Management System". *Proceedings of the 37th Annual Hawaii International Conference on System Sciences.* Hawaii.
MOORE, G. C. & BENBASAT, I. (1991) Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation. *Information Systems Research,* 2**,** 192-222.
MORRIS, M. G. & VENKATESH, V. (2000) Age differences in technology adoption decisions: Implications for a changing work force. *Personnel Psychology,* 53**,** 375-403.
MYERS, M. D. & TAN, F. B. (2002) Beyond Models of National Culture in Information Systems Research. *Journal of Global Information Management,* 10**,** 24-32.
OECD (1998) Annual Competitiveness Report SME Performance. IN OECD (Ed.).
ONG, C.-S. & LAI, J.-Y. (2006) Gender differences in perceptions and relationships among dominants of e-learning acceptance. *Computers in Human Behavior,* 22**,** 816-829.
ORLIKOWSKI, W. J. (2000) *Managing use not technology: a view from the trenches, in: Marchand, D.A., T.H. Davenport & T. Dickson (Eds), Mastering Information Management,* London, Prentice-Hall.
OVERBY, J. & MIN, S. (2001) International Supply Chain Management in an Internet Environment: A Network-Oriented Approach to Internationalization. *International Marketing Review,* 18**,** 392-419.
PARASURAMAN, S. & IGBARIA, M. (1990) An examination of gender differences, in the determinants of computer anxiety and attitudes towards computers among managers. *International Journal of Man-Machine Studies,* 32**,** 327-340.
PARK, N. K., MEZIAS, J. M. & SONG, J. (2004) A Resource-based View of Strategic Alliances and Firm Value in the Electronic Marketplace. *Journal of Management,* 30**,** 7-27.
PETTY, R. E. & CACIOPPO, J. T. (1985) *Attitude and Persuasion: Classic and Contemporary Approaches,* Debuque, IA, WCB.
PIJPERS, G. M., BEMELMANS, T. M. A., HEEMSTRA, F. J. & VAN MONTFORT, K. (2001) Senior executives' use of information technology. *Information and Software Technology,* 43**,** 959-971.

POON, S. & SWATMAN, P. (1999) A longitudinal study of expectations in small business Internet commerce. *International journal of electronic commerce,* 3**,** 21 - 33.
PREMKUMAR, G. & ROBERTS, M. (1999) Adoption of new information technologies in rural smal businesses. *OMEGA International Journal of Management Science,* 27**,** 467-484.
RAI, A. & BAJWA, D. S. (1997) An Empirical Investigation into Factors Relating to the Adoption of Executive Information Systems: An Analysis of EIS for Collaboration and Decision Support. *Decision Sciences,* 28**,** 939-974.
RAITOHARJU, R. (2005) "When Acceptance is not Enough - Taking TAM-Model into Healthcare" *38th Annual Hawaii International Conference on System Sciences (HICSS'05).* Hawaii.
RAWSTORNE, P., JAYASURIYA, R. & CAPUTI, P. (2000) Issues in Predicting and Explaining Usage Behaviours with the Technology Acceptance Model and The Theory of Planned Behaviour when Usage is Mandatory. *The twenty first international conference on Information Systems.*
RICE, R. E. & ROGERS, E. M. (1984) *'New Methods and Data for the Study of New Media in: Rice, R.E. (Ed.), The New Media',* Beverly Hills, Communication, Research, and Technology Sage.
RIDGON, E. E. (1998) *Structural Equation Modeling, in: Marcoulides, G.A. (ed.) Modern methods for business research,* New Jersey, Lawrence Erlbaum, Mahwah.
RIEMENSCHNEIDER, C. K., HARRISON, A. W. & MYKYTYN, P. P. (2003) Understanding it adoption decisions in small business: integrating current theories. *Information and Managent,* 40**,** 269-285.
ROBERTS, P. & HENDERSON, R. (2000) Information technology acceptance in a sample of government employees: A test of the technology acceptance model. *Interacting with Computers,* 12**,** 427-443.
ROGERS, E. M. (1995) *Diffusion of Innovation,* New York, The Free Press.
RUBIN, D. B. (1996) Multiple imputation after 18+ years. *Journal of the American Statistical Association,* 91**,** 473-489.
RUSSELL, J. A. (1980) A circumplex model of affect. *Journal of Personality and Social Psychology,* 39**,** 1160-1178.
SAADE, R. G. & KIRA, D. (2006) Mediating the impact of technology usage on perceived ease of use by anxiety. *Computers & Education,* In Press, Corrected Proof.
SAGE, V. L. & ZMUD, R. W. (1993) *The Nature and Determinants of IT Acceptance, Routinization, and Infusion, in: Levine, L.(Ed.), Diffusion, Transfer and Implementation of Information Technology,* Amsterdam, Elsevier Science.
SEELY, M. E. & TARGETT, D. (1997) A senior executive end-user framework. *Information Systems Journal,* 7**,** 289-308.
SEELY, M. E. & TARGETT, D. (1999) Patterns of senior executives' personal use of computers. *Information & Management,* 35**,** 315-33.
SEGARS, A. H. & GROVER, V. (1993) Re-examining Perceived Ease of Use and Usefulness: A Confirmatory Factor Analysis. *MIS Quarterly,* 17**,** 517-525.
SIMPSON, M. & DOCHERTY, A. J. (2004) E-commerce adoption support and advice for UK SMEs. *Journal of Small Business and Enterprise Development,* 11**,** 315-328.
SNIJKERS, G. J. M. E. (2007) Between chaos and creation: last en noodzaak van bedrijfsenquetes (burden and need of organisational surveys for official statistics). Heerlen, Official Statistics Netherlands.
STRASSMANN, P. A. (1997) *The Squandered Computer: Evaluating the Business Alignment of Information Technologies,* Connecticut, The Information Economic Press, New Canaan.

STRAUB, D. W., LIMAYEM, M. & E., K.-E. (1995) Measurig System Usage: Implications for IS Theory Testing. *Management Science,* 41**,** 1328-1342.
SUBRAMANIAN, G. H. (1994) A Replication of Perceived Usefulness and Perceived Ease of Use Measurement. *Decision Sciences,* 25**,** 863-874.
SZAJNA, B. (1996) Empirical Evaluation of the Revised Technology Acceptance Model. *Management Science,* 42**,** 85-92.
TAYLOR, M. & MURPHY , A. (2004) SMEs and e-business. *Journal of Small Business and Enterprise Development,* 11**,** 280-289.
TAYLOR, S. & TODD, P. (1995) Understanding Information Technology Usage: A Test of Competing Models. *Information Systems Research,* 6**,** 144-176.
TEO, T. S. H., LIM, V. K. G. & LAI, R. Y. C. (1999) 'Intrinsic and extrinsic motivation in Internet usage'. *OMEGA International Journal of Management Science,* 27**,** 25-37.
THATCHER & PERREWE (2002) An emperical examination of individual traits as antecedents to computer anxiety and computer self efficacy. *MIS Quarterly,* 26**,** 381-396.
THATCHER, S. M. B., FOSTER, W. & ZHU, L. (2006) B2B e-commerce adoption decisions in Taiwan: The interaction of cultural and other institutional factors. *Electronic Commerce Research and Applications,* 5**,** 92-104.
THOMAS, J. D. E. (2006) *Computer Anxiety and the User,* Harrisburg, Idea Group Publishing.
THOMPSON, R. L., HIGGINS, C. A. & HOWELL, J. M. (1991) Personal Computing: Toward a Conceptual Model of Utilization. *MIS Quarterly,* 15**,** 125-143.
THOMPSON, R. L., HIGGINS, C. A. & HOWELL, J. M. (1994) Influence of Experience on Personal Computer Utilization: Testing a Conceptual Model. *Journal of Management Information Systems,* 11**,** 167-187.
THONG, J. Y. L. (1999) An Integrated Model of Systems Adoption in Small Businesses. *Journal of Management Information Systems,* 15**,** 187-214.
THONG, J. Y. L., HONG, S.-J. & TAM, K. Y. (2006) The effects of post-adoption beliefs on the expectation-confirmation model for information technology continuance. *International Journal of Human-Computer Studies,* 64**,** 799-810.
THONG, J. Y. L. & YAP, C. S. (1995) CEO Characteristics, Organizational Characteristics and information Technology Adoption in Small Businesses. *OMEGA International Journal of Management Science,* 23**,** 249-442.
TORNATZKY, L. G. & KLEIN, K. J. (1982) Innovation Characteristics and Innovation-Adoption Implementation: A Meta-Analysis of Findings. *IEEE Transactions on Engineering Management,* 29**,** 28-45.
UMARJI, M. & EMURIAN, H. (2006) Acceptance Issues in Metrics Program Implementation *11th IEEE International Software Metrics Symposium*
VAN DER HEIJDEN, H. (2003) Factors influencing the usage of websites: the case of a generic portal in The Netherlands. *Information & Management,* 40**,** 541-549.
VAN GILS, A. (2005) Management and Governance in Dutch SMEs. *European Management Journal,* 23**,** 583-589.
VAN STEL, A., CARREE, M. & THURIK, R. (2005) The effect of entrepreneurial activity on national economic growth. *Small Business Economics,* 24**,** 311–321.
VANDENBOSCH, B. & HIGGINS, C. (1995a) Executive support systems and executive preferences: a comparison of information channel select theories. *Information Systems Journal,* 5**,** 105-118.
VENKATESH, V. (1999) Creation of Favorable User Perceptions: Exploring the Role of Intrinsic Motivation. *MIS Quarterly,* 23**,** 239-260.

VENKATESH, V. (2000) Determinants of perceived ease of use: integrating control, intrinsic motivation and emotion into the technology acceptance model. *Information Systems Research,* 11**,** 342-365.
VENKATESH, V. & BROWN, S. A. (2001) A longitudinal investigation of personal computuers in homes: Adoption determinants and emerging challenges. *MIS Quarterly,* 25**,** 71-102.
VENKATESH, V. & DAVIS, F. D. (1996) A Model of the Antecedents of Perceived Ease of Use: Development and Test. *Decision Sciences,* 27**,** 451-481.
VENKATESH, V. & DAVIS, F. D. (2000) A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies. *Management Sciences,* 46**,** 186-204.
VENKATESH, V. & MORRIS, M. G. (2000) Why Don't Men Ever Stop to Ask For Directions? Gender, Social Influence, and Their Role in Technology Acceptance and Usage Behavior. *MIS Quarterly,* 24**,** 115-139.
VENKATESH, V., MORRIS, M. G., DAVIS, G. B. & DAVIS, F. D. (2003) User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly,* 27**,** 425-478.
VENKATESH, V. & SPEIER, C. (1999) Computer Technology Training in the Workplace: A longitudinal Investigation of the Effect of Mood. *Organizational Behavior and Human Decision Processes,* 79**,** 1-28.
VENKATESH, V., SPEIER, C. & MORRIS, M. (2002) User Acceptance Enablers in Individual Decision Making About Technology: Toward an Integrated Model. *33,* 2.
VESSEY, I., RAMESH, V. & GLASS, R. L. (2002) Research in Information Systems: An Emperical Study of Diversity in the Discipline and its Journals. *Journal of Management Information Systems,* 19**,** 129-174.
WALSTROM, K. A. & WILSON, R. L. (2004) An examination of executive information system (EIS) users. *Information & Management,* 32**,** 75-83.
WEBSTER, J. & MARTOCCHIO, J. J. (1992) Microcomputer Playfulness: Development of a Measure With Workplace Implications. *MIS Quarterly,* 16**,** 201-226.
WEISBAND, S. & KIESLER, S. (1996) *Self-disclosure on computer forms: Meta-analysis and implications. ,* Tucson, AR, University of Arizona.
WHITLEY, B. E. (1997) Gender Differences in Computer-Related Attitudes and Behavior: A Meta-Analysis. *Computers in Human Behavior,* 13**,** 1-22.
WILSON-JEANSELME, M. & REYNOLDS, J. (2005) Growth without profit: explaining the internet transaction profitability paradox. *Journal of Retailing and Consumer Services,* 12**,** 165-177.
WOOD, W. (2000) Attitude change: persuasion and social influence. *Annual Review of Psychology* 51**,** 539-570.
YI, Y., WU, Z. & TUNG, L. L. (2006) How individual differences influence technology usage behavior? *The Journal of Computer Information Systems,* 46**,** 52-63.
ZALTMAN, G. & STIFF, R. (Eds.) (1973) *Theory of Diffusion,* Englewood Cliffs, NJ, Prentice-Hall.
ZHANG, P., LI, N. & SUN, H. (2007) "Affective Quality and Cognitive Absorption: Extending Technology Acceptance Research," *39th Annual Hawaii International Conference on System Sciences.* Hawaii