Explaining e-business adoption

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EXPLAINING E-BUSINESS ADOPTION

INNOVATION & ENTREPRENEURSHIP IN DUTCH SMES

PROEFSCHRIFT

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Prof. dr. Ir. W.E. During

en de assistent-promotor
Dr. A.J. Groen

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Preface

The dissertation before you is the result of five years of hard work. It is also the result of combining a research position at Nikos with a job at Syntens. Lastly, this thesis is a product of my curiosity, my drive to learn, and persistence. From the moment I received my master's, I had the idea to work on a PhD project one day. However, I first wanted to 'get my hands dirty'. So, after finishing my master thesis, I worked in different factories on the optimisation of production logistics. Successively, plastic pipelines, bicycle tires, ketchup and again bicycle tires made my day. The most memorable experience was working at the Ralson factory in Bhopal (India) starting up the production of bicycle tires for Vredestein. We dealt with the most bizarre situations like long power cuts, water rationing, and extreme humidity (my hair dryer proved its worth). The hospitality and commitment of our Indian colleagues made a lasting impression. All these experiences contributed to my interest in manufacturing. However challenging, over the years I developed a need for a 'deeper dive' than the day-to-day hassle in a factory. After many doubts, Henri encouraged me to finally take up the challenge of starting a PhD project. Thank you for that. I was introduced to Martin Stor at Syntens, who patiently listened to my proposition of combining a job with a research position. It was Martin that led me to Peter Koudstaal. Now, Peter Koudstaal is a true corporate entrepreneur and a master in recognis-

ing opportunities and grabbing them. Leading the SpOED-project at the time, he saw an opportunity in combining Syntens and me. Later, managing the NGD-project, Peter created the opportunities that enabled the research as described in this thesis. Although we are quite different in character, the past five years of collaboration proved that we suit one another. Peter, I want to thank you for your support, for being thoughtful, and for your never-ending optimism. Peter's partner-in-crime, Henny Lardenoye made many things possible in relation to my work and research with Syntens. He also offered me a new and challenging perspective that I grabbed with both hands. Henny, thank you for your support and your confidence in me. This research was greatly supported by Syntens' consultants that acted as experts, as well as the devil's advocates. They challenged my knowledge on ICT, e-business, and SMEs, and forced me to bridge the gap between the academic and practical world. I would like to thank all colleagues at Syntens that, in one way or the other, contributed to my research. In particular (but in no specific order) I would like to thank: Henk van Heerde, Hermie Heijnen, Henk van Dijk, Koos Kerstholt, and Hans Versloot.

Going back to the academic world was a risk. Was it going to be dull and dusty? No, it never was and I never regretted my decision one bit. In fact, I regarded being an 'AIO' as a rather luxurious position. To me, the best part of it was reading books and being paid for it (that is, apart from the conferences abroad). Doing research satisfies my curiosity and at the same time feeds it. It is addictive. When I met Wim During, he already had a long career behind him. However, his broad knowledge on entrepreneurship and high tech small firms never stops him from being curious. Also, he attaches great significance to combining theory and practice. What is more, Wim combines these qualities with a warm personality (and, at times, generous gifts of eggs or courgettes). Wim, I want to thank you for motivating me, for putting things into perspective, for your pragmatic attitude, and above all for your personal way of supervising. My 'daily' supervisor, Aard Groen, played a decisive role in establishing Nikos in 2001. Aard managed to put Nikos 'on the map' in entrepreneurship research. Aard, although we had our struggles and I find it hard to share your enthusiasm for the 4S model, I learned a lot from your approach to research and methodology. Thank you for keeping me sharp. In addition to my supervisors, I would like to thank two persons in particular that helped me out. Peter Geurts showed remarkable patience in demystifying quantitative data-analysis and LISREL in particular.

Peter, thank you (and I hope it shows). Jeroen de Jong at EIM took care of the survey and a whole lot more. Jeroen, thank you for not taking your assignments too literally, and I hope we can extend our collaboration. Thanks also to my colleagues at Nikos. Regrettably, I live too far off to enjoy more of your company (and drinks). A special colleague and friend is Ingrid Wakkee. I consider myself very lucky to have a friend I can share my research, joy and concerns with. Two moments in our joint venture I will never forget, both in Jönköping. In 2001, at the Babson conference, we were so excited that we kept each other awake discussing entrepreneurship research. In 2002, we made a trip to snow-covered Sweden on invitation by Per Davidsson. We copied literature from the ICE-library, as much as we could possibly carry. Thanks, Ingrid.

Whatever happens in my career and personal life, there is one stable factor, a valuable home base. Jaap and Jacomien, I want to thank you for always supporting me and being there, for your good advice and love. Klaas, my dearest brother, we are so different, yet so much alike. This thesis gave me the chance to actually experience your professional skills in graphic design. I enjoyed your efforts in making this dissertation look good, your candid and valuable opinions, and your innovative ideas. Thanks.

My last words of appreciation are reserved for a very special person. I met Joost by a weird coincidence in an old mayor's residence in St.Remy. Since then we are together and I fully enjoy it. Joost, thank you for hearing me out whenever I returned from Enschede, for keeping us alert, and above all for teaching me the joy of living. I hope we will share many more experiences and journeys.

Marijke van der Veen
Oosterhout, December 2004

1 Introduction and research questions

This dissertation deals with the explanation of e-business adoption in Dutch small and medium sized enterprises. In the first sections of this chapter (**1.1**, **1.2** and **1.3**), I introduce the subject of research. The research approach and main research questions are presented in **1.4**. Next, the theoretical and practical scope of the investigation is discussed (**1.5**). Section **1.6** elaborates on the definitions of central concepts in this study. Finally, a reading guide for the dissertation is presented (**1.7**).

1.1 E-business and small and medium sized enterprises

Information and communication technologies (ICTs) have become an essential part of our lives. In the Netherlands, ownership of personal computers is high, and still growing, in households as well as in businesses (CBS, 2003). In the past decade the use of ICT throughout society really took off with the introduction of the Internet[1]. The Internet started mainly as a network for researchers that gave the opportunity to share information and ideas. An important step in the commercialisation of the Internet was the announcement of the World Wide Web

1 Internet (Interconnected networks) = the large system of many connected computers around the world which people use to communicate with each other. (Cambridge University Press, 2003).

(WWW)[2] in 1991 by Tim Berners-Lee of CERN (Kalakota and Whinston, 1996). The WWW enables publication and retrieval of information on the Internet. In addition, other applications of Internet technology like e-mail, 'chatting', up- and downloading of files, and newsgroups, have boosted the popularity of ICT. Words like Internet, website, chat, e-commerce and e-business are now in the Van Dale dictionary of modern Dutch language (Van Dale & Van Sterkenburg, 2002).

The diffusion of the aforementioned technologies has entailed dramatic changes in the business community as well. ICT can no longer be set aside from doing business. Electronic business is very often associated with large businesses and multinationals. We all know the examples of Dell, Cisco and Amazon.com, who successfully integrated information and communication technologies (ICTS) into their business models. At the end of the 1990's, these examples were frequently used to motivate small companies to adopt e-mail and Internet. Unfortunately so, as the business environment of a small established company is a far cry from that of those million dollar Internet start-ups. However, before these companies turned large they too were small. At the start, Michael Dell sold memory chips and disk drives from his dorm-room, Cisco was a husband-and-wife adventure, and Jeff Bezos started Amazon in his garage (Kalakota & Robinson, 1999). These examples show that entrepreneurs can use ICTS to build successful businesses from scratch. They identified unique business opportunities and managed to exploit them with great success.

Existing small and medium sized enterprises (SMES) can certainly benefit from adopting ICTS as well. By now, interesting examples of SMES in various lines of business can be found that use ICTS to their advantage[3]. A good example is The Royal Dutch Pipe Factory Elbert Gubbels & Sons. This company started their own production of pipes in 1946 and today employs nearly 50 people. Gubbels sells its products through resellers; so setting up a web shop was not an option. Instead, they opted for improving the turnover of their resellers and at the same time lower costs of sales by setting up two websites: **www.elbertgubbels.com**

2 The World Wide Web is the system of connected documents on the Internet, which often contain colour pictures, video and sound, and can be searched for information about a particular subject (Cambridge University Press, 2003).

3 Examples can be found a.o. at www.syntens.nl/ict, and www.dti.gov.uk/bestpractice/.

and **www.bigben.nl**. The websites have a secured ordering system and are linked to the Gubbels back-office. Resellers can now easily view and order products. By using the websites, Gubbels measurably improved its turnover, and lowered its costs. Moreover, the company strengthened its relationship with the resellers. In addition, consumers can now also view their assortment and locate a reseller.

Another interesting example is Geertsma in Dokkum, a wholesale trade company for bicycles and bicycle parts. Geertsma employs 22 people. Eight sales representatives are on the road everyday to visit around 1200 customers (bike shops). Every night, handwritten orders are faxed to the office in Dokkum, articles are collected from the warehouse, and finally the orders are processed in a computer system. This way of working offered too many possibilities for mistakes and took a lot of time. After a stranded pilot project with laptops, Geertsma found the perfect solution in handheld computers provided with GPRS[4] communication. Now, the sales representatives pull out a flashy PDA and impress their customers with a complete database of the 15000 products, most even with photos. Today, orders are processed much faster and more accurate, and the turnover rate of the supplies has improved.

Comparing Dell, Cisco and Amazon with the companies of Gubbels and Geertsma sheds a very different light on what e-business is. Gubbels and Geertsma are traditional companies selling low-tech products like pipes and bicycles. They managed to turn around their existing way of working and succeeded in creating value with ICT. To them, e-business means supporting their business processes with ICT in a way that benefits their business. To Dell, Cisco and Amazon, ICTs are the basis their companies are built on; without ICT these companies would not exist. This study focuses on traditional small and medium sized companies in the Netherlands, and tries to find out what e-business adoption is in SMEs.

1.2 The policy makers' view

In order to put the subject of e-business and SMEs into perspective, it is interesting to follow the development of public policies from the mid 1990s onwards.

4 General Packet Radio Service (GPRS), a standard for wireless communications. It is particularly suited for sending and receiving small bursts of data, such as e-mail and Web browsing, as well as large volumes of data (www.webopedia.com, accessed August 11, 2004).

Public policies are easily accessible and form a good source of information. The development of the e-business concept can be traced back from the introduction of the Internet and e-commerce. Moreover, it gives a good view on the ideas that exist amongst policy makers, about SMEs and the significance of e-business.

At the end of the 90's when Internet application really caught on, high expectations were felt about the positive impact the Internet might have on business like access to a global marketplace, and significant cost savings. Governments and international organisations recognised the potential of the Internet to radically alter economic activities and the social environment (a.o. OECD, 1997a, 1997b, 1998a; European Commission, 2000). In its first policy brief dealing with electronic commerce[5] the Organisation for Economic Co-operation and Development (OECD) states:

> *With electronic commerce, the world is on the threshold of a new revolution. Because electronic commerce provides a fundamentally new way of conducting commercial transactions, it will have far-reaching economic and social implications. Current ways of doing business will be profoundly modified: anyone with a computer and Internet access can become a merchant and reach consumers all over the world; any consumer can acquire products and services offered anywhere in the world. New and far closer relationships will be forged between businesses and consumers; many of the traditional intermediaries will be replaced; new products and markets will be developed* (OECD, 1997a).

SMEs[6] were specifically addressed as important beneficiaries of these technological developments (OECD, 1998b, 1999a; European Commission, 1997).

> *Given the paramount economic importance of SMEs and their intrinsic community value, the role of small businesses in emerging markets based on electronic commerce is a major policy issue for governments. Smaller companies can benefit disproportionately from the opportunities offered by information technolo-*

5 Electronic commerce defined as 'commercial transactions occurring over open networks, such as the Internet (OECD, 1997a).

6 Small and medium sized enterprises (SME) are defined by the European Commission as enterprises which employ fewer than 250 persons (EC, 2003a).

> *gies and electronic commerce. The Internet can make size irrelevant; because it can level the competitive playing field by allowing small companies to extend their geographical reach and secure new customers (...)* (OECD, 1999a: 152-153).

Early public policies by for example the G8 and the European Commission were mainly directed towards connecting SMEs to the global marketplace via the Internet (Moline, Toui & Zobel, 1998; Troye-Walker, 1998). Later on, the focus was on accelerating the growth of e-commerce, defined as selling and buying goods and services over the Internet (European Commission, 2000). In more recent communications however, the European Commission has the objective to help SMEs better use the Internet as a business tool to increase competitiveness and raise productivity and growth. The European Commission observed that although SMEs appear to close the gap in terms of ICT penetration and Internet connectivity, they still seem to find it harder than larger enterprises to implement new technologies in a profitable way. This observation made the Commission review its policy regarding stimulating the use of ICT in SMEs (European Commission, 2003b). The policy challenge shifted from stimulating Internet connectivity in SMEs to helping them implement ICTs in a profitable way (European Commission, 2002c, 2002d, 2003b, 2003c, 2003d).
Now, the concept of e-business[7] is considered much wider than merely Internet connectivity or e-commerce: 'E-business relates both to external and to company internal processes and does not only describe external communication and transaction functions, but also relates to flows of information within the company, i.e., between departments, subsidiaries and branches.'

In the Netherlands, the ideas of the ministry of Economic Affairs on the use of ICT and the Internet in SMEs developed along the same lines. At first, general policies were targeted towards ensuring access to the 'electronic highway' (EZ, 1994). Later, electronic commerce became the focal point (EZ, 1998a). Yet, the ministry observed at an early stage that electronic commerce was much more than buying and selling via the Internet. They defined electronic commerce as all business transactions that are executed electronically in order to improve the efficiency and effectiveness of market and business processes (EZ, 1998b, *translation by the author*). In 2001, the policy goals were aimed at Internet access

7 This description of e-business is the working definition of E-business W@tch, an initiative of the European Commission, Enterprise Directorate General, www.ebusiness-watch.org, accessed 24-10-2003.

and e-mail facility for SMEs with an emphasis on Internet presence and conducting electronic transactions with customers, suppliers and business contacts via the Internet (EZ, 2001). The ministry's policy regarding ICT and SMEs is now targeted towards e-business as the integration of ICT into business processes in order to improve competitiveness and stimulate economic growth (EZ, 2004a).

The emphasis of public policies shifted from promoting the diffusion of the Internet to the instrumental role of ICTs in doing business and creating value. This indicates, from a policy makers' view, that the adoption of e-business plays an important part in making existing businesses more efficient and effective. Moreover, it is a tool for business development and the creation of new economic activity.

1.3 The current state of affairs

Statistics show that by now the penetration of computers and Internet access in SMEs is quite high in Europe (European Commission, 2003c) as well as in the Netherlands (Snelders, 2004; CBS 2002). The majority of SMEs is aware of the existence of these technologies and has some knowledge of their functioning. However, when it comes to electronic *business*, like having a web presence or selling on-line, the SME population shows a large variation in the rates of adoption, existing among sectors as well as within one line of business (European Commission, 2002a, 2002b, 2003c; Snelders, 2004). Also, a 'digital divide' by company size can be found (European Commission, 2002a; DTI, 2003). Already at the next stages of electronic business evolution, for example when it comes to having their own website, SMEs in general lag behind larger companies. For specific sectors the 'divide' between small and large companies is even wider (European Commission, 2002a; DTI, 2003). These statistics underpin the policy makers' view; the utilisation of e-business in SMEs is the challenge for the years to come. This refers to the use of ICT in business processes within and between enterprises with the specific purpose of improving and developing business.
ICT includes Internet and e-mail technology, as well as other technologies that support data-communication like EDI (Electronic Data Interchange) or mobile telecommunication.

As SMEs play a significant role in the economy, it is important to stimulate electronic business in SMEs to promote competitiveness and economic growth. It seems that SMEs have particular problems that hold them back in adopting e-business (EZ, 2001; OECD, 2001; European Commission, 2002a; DTI, 2003). Barriers that discourage SMEs from applying ICT are often sought in the following categories: (1) a lack of awareness of the possibilities of ICT, (2) insufficient ICT know-how and skills, (3) a lack of confidence in ICT, and (4) a lack of resources and capacity (EZ, 2001). In a recent study, 56% of SMEs that are not interested in e-business indicated that they do not see the relevance of Internet or e-business to their product, service, or enterprise; 17% indicated they do not see any advantages (Snelders, 2004). Although it cannot be expected that e-business offers benefit to any type of business, many businesses fail to recognise what opportunities the technology can offer their business. This inability may arise from a lack of ICT knowledge and experience, possibly amplified by uncertainty about for example security issues. Uncertainty about the added value of e-business can easily lead to reluctance in investing time and money. In order to stimulate SMEs to take up e-business, we need a better insight into factors that facilitate e-business adoption.

Summarising the introduction of the subject so far, I conclude that e-business is considered a much wider concept than e-commerce or Internet-commerce, and concerns the support of business processes with ICTs in order to improve and create business. Today, many SMEs have computers and Internet access. However, in general SMEs lag behind larger companies when it comes to benefiting from the integration of ICTs into their daily business. SMEs play an important part in our economy and e-business adoption can improve their competitiveness. It is therefore relevant to investigate what e-business is and what makes SMEs adopt it.

1.4 Research approach, questions and objectives

Research approach

The lack of insight into e-business adoption leads to the following provisional research questions: *what is e-business adoption?* And *what explains e-business adoption in smes?* To answer these questions, the obvious choice for a theoretical approach appears to be innovation adoption theory. In this line of research, a lot of knowledge has been gathered on conceptualising innovation adoption, mechanisms of organisational innovation adoption behaviour and related firm characteristics. However, in innovation adoption research it is generally assumed that the innovation, often a technological innovation, has stable, pre-determined features and is considered for adoption when the organisation judges it to be beneficial to the business. Yet, in my view, e-business is an innovation that is largely shaped by the adopting organisation. After all, it is the organisation that decides how to apply ICTs. I also assume that e-business is about generating business and value creation. Innovation is not a goal in itself, but an instrument for a firm to achieve its (strategic) goals. ICTs are applied in order to create business.

In entrepreneurship literature, the instrumental role of innovations in creating business can be recognised. It was Schumpeter that pointed at innovativeness as the key ingredient to entrepreneurship (Schumpeter, 1934). As Drucker put it: innovation is the specific tool of entrepreneurs, the means by which they exploit change as an opportunity for a different business or a different service (Drucker, 1985). Technological innovation offers a multitude of opportunities for entrepreneurship. Internet and e-mail are innovations that indeed offer entrepreneurs various opportunities for electronic business by generating efficiency, effectiveness and/or strategic benefits (Riggins, 1999). These technological innovations, however, are not ready-to-use. The business opportunities that they can offer for electronic business need to be recognised and developed by an organisation before they come into existence. Consequently, different firms will discover different business opportunities given innovations like e-mail and Internet. Shane demonstrates in his study that before technological change can influence output in a firm, an entrepreneurial opportunity must be perceived (Shane, 2000). Apparently, some SMEs are very good at discovering and

realising Internet-based business opportunities (e.g. IDC, 2002), while others are not. I assume that the adoption of e-business is driven by an ability to recognise opportunities. The adoption of technologies like e-mail or Internet is part of a process of developing e-business opportunities.

Policy makers often refer to innovation diffusion and adoption when discussing e-business and the integration of ICT in businesses (e.g. DTI, 2001; European Commission, 2002a; OECD, 2003). Many researchers conceptualise the process of e-business integration as an innovation adoption process (will be discussed in **chapter 2**). My interest however, is what SMEs actually do with ICTs to create business. If we look at e-business adoption this way, we may get a new perspective on electronic business as innovation. What makes companies able to identify and make use of opportunities offered by ICTs?

The general objective of this study is to find firm factors that influence the behaviour of companies in discovering, considering and exploiting business opportunities based on ICT-technologies. One way of developing theory is to borrow a perspective from another field in order to challenge assumptions of accepted theories (Whetten, 1989). In this study, the phenomenon of e-business adoption is considered from two theoretical perspectives, innovation adoption and entrepreneurship. In reviewing literature from both streams, it becomes clear that innovation and entrepreneurship have a strong relationship. Nevertheless, each perspective has its own view on seizing business opportunities offered by innovations, and emphasises different aspects of business processes. Entrepreneurship theory and more specifically opportunity recognition theory emphasises the entrepreneurial element in the adoption of e-business: the creation of new business. Unfortunately, research into opportunity recognition is relatively young compared to innovation adoption research and so far has yielded limited knowledge on firm characteristics that are instrumental in opportunity recognition (Puhakka, 2002).

After reviewing e-business adoption literature I conclude that the entrepreneurial aspect of innovation adoption appears to be underexposed (will be elaborated in **chapter 2**). In order to arrive at an explanation of e-business adoption taking the creation of new business into account, literature on entrepreneur-

ship and opportunity recognition is reviewed (**chapter 3**). By combining e-business adoption and opportunity recognition literature I aim to investigate which firm attributes contribute to the recognition of business opportunities based on ICTs, the adoption of e-business and the creation of value (**chapter 4**). As such, this study intends to empirically test hypothesised relationships between firm characteristics, e-business adoption and value creation. In addition, this study will provide a deeper understanding of the relevance of an entrepreneurship perspective to the explanation of e-business adoption. In the end, the entrepreneurship perspective will be compared to the innovation adoption perspective on explaining e-business adoption to investigate their differences.

Research questions

In order to explain e-business adoption, I need to examine how e-business adoption can be conceptualised and measured. Consequently, the first research question in this study is:

1 ***What is e-business adoption?***

Next, this study focuses on identifying firm characteristics that facilitate the recognition of opportunities for e-business, resulting in its adoption and the creation of value. The second research question is formulated as follows:

2 ***Which firm characteristics explain e-business adoption in SMEs?***

These first two research questions will be investigated from two theoretical perspectives: an innovation adoption perspective and an entrepreneurship perspective. Consequently, it is interesting to examine the differences in explaining e-business adoption from these two views. Therefore, the third research question is:

3 ***What are the differences in explaining e-business adoption from an innovation adoption perspective compared to an entrepreneurship perspective?***

Research Objectives

The overall objective of this study is to explain the adoption of e-business in SMEs by assessing e-business adoption on firm level and identifying firm characteristics that influence adoption. In detail, this study has the objective to:

- Conceptually analyse and define the main concepts in the study
- Review, analyse and synthesise existing literature on innovation adoption, in particular e-business adoption, and opportunity recognition in order to understand the adoption of e-business
- Build a theoretical framework and derive propositions of relations between firm characteristics and e-business adoption
- Design a method to test these propositions, which includes the operationalisation of concepts, formulation of hypotheses, designing the research instrument, determining a sample, designing data collection, and discuss reliability and validity of the study
- Empirically test the hypotheses, and determine consequences for the hypothesised relations and theoretical model
- Draw conclusions from the study and describe the implications for theory and future research, as well as for parties involved and interested in the adoption of e-business in SMEs like SMEs, consultants and policy makers.

1.5 Scope of the study

Theoretical scope

The determination of the theoretical scope starts by defining its role in the larger context of research. This study falls within two fields of research: innovation research and entrepreneurship research. Within the context of innovation research, my conceptualisation of innovation is similar to that of 'variance sociologists', interested in contextual, structural, and individual factors explaining variance in innovation adoption at the level of the organisation.

Research in this stream examines the relation between firm factors, external environmental factors, and innovation. The strength of these relations is determined by the amount of variance of the dependent variable that is explained by a set of independent variables (Subramanian & Nilakanta, 1996). In this perspective, e-business adoption (the dependent variable) is studied as the result of an

innovation adoption process. Yet, the focus of this study is not on the *process* of innovation. Rather, firm characteristics (the independent variables) are identified that influence the result of the innovation adoption process. The objective is to find out which of these firm characteristics explain the adoption of e-business. Innovation theory and innovation adoption theory provide knowledge on both the conceptualisation of innovation adoption as well as firm characteristics that influence innovation adoption. Since 1996, several studies have been published on the adoption of e-business in particular. They provide insight into the conceptualisation of e-business adoption and determinants of e-business adoption. Most of these studies explain e-business adoption using the adopter's perception of innovation characteristics as explanatory variables.

The field of entrepreneurship research involves the study of sources of opportunities; the processes of discovery, evaluation, and exploitation of opportunities; and the set of individuals who discover, evaluate, and exploit them (Shane & Venkataraman, 2000). Zahra and Dess (2001) suggest complementing this description of the field with the study of the outcomes of entrepreneurial behaviour. Traditionally, in entrepreneurship research, significant attention has been given to the effect of personality on entrepreneurial behaviour, however with inconclusive results (Gartner, 1988; Chell, Hayworth & Brearly, 1991; Shaver & Scott, 1991; Krueger, Reilly & Carsrud, 2000). Over the years, the attention shifted from trait research towards understanding the nexus of enterprising actors and valuable opportunities (Venkataraman, 1997). Today, entrepreneurship is treated as the process of recognising and exploiting opportunities, and the enterprising actor may as well be an entrepreneurial team or firm (Van der Veen & Wakkee, 2004). Within the context of entrepreneurship research, this study relates particularly to research into opportunity recognition behaviour. Opportunity recognition is considered to be the first phase of the entrepreneurial process (Bhave, 1994; Puhakka, 2002; Van der Veen & Wakkee, 2004). In this process, an initial idea for new business is developed into a feasible and desirable business opportunity that is ready to be exploited (De Koning, 1999). Literature on explaining opportunity recognition offers insight into explanatory factors, however mainly on the individual level. Besides social and psychological attributes, knowledge and information differences, and differences in cognitive behaviour are used as explanatory factors.

In this study, it is assumed that e-business concerns the recognition of business opportunities that are based on ICTs. The exploitation of these opportunities for e-business results in the creation of new business. This study focuses on the ability of firms to discover and exploit opportunities based on ICTs. Again, the emphasis is not on the *process* of opportunity recognition itself. Rather, the result (the exploited e-business opportunity) is related to a firm's ability to recognise opportunities. In other words, which firm characteristics explain the recognition of opportunities for e-business leading to its adoption? Entrepreneurship literature provides knowledge on the conceptualisation of business opportunities as well as on actor characteristics that contribute to opportunity recognition. The body of knowledge on individual opportunity recognition is used as a basis, combined with a few recent firm level studies, to find firm characteristics explaining opportunity recognition.

Empirical scope

This study investigates existing small and medium sized enterprises in the Netherlands in nine lines of business (definitions will be discussed in detail in the next section). The firm characteristics that are identified to explain the adoption of e-business are relevant to this group. Differences within sectors or classes of size, however interesting, will not be investigated here. Furthermore, this study focuses on firm behaviour, and does not look at behaviour of individuals. However, for practical reasons the owner/manager or managing director is contacted to collect empirical data.

1.6 Definitions of central concepts

Small and medium sized enterprises

Central in this study are small and medium sized enterprises (SMEs) in the Netherlands. Generally, the size of the company in number of employees is taken to define SMEs. The Dutch Ministry of Economic Affairs defines an SME as a company with less than 100 employees. SMEs account for 99% of the number of companies in the Dutch private sector and more than 50% of employment (EZ, 2001). The SME population is highly heterogeneous in terms of turnover, innovation levels, technology adoption, etc., even when they operate in the same sector.

In particular for e-business, the analysis of SMEs should take into account their diversity rather than address them as a generic category of enterprises (European Commission, 2003d). In this study, three classes of size are distinguished (in number of employees): 0-9, 10-49, and 50-99. Nine different sectors are chosen that are defined by using a three-digit sector-code (BIK-SBI): industry, building industry, wholesale trade, retail, hotel and catering industry, transport, business services, financial services, and personal services.

Electronic business

Numerous definitions are available on electronic business or e-business and each description reflects the vision on the phenomenon by its author[8]. Also, definitions have evolved according to the shifting locus of attention, especially with policy makers. For example, early definitions dealt with *e-commerce*, narrowly defined as selling and buying products and services on the Internet (EZ, 1998a; European Commission, 2000). Later definitions concern *e-business* which relates to the use of ICTs in both external and internal company processes and does not only describe external communication and transaction functions, but also relates to flows of information within the company, i.e., between departments, subsidiaries and branches[9].

Basically, definitions differ on two main aspects:

a The activities or type of transactions included in the definition. When leaving out the 'e' of e-business, 'business' is what remains. The range of business processes or transactions that are involved, determine the scope of the definition. Some definitions focus exclusively on trade processes with customers and suppliers. Others include business processes with other external actors like banks, local governments, business partners or telephone companies. Internal processes like management, R&D, or human resource management may also be included in the definition.

b The communication infrastructure these activities or transactions are carried out on or the specification of the 'e' in e-business. Two dimensions define the

8 Pieter Peelen posted a question about possible definitions of e-business on the eThesis discussion list for his Master's thesis (Peelen, 2001), and received a wide variety of definitions. The archived discussion thread is available on lists.topica.com/lists/eThesis/read, accessed 12-12-2004.

9 This is the working definition of E-business W@tch, an initiative of the European Commission, Enterprise Directorate General, www.ebusiness-watch.org, accessed 24-10-2003.

communication infrastructure: applications and networks. It refers to all the possible applications (e.g. World Wide Web, Electronic Data Interchange, e-mail, etc.) running over all the possible communication networks (e.g. open, closed, proprietary or non-proprietary networks) (OECD, 1999b).

In practice, by considering various combinations of types of activities, applications, and networks, one can think of different types of e-business definitions. Clearly, e-business is much more than using a technology or application. In this study, e-business relates to the application of information and communication technologies to the entire value chain of business processes conducted electronically. **Chapter 2** further deals with the conceptualisation of e-business adoption. E-business adoption is operationalised in **chapter 6**.

Innovation

Innovation generally has two meanings: innovation as a process, and *the* innovation as the outcome of that process (Gopalakrishnan & Damanpour, 1997). Innovation as a process can be defined as the process of creating a new product-market-technology-organisation-combination (Boer & During, 2001). The innovation process leads to a change in at least one of the four elements. In this study, innovation as a process refers to the innovation decision process as conceptualised by Rogers (Rogers, 1995). It is defined as the process through which a decision making unit passes from first knowledge of an innovation, to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision (Rogers, 1995). Essentially, innovation is considered here as the adoption and implementation of externally developed innovations. This conceptualisation of the innovation process is essentially different from *intra-firm* innovation models in which innovations are conceived, and developed within the firm, and consequently marketed (During, 1986; Boer, 1991).

The innovation generally is defined as an idea, practice, or object that is perceived as new by an individual or unit of adoption (Rogers, 1995). The term innovation is not reserved for technological inventions or the in-house development of products or services. On the contrary, the majority of innovations are based on the cumulative effect of incremental change in products and

processes, or in the creative combination of existing techniques, ideas, and methods (Tushman & Nadler, 1986). The quality 'new' refers to the perception of the people or firm involved. The innovation may therefore be an imitation, or something that exists elsewhere (Van de Ven, 1986). The extent, to which an innovation is new, ranges from incremental to radical (Tushman & Nadler, 1986). In traditional innovation research the type of innovation is often characterised by three sets of contrasting types[10]: product – process, technical – administrative, and radical – incremental (Gopalakrishnan & Damanpour, 1997). In view of the purpose of this study, a distinction between the different types of innovation will not be made. Electronic business often concerns process as well as product innovation, like the introduction of a web-based tracking and tracing service to customers, necessitating product development as well as a redesign of internal processes. Also, e-business may involve technical as well as administrative innovation, like the adoption of a web-based system for the administration and payment of salaries, affecting both the administrative procedures as well as the level of information technology. The distinction between radical and incremental innovation will not be made either, at least, not in the sense of the perceived extent of change or degree of novelty (Tidd, Bessant & Pavitt, 1997). In this study, the consequences of e-business adoption will be looked at in terms of different types of value creation.

Entrepreneurship

In this study, research is focused on existing firms and firm behaviour. Therefore, entrepreneurship is regarded here as taking advantage of opportunities by combining new and existing resources in innovative ways that have impact on the market (based on Wiklund, 1998). Therefore, in my view, entrepreneurship refers to the entrepreneurial function in a firm that combines new and existing resources in innovative ways to take advantage of opportunities. This view on entrepreneurship focuses on finding ways to exploit innovation, and create business value. Considering Gartner's study[11] into definitions of entrepreneurship, innovation and value creation are only two out of eight central themes in

10 Other classifications can be made as well, like disruptive-sustaining, or discontinuous-continuous innovations.

11 Gartner (1990) concluded that eight themes or principal ideas dominate the characterisation of entrepreneurship in literature: the entrepreneur, innovation, organisational creation, creating value, profit or non-profit, growth, uniqueness, and the owner-manager.

characterising entrepreneurship (Gartner, 1990). Consequently, the study confines itself to this conception of entrepreneurship. Entrepreneurship is discussed in **3.1**.

Opportunity
Overlooking the definitions of opportunity, this study considers an entrepreneurial opportunity to be a feasible and desirable future state that requires: (a) the introduction of new goods, services, raw materials and organising methods; (b) having an impact on the market; and (c) offering profit potential through (d) the creation of new ventures or radical improvement of existing ventures (Van der Veen & Wakkee, 2004). The opportunity concept is discussed in detail in **3.2**.

1.7 Overall research design and reading guide

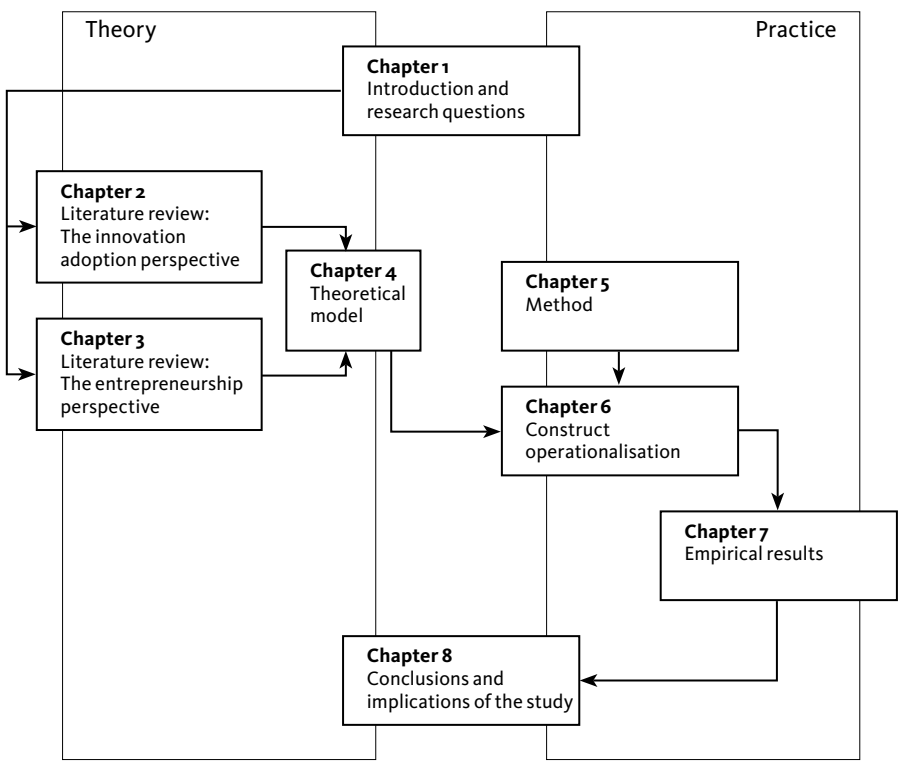
This research is designed to follow the empirical cycle (De Groot, 1961; Swanborn, 1987). The empirical cycle describes the interaction between theory and practice in order to find an answer to a problem. The basic research design of this study is reflected in the order and contents of the chapters in this dissertation (depicted in **figure 1**). The point of departure is the formulation of a problem. Central to this research are the research questions:

1 ***What is e-business adoption?***
2 ***Which firm characteristics explain e-business adoption in*** SME***s?***
3 ***What are the differences in explaining e-business adoption from an innovation adoption perspective compared to an entrepreneurship perspective?***

To answer these central questions, I first investigate e-business adoption literature on how to conceptualise and explain e-business adoption on firm level (**chapter 2**). This literature mainly takes on an innovation adoption perspective on e-business adoption. Subsequently, I investigate an entrepreneurship perspective on e-business adoption as I presume that opportunity recognition plays an important role in the adoption of e-business. In **chapter 3**, I therefore review literature on entrepreneurship and opportunity recognition.

From the entire literature review, I construct a theoretical model in **chapter 4**. It is a framework of proposed relations between firm attributes, perceived opportunity characteristics, e-business adoption, and value creation. Methodological issues and the research design are discussed in **chapter 5**. Subsequently, the theoretical constructs are operationalised into measurable variables (**chapter 6**). In **chapter 7**, the propositions are reformulated into hypotheses, ready to be tested. Next, the collected empirical data are analysed to test the hypothesised relationships (**chapter 7**). Finally, in **chapter 8**, the research questions are revisited to draw conclusions from the study and reflect on its limitations. Following from the conclusions and limitations, implications are discussed for the development of theory and future research. Also, recommendations will be formulated to enhance SME management, policy and consultancy.

Figure 1 **Basic research design and lay-out of the dissertation**



2 Review of e-business adoption literature

In this chapter, a review of the existing literature on the adoption of electronic business is presented. First, I describe the method used (**2.1**). Next, the results of the review are presented (**2.2**). The review gives an overview of the existing body of knowledge on e-business adoption in SMEs. In particular, it focuses on studies that have empirically investigated the adoption of electronic business and related technologies. The aim of the review is first to gain better insight into the conceptualisation and measurement of e-business adoption in the current literature on the subject. The second objective is to establish how e-business adoption has been explained. Subsequently, I will discuss the findings in the context of their research traditions to better understand e-business adoption in view of the research questions (**2.3**). In the discussion, general literature on innovation adoption and innovation are used as a frame of reference. In the last section (**2.4**), I conclude on the findings of the review.

2.1 Method

To find relevant academic publications, I used two major academic search engines: *Web of Science* and *Science Direct*. The following keywords were used: *Internet, World Wide Web, electronic commerce, electronic business,* in combina-

tion with the keywords: *adoption* and *use*. I conducted a search for studies published between 1996 and 2002. This time span was determined by two considerations. First, 1996 was the first year in which several academic articles were published concerning the adoption of the Internet (using the aforementioned search engines). Second, the 1st of January 2003 was set as a practical limit to the search so as to enable analysis. Studies focusing on consumers were omitted. In addition to the Internet search results I used a number of relevant refereed publications, which were either cited in references in the publications found or given to me by colleagues. In total, this procedure yielded 45 studies. There is no guarantee that the review of existing literature from this time span is complete. However, the search engines used safeguard the inclusion of publications on this topic in the most relevant journals. *Web of Science* contains all journals from the Social Sciences Citation Index and *Science Direct* contains journals published by the world's largest academic publisher.

The literature review was completed in two stages. In the spring of 2002, I collected 28 studies on e-business adoption. To investigate the conceptualisation and measurement of e-business adoption, I looked for the dependent variable in every study. I read and analysed every study twice to identify different approaches for conceptualising and measuring e-business adoption. I noticed that many authors use different perspectives to describe the use of ICT technologies. I labelled these different perspectives 'dimensions' of e-business adoption (Van der Veen, 2002). With knowledge gained from the first literature review, I developed a more structured search procedure as described above. Using this procedure in a second literature search (2003), I found an additional 17 studies. I read and reread all 45 studies to identify different approaches for conceptualising e-business adoption. I found seven dimensions of e-business adoption. I also investigated the way in which e-business adoption is explained. In 26 of the 45 studies under investigation, the authors' objective is to explain the adoption of ICT technologies. The use of perceived innovation characteristics to explain e-business adoption clearly prevailed in the studies reviewed. In addition, adopter characteristics or network influences were used as explanatory variables. I classified the explanatory variables used into three main categories of explanatory variables. For each explanatory variable I examined its reported relationship to e-business adoption.

2.2 Results of the literature review

The literature review is divided into two sections. The first section (**2.2.1**.) focuses on the dependent variable of e-business adoption and reviews studies measuring electronic business or the use of ICT such as the Internet in companies.
In the second section (**2.2.2**) studies aimed at explaining e-business adoption are investigated. Both categories of studies involve companies of various sizes and the analysis is conducted on either firm or individual (e.g. employee) level.

2.2.1 Conceptualising and measuring e-business adoption

45 studies were found which conceptualised and measured e-business adoption in various ways. Studies were collected on e-business, e-commerce, the World Wide Web and Internet related innovation adoption regardless of their precise definition, to gain insight into how the conceptualisation and measurement of e-business adoption is approached in empirical research. An overview of the studies can be found in **appendix 2.1**.

In the studies under review, e-business adoption is conceptualised from various viewpoints. Some authors look at the type of applications that are used to characterise e-business adoption. Others investigate the value of e-business and how this is achieved or the intensity with which applications are used. In most studies a combination of aspects or features is used to obtain a characterisation of e-business adoption. I refer to these different aspects as dimensions of e-business adoption.

Seven dimensions of e-business adoption were found:

- ***Activity.*** An activity-based aspect offers insight into the way that the company is supported by ICT. Usually, several business processes are listed, such as sending purchase orders to suppliers or offering information to customers. In many activity based measures, it is unclear how the list of business processes or activities was arrived at. This dimension of adoption was frequently applied in the studies examined (21 out of 45).
- ***Application.*** In these studies, adoption is measured by the use of certain applications such as e-mail, WWW, website, Intranet etc. in the company. Indicating that certain applications are present in the company comes close to measur-

ing adoption/non-adoption of a list of applications. Sometimes, the variable of adoption is a dichotomous variable (marked as X (d) in **appendix 2.1**) referring to the adoption or non-adoption of only one application. It should be noted that the mere presence of applications or access to certain types of ICTs does not imply that the applications are actually used. Many of the studies (18 out of 45) focused on an application-based measure of adoption.

- ***Value creation.*** Another category of studies characterises adoption based on the value that the use of Internet-based applications has for the business. Usually, the respondents are asked about the actual or perceived benefits gained by using e-mail, the Internet or the World Wide Web (for example Daniel & Grimshaw, 2002). Remarkably, negative outcomes of adoption such as higher costs or decreased personal contact are often excluded.
- ***Intensity of use.*** In this category, measures represent some sort of intensity or frequency: how much, how often or how widespread is the innovation being used? For example, the number of times per day that the Internet is used (Teo, Lim & Lai, 1999) or the number of departments with an Intranet application (Eder & Ibaria, 2001).
- ***First time of use.*** A classic measure of diffusion is based on the notion that it is possible to classify organisations into adopter categories, based on the point in time when they adopt the innovation relative to other organisations (Rogers, 1995). For example, Cockburn and Wilson (1996) investigate the number of years a company has access to the Internet. The measure can also be used internally in organisations to measure diffusion (for example Eder & Igbaria, 2001).
- ***Stage of development.*** In only a few studies (6 out of 45), researchers assess the adoption of Internet using a stage or level of development model. This is in contrast with literature on the Internet or e-business strategy, where the use of multi-stage business models is very common to characterise companies and their use of the Internet (for example Fischer, 1998; Venkatraman & Henderson, 1998; Amit & Zott, 2000; Earl, 2000; Timmers, 2000; Holland, Bouwman & Smidts, 2001). For measuring the level of adoption, stage models are only helpful for roughly categorising the adoption of e-business in companies or departments.
- ***Other.*** Most studies surveyed fall into one or more of the previous categories, apart from a few exceptions. A noteworthy example of such an exception is the study by Cockburn and Wilson, later continued by Ng, Pan and Wilson (1998) and

Greaves, Kipling and Wilson (1999), who also characterise the adoption of the World Wide Web by the cost of maintaining the company's website.

From the overview (**appendix 2.1**) it is evident that most researchers make use of multidimensional measures to characterise electronic business in a company (24 studies out of 45). To describe e-business adoption many authors rely on measures from various viewpoints to obtain a richer picture of the phenomenon. In doing so, most authors pass over the conceptualisation of their subject of study and focus on operationalisation. Consequently, most studies are clearly empirical observations and do not offer conceptual or theoretical contributions.

I decided to characterise the studies reviewed as studies of e-business adoption. The diversity in these studies shows that electronic business is not a clearly defined concept, and most authors have their own point of view. However, from the overview an implicit conception of e-business appears. In the studies, e-business is often associated with supporting business activities by using the Internet to gain certain benefits. Typically, e-business adoption is measured by listing which business activities are electronically supported (activity), which ICT applications are used (application) and the value it has for the business (value creation).

Many of the studies investigate the adoption of the Internet or the World Wide Web in business. This is usually limited to assessing the functionality of the company's website, or the support offered by the Internet for a list of business activities or processes. In my opinion, the measurements used are not well developed. For example, several studies list a number of business activities, which are supported by the use of the Internet. In some studies, the authors refer to activities mentioned in previous research (e.g. Daniel, Wilson & Myers, 2002), while others have apparently casually drawn up a list of business activities (e.g. Walczuch, Van Braven & Lundgren, 2000). Either way, the list of business activities was compiled relatively *ad hoc* and was not derived from a reasoned conception of business.

2.2.2 Explaining e-business adoption

In this section, I discuss studies aimed at explaining the rate of e-business adoption. Among the 45 studies in this survey, 26 focus on explaining the adoption of electronic business. These are surveys as well as multiple case studies. Nine studies aim at explaining adoption on the individual level and the others focus on firm level. In **appendix 2.2** an overview of these studies is presented. A large variety of variables and their relation to e-business adoption have been investigated. The determinants of adoption or use can be roughly divided into two categories: *perceived innovation characteristics, and adopter characteristics*.

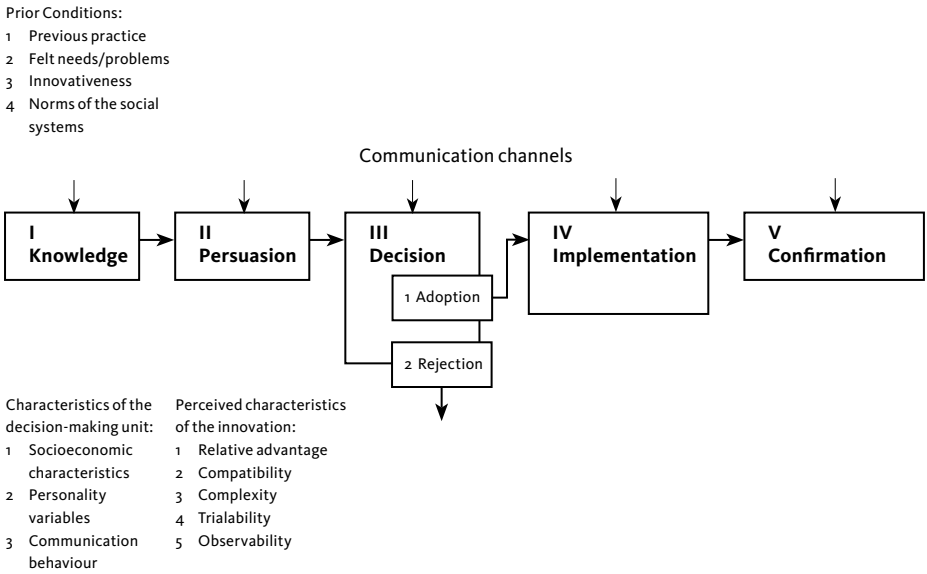
Perceived innovation characteristics

A large number of studies (18 out of 26) examine the role of *perceived innovation characteristics* in the adoption of e-business. The attributes of the innovation at hand as perceived by the adopter have proven to be significantly instrumental in predicting adoption (Tornatzky & Klein, 1982). The majority of the studies reviewed examine the adoption of Internet related technologies in the tradition of Rogers (1995). Rogers conceptualises innovation adoption as a process through which an individual or other decision making unit passes from first knowledge of an innovation, to forming an attitude towards the innovation, to a decision to adopt or reject it, to the implementation of the new idea and to the confirmation of this decision (see **figure 2.1**). Central to Rogers' model are the innovation characteristics as perceived by the adopter. Rogers postulates that 'subjective evaluations of an innovation, derived from individuals' personal experiences and perceptions and conveyed by interpersonal networks, drives the diffusion process' (Rogers, 1995: p. 208). Interpersonal networks together with mass media channels make up communication channels through which subjective evaluations of an innovation are communicated to the potential adopter. The adopter's evaluation of certain characteristics of the innovation can inhibit adoption, such as its perceived complexity, or encourage adoption, such as its perceived advantages. In his review, Rogers (1995) investigates five perceived innovation characteristics:

- ***Relative advantage.*** The degree to which an innovation is perceived as being better than the idea it supersedes,
- ***Compatibility***. The degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters,

- ***Complexity.*** The degree to which an innovation is perceived as relatively difficult to understand and use,
- ***Trialability***. The degree to which an innovation may be experimented with on a limited basis, and
- ***Observability.*** The degree to which the results of an innovation are visible to others.

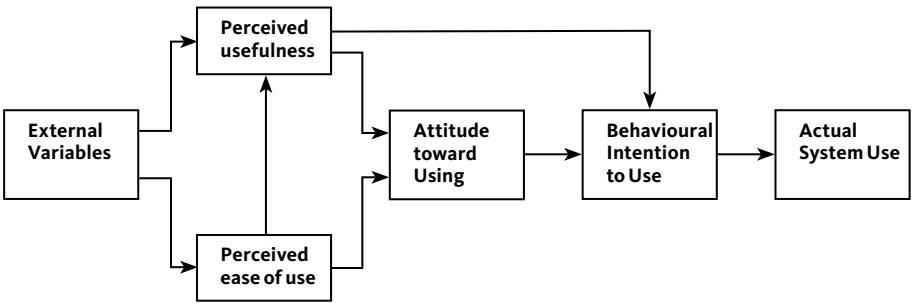
Figure 2.1 The innovation decision process by Rogers (1995)



A smaller number of studies uses the TAM or Technology Acceptance Model (Davis, 1989; Davis, Bagozzi & Warshaw, 1989) in which perceived innovation attributes also play a central role. This model is an individual level adoption model based on Fishbein and Ajzen's Theory of Reasoned Action (TRA) (1975). Davis introduces the TAM as an adaptation of TRA, specifically meant to explain

computer usage behaviour (Davis, Bagozzi & Warshaw, 1989). Based on certain beliefs, a person forms an attitude about a certain object, on the basis of which he or she forms an intention to behave with respect to that object. TAM proposes two specific belief constructs -perceived usefulness and perceived ease of use- as determinants of an individual's technology adoption decision (Davis, 1989). Perceived usefulness (PU) is defined as '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 use (PEOU) refers to 'the degree to which a person believes that using a particular system would be free of effort' (Davis, 1989, p. 320). TAM is an individual level adoption model, however Riemenschneider, Harrison and Mykytyn used the model to explain website adoption on *company* level. They justify using the model by arguing that 'IT adoption decisions in small businesses are typically made by a single executive' (Riemenschneider, Harrison & Mykytyn, 2003: 270). The original model is depicted in **figure 2.2**.

Figure 2.2 Technology Acceptance Model (TAM) (Davis, Bagozzi & Warshaw, 1989)



In **table 2.1** an overview is presented of the perceived innovation characteristics found in at least two of the e-business adoption studies reviewed. Three characteristics clearly predominate as the most frequently tested and were found to be related to e-business adoption:

- ***Relative advantage***. In the studies, this variable is referred to in a slightly different way (perceived usefulness, perceived consequences, or perceived benefits), but the idea is largely the same. Perceived relative advantage is positively related to adoption.
- ***Compatibility.*** Perceived compatibility is positively related to adoption.
- ***Complexity.*** In some studies the antonym of this variable is used: perceived ease of use. The perceived complexity of an innovation is negatively related to adoption. Remarkably, in many studies perceived complexity is insignificantly related to adoption.

Less commonly used innovation attributes are trialability, observability, affect and cost. Affect is defined as 'the direct emotional response to the thought of the behaviour' (Cheung, Chang & Lai, 2000). The relation between perceived trialability and adoption has been found positive in two e-business adoption studies (Kendall, Tung, Chua, Hong, Ng & Tan, 2001; Agarwal & Prasad, 1997). The relations to adoption of perceived observability, affect and cost are more ambivalent.

Table 2.1 Reported relationships between perceived innovation characteristics and adoption

Perceived innovation characteristic	Reported relationship to adoption[a]		
		Author(s)	Innovation
Relative advantage (usefullness, benefits)	+	Gefen & Straub, 1997	E-mail
		Busselle, Reagan, Pinkleton & Jackson, 1999; Teo, Lim & Lai, 1999; Cheung, Chang & Lai, 2000; Beatty, Shim & Jones, 2001; Chang & Cheung, 2001; Griffin, 2001; Mehrtens, Cragg & Mills, 2001; Moon & Kim, 2001	Internet/www
		Lederer, Maupin, Sena & Zhuang, 2000; Raymond, 2001	Website
		Premkumar & Roberts, 1999	ICT technologies
		Kendall, Tung, Chua, Hong, Ng & Tan, 2001	E-commerce
		Nambisan & Wang, 2000	Web technology
		Lal, 2002	E-business
	o	LaRose & Hoag , 1996; Agarwal & Prasad, 1997; Cheung, Chang & Lai, 2000;	Internet/www
		Raymond, 2001	Website
Compatibility	+	LaRose & Hoag, 1996; Agarwal & Prasad, 1997	Internet/www
		Nambisan & Wang, 2000	Web technology
		Beatty, Shim & Jones, 2001	Website
		Kendall, Tung, Chua, Hong, Ng & Tan, 2001	E-commerce
	o	Premkumar & Roberts, 1999	ICT technologies
Complexity (ease of use)	–	Teo, Lim & Lai, 1999; Cheung, Chang & Lai, 2000; Chang & Cheung, 2001; Moon & Kim, 2001	Internet/www
		Lederer, Maupin, Sena & Zhuang, 2000	Website
		Nambisan & Wang, 2000	Web technology
	o	Gefen & Straub, 1997	E-mail
		LaRose & Hoag, 1996; Agarwal & Prasad, 1997; Busselle, Reagan, Pinkleton & Jackson, 1999; Cheng, Cheung & Chang, 2002	Internet/www
		Premkumar & Roberts, 1999	ICT technologies
		Beatty, Shim & Jones, 2001	Website
		Kendall, Tung, Chua, Hong, Ng & Tan, 2001	E-commerce
Trialability	+	Agarwal & Prasad, 1999	www
		Kendall, Tung, Chua, Hong, Ng & Tan, 2001	E-commerce
Observability	o	Agarwal & Prasad, 1997	www
		Kendall, Tung, Chua, Hong, Ng & Tan, 2001	E-commerce
Affect	+	Chang & Cheung, 2001; Cheng, Cheung & Chang, 2002 (service)	Internet/www
	o	Cheung, Chang & Lai, 2000; Cheng, Cheung & Chang, 2002 (manufacturing)	Internet/www
Cost	+[b]	Nambisan & Wang, 2000	Web technology
	o	Premkumar & Roberts, 1999	ICT technologies

a + = positive; o = insignificant; - = negative

b highly correlated with complexity and dropped from model

Adopter characteristics

The second category of determinants of adoption consists of *adopter characteristics*. The adopter is a firm, or an individual within a firm depending on the level of analysis. Looking at the list of variables found in the review (**appendix 2.2**), some clusters can be distinguished:

- ***Relevant knowledge and experience.*** Several determinants of adoption relate to the presence of knowledge and experience relevant to e-business like IT-knowledge or experience with information systems. In general, relevant knowledge and experience facilitate e-business adoption. Examples of these variables are adoption of clusters of related IT-innovations (LaRose & Hoag, 1996), knowledge barriers (Nambisan & Wang, 2000), organisational readiness in terms of IT knowledge and use (Mehrtens, Cragg & Mills, 2001), and managing director's education (Lal, 2002).
- ***Organisational size.*** Nine studies investigate the role of firm size on adoption with various results (LaRose & Hoag, 1996; Sillince, Macdonald, Lefang & Frost, 1998; Premkumar & Roberts, 1999; Nambisan & Wang, 2000; Eder & Igbaria, 2001; Wei, Ruys, Van Hoof & Combrink, 2001; Daniel & Grimshaw, 2002; Lal, 2002; Sadowski, Maitland & Van Dongen, 2002). In some studies, the influence of size on adoption is positive, in others insignificant.
- ***Network pressure.*** Outside the firm, actors in the firm's network or value chain motivate the firm or exert influence on the firm to adopt e-business. In general, network pressure has a positive influence on e-business adoption in the firm. Examples of variables in this group are external pressure (from trading partners) (Premkumar & Roberts, 1999), competitive pressure (Premkumar & Roberts, 1999; Mehrtens, Cragg & Mills, 2001; Raymond, 2001; Sadowski et al., 2002), customer and supplier pressure (Daniel & Grimshaw, 2002), and e-mail use by trading partners (Sillince et al., 1998).

  In studies on individual level, equivalent determinants are used. For employees, adoption can be influenced by a normative belief about e-business within the firm and a motivation to comply (Cheung et al., 2000; Chang & Cheung, 2001; Cheng, Cheung & Chang, 2002).
- ***Network orientation.*** A firm can turn to actors in the firm's network for information and support. Several studies demonstrate that e-business adoption is facilitated by a network orientation. Examples of determinants in this group are external training and technical support (Premkumar & Roberts, 1999),

technological collaboration (Lal, 2002), the degree of involvement of a supply side institution (Nambisan & Wang, 2000), and the involvement of a change agent (De Berranger, Tucker & Jones, 2001).
In studies on an individual level, e-business adoption is positively influenced when employees are facilitated by training, support and easy access to Internet (Cheung et al., 2000; Chang & Cheung, 2001; Cheng, Cheung & Chang, 2002).

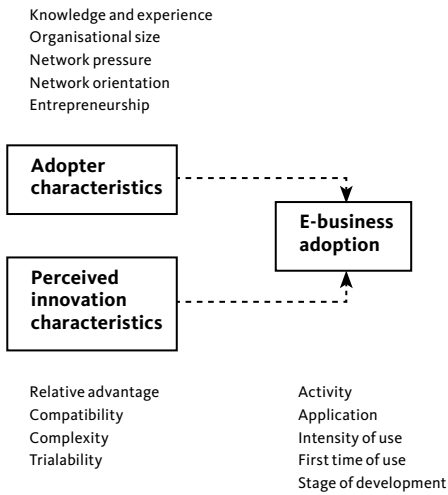
– ***Entrepreneurship.*** Less evident as a group is a number of variables that refer to a positive and encouraging attitude towards innovation within the firm and strategic importance that is being attached to e-business. Organisational support was found to be positively related to adoption in various studies (Sillince et al., 1998; Premkumar & Roberts, 1999; Beatty, Shim & Jones, 2001). Two studies observe the importance of an in-house champion (LaRose & Hoag, 1996; Mehrtens, Cragg & Mills, 2001). Teo and Too (2000) found that firms with a more strategic view of information systems use the Internet more proactively to tap new business opportunities and achieve competitiveness. Katz and Dennis (2001) found that firms are likely to undertake innovations like e-commerce when they see innovation as central to their vision for the firm. In an individual level study, Busselle, Reagan, Pinkleton and Jackson (1999) found that the adopter's need for innovativeness was the strongest factor in explaining Internet use.

2.3 Discussion

In **figure 2.3**, I combined the findings from the literature review on e-business into a provisional model of e-business adoption. It gives insight into the measurement of e-business adoption and factors that were found to be related to e-business adoption in various empirical settings. It does not however provide a conceptual view on e-business, nor an explanation as to why precisely these factors are influential, and how they are related to adoption. In my view, the articles reviewed do not offer a comprehensive understanding of e-business adoption nor do they render a coherent body of knowledge. However, all explanatory studies reviewed use either Rogers' model or the model of Davis et al. to explain e-business adoption. These models have been used extensively in other contexts and in their turn are part of a large tradition of research on innovation and innovation adoption. This provides a frame of reference to interpret the findings

and look for a better understanding of e-business as a concept and the mechanisms behind e-business adoption. I prefer to discuss their contribution to e-business research in the context of their research traditions.

Figure 2.3 Provisional model of e-business adoption



2.3.1 The conceptualisation of e-business adoption

Although some consistency can be found in characterising e-business adoption, in the e-business literature reviewed it is difficult to discern a commonly accepted approach on conceptualising and measuring the adoption of e-business. This may be because e-business is a young field of research, where exploration of the phenomenon is relevant. However, even a discussion on the measurement problem is largely non-existent in the e-business literature reviewed. This is surprising for two reasons. First, in the field of innovation adoption and

information systems several publications deal with the conceptualisation and measurement of innovation adoption. Second, possible beneficiaries of research like governments and IT companies are active themselves in finding ways to systematically monitor e-business adoption in companies[1]. So, in order to complete a discussion on the conceptualisation of e-business adoption, I will consult both innovation adoption and information systems literature[2] on this issue.

Explaining variance in adoption between firms begins with assessing a level or extent of adoption in a firm. Surprisingly, Gopalakrishnan and Damanpour (1997) do not acknowledge the conceptualisation of the dependent variable as one of the primary research questions for variance sociologists. However, the conceptualisation and operationalisation of innovation as a dependent variable are definitely worth a closer look. Downs and Mohr (1976) identify the measurement of innovation as a potential source of instability in innovation research as the behaviours being explained in various studies may be quite different. They observe three principal, interrelated operationalisations of innovation: (a) the time of first adoption or use, (b) dichotomous adoption or non-adoption, and (c) the extent to which an organisation has implemented an innovation, or the degree to which an organisation is committed to the innovation. The first two operationalisations are relatively easy to measure. However, 'the extent of implementation comes closer to capturing the variations in behaviour that we really want to explain' (Downs & Mohr, 1976: 709). In discussing 'ideal' innovation attribute studies, Tornatzky and Klein (1982) propose to focus on both adoption and implementation as the dependent variable instead of a dichotomous yes/no adoption decision. They state, that a degree-of-implementation will vary widely across a group of adopting organisations, whereas adoption will not. Gatignon and Robertson (1985) conclude that the concept of adoption has been used in a rather limited way to refer to a single decision. They propose to conceptualise adoption in two dimensions (width and depth), to be able to assess maximum diffusion potential within a social system. Width refers to the number

1 Here I have in mind a.o. an early report by Den Hertog, Holland, and Bouwman (1999), and the yearly NIPO-reports (Snelders, 2004; Snelders & Eecen, 2000, 2001, 2003) for the Dutch Ministry of Economic Affairs, the efforts by the European Commission, notably the E-business W@tch project (European Commission, 2003b), the British department of Trade and Industry (DTI, 2001, 2003), and the US Census Bureau (Mesenbourg, 2001).

2 The utilisation of information technology (IT) by individuals, groups, or organisations is a core variable in IS research (Straub, Limayem & Karahanna-Evaristo, 1995). Electronic business can be viewed as the use of Internet-related information technology, and therefore IS literature is relevant.

of people in the adopting unit using the product, or the number of different uses for the product. Depth indicates the amount of usage.

In information systems research, I found several studies dealing with measuring innovation adoption. Fichman and Kemerer (1999) clearly demonstrate that the acquisition of information technology in a firm need not be followed by widespread deployment and actual use in the organisation. This 'assimilation gap' makes it necessary for any study concerning IT adoption to clearly define whether adoption refers to either the purchase or the actual deployment of information technology. In their review of measures for IS success, Delone and McLean (1992) state that the use of an information system is one of the most frequently reported measures of information system success. They observe several perspectives on the measurement of use. Some studies compute actual use, while others rely on subjective or perceived measures of use. Some researchers study who is using the information system, while others look at different levels of use or adoption, or the nature of system use. Trice and Treacy (1988) investigate utilisation as a dependent variable. They state that the decision on what aspects of use to measure should be guided in part by the purpose of the investigation. Different independent variables will alter utilisation in different ways. Therefore, utilisation needs to be defined in terms that can measure these effects best. They suggest recognising utilisation as a multidimensional variable to better understand system usage. For example, in order to guide an organisation's EDI initiatives, Massetti and Zmud (1996) present a multidimensional approach to measure EDI-usage. EDI-implementation is investigated along four distinct dimensions: volume, breadth, diversity, and depth. The authors show that mapping implementation this way contributes to understanding the nature and impact of EDI on an organisation. Another example is the work of Broadbent and Weill (1996, 1999a, & 1999b). Although not a dependent variable, they show that assessing IT infrastructure capability by means of three measures (two types of services, reach and range) makes it possible to capture this complex concept, and makes firms comparable. Purvis, Sambamurthy and Zmud (2001) investigate the 'assimilation' of computer aided software engineering tools (CASE) in a firm by measuring the types of projects that use CASE and the extent of that use. In IS research where the TAM-model is used, actual (system) use is generally the dependent variable, often operationalised as frequency of use

(Straub, Keil & Brenner, 1997). According to Lassila and Brancheau (1999), information technology utilisation is generally defined as the *volume* of technology used (number of hours of technology use), the *reliance* on the technology to get the job done (how much a user depends on the technology), and the *diversity* of different functions put to use (the number of different software features used).

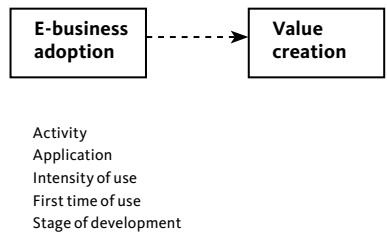
Both innovation adoption research and information systems research suggest using a measure that indicates a degree of adoption or extent of use of an innovation rather than a dichotomous yes/no adoption variable. Adoption thus refers to acquisition, deployment and use of an innovation, which indicates actual use much more meaningful than the purchasing of an information system or the adoption decision alone. Several suggestions are given with regard to conceptualising the multidimensionality of innovation adoption in general. The purpose of the investigation determines the exact choice for dimensions of adoption to measure.

The e-business literature review gives an insight in the dimensions that have been chosen to characterise e-business adoption. In the studies reviewed, e-business is often associated with supporting business activities by the use of Internet to gain a certain benefit. Typically, e-business adoption is measured by listing which business activities are electronically supported (activity), complemented by looking at which ICT applications are used (application) and what business value is created (value creation). In addition, some studies include an indication of the intensity of use, the first time of use or the stage of development. It is evident that e-business adoption is a complex concept, and researchers measure the degree of adoption or use from various viewpoints to capture it.

Although innovation adoption and information systems literature give diverse suggestions to conceptualise innovation adoption, in my view, it usually comes down to an indication of the extent of implementation of an innovation within the organisation. Notably, in measuring e-business adoption, many studies include what type of business value is anticipated or created. Here, the 'extent of implementation' does not only refer to internal diffusion of certain technologies, but also regards what these technologies are used for. E-business adoption is not merely about having Internet access or having a website. From the review

I conclude that it apparently matters in what way these technologies support doing business and how value is created. In my view, this indicates that conceptualising e-business adoption goes beyond the observation of implemented technologies. **figure 2.4** below depicts the supposed relation between e-business adoption and value creation. The dashed arrow represents a hypothetical relationship.

Figure 2.4 E-business adoption and value creation



2.3.2 Explaining e-business adoption

In innovation adoption literature there is conceptual and empirical material in plenty on explaining innovation adoption. Two types of organisational adoption decisions can be distinguished; the decision is made by the organisation or by an individual inside the organisation (Frambach & Schillewaert, 2002). Accordingly, studies are devoted to individual adoption (overviews: Frambach & Schillewaert, 2002; Legris, Ingham & Collerette, 2003), or organisational innovation adoption (overviews: Tornatzky & Klein, 1982; Damanpour, 1991). On both levels of analysis, the formation of an attitude towards the innovation at hand plays a crucial role (Rogers, 1995; Frambach & Schillewaert, 2002). This attitude or behavioural intention determines the actual deployment of the innovation, and has been conceptualised as perceived innovation characteristics (Tornatzky & Klein, 1982; Rogers, 1995). The perception of attributes of the innovation can predict the adoption and implementation of various innovations, with some degree of consistency across various settings (Tornatzky & Klein, 1982). In various studies,

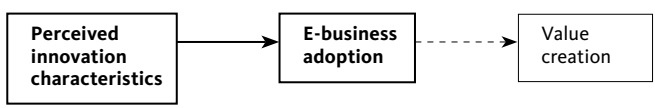
different types of innovation characteristics have been investigated. Tornatzky and Klein (1982) provide an overview of 30 different attributes. Their meta-analysis is perhaps a bit outdated, but still frequently quoted in present day research. The surplus value of their research is that, by comparing and analysing 75 studies on innovation characteristics, they evaluate the consistency of the direction of correlation between the characteristics and innovation adoption or implementation. They show that only three innovation characteristics consistently relate to innovation adoption. Compatibility and relative advantage are positively related to adoption, complexity is consistently negatively related to adoption. The findings by Tornatzky and Klein are in line with the perceived innovation characteristics predominantly used in e-business adoption studies (**2.2.2**).

In information systems research, information technology adoption and usage is often explained with the help of intention models or behavioural decision theories from social psychology (Agarwal & Prasad, 1997; Riemenschneider et al., 2003). Legris, Ingham and Collerette (2003) have reviewed 22 articles and provide an overview of empirical research using the TAM-model of innovation adoption behaviour by Davis, Bagozzi and Warshaw (1989). They conclude that in general TAM explains approximately 40% of system use, and the relation between behavioural intention to use and actual system use was found to be significantly positive. Moore and Benbasat (1991) argue that perceived relative advantage and perceived complexity refer to the same constructs as perceived usefulness and ease of use respectively. They extensively discuss existing measurement instruments (including TAM), and develop scales for seven perceived innovation characteristics: relative advantage, compatibility, voluntariness, ease of use, image, result demonstrability, and visibility. The scales were tested in the context of the individual adoption of personal workstations. Relative advantage and compatibility (1 factor), voluntariness, and ease of use explained the largest percentage of variation (cumulative 44,7%).

It is difficult to assess to what extent existing literature succeeded in explaining variance in e-business adoption. First, the various studies aim to explain related, yet different, phenomena like Internet adoption, e-commerce adoption, business use of Internet, Intranet diffusion, et cetera. Also, as discussed in **2.2.1**, these dependent variables are measured along various dimensions, so a com-

parison of results is hard. Second, some studies seek firm-level determinants of adoption, while others focus on the adopting individual. Despite these differences in research subject and design, it is clear from my e-business literature review that perceived innovation characteristics provide an explanation for the adoption of e-business. In particular, the positive influence of relative advantage and compatibility, and the negative influence of complexity on e-business adoption, was repeatedly found in these adoption studies (**table 2.1**). These findings are in line with Tornatzky and Klein's findings (Tornatzky & Klein, 1982), and findings by Moore and Benbasat (1991). Remarkably, the other innovation characteristics mentioned by Rogers (1995), observability and trialability, were used in only two studies on e-business adoption (Agarwal & Prasad, 1997; Kendall et al., 2001). Hence, from existing research I conclude that perceived innovation characteristics relate to e-business adoption. This relation is depicted in **figure 2.5**. Since the relation between perceived innovation characteristics and e-business adoption has been found repeatedly in literature, a continuous arrow represents it.

Figure 2.5 The relation between perceived innovation characteristics and e-business adoption



The role of the adopter

In my review, several studies show that a positive attitude, in terms of perceived innovation characteristics, is a good predictor for the adoption of Internet-related technologies. However, assessing the adopter's attitude and its relation to adoption is only part of the explanation. It does not explain *why* the adopter has this particular attitude, and what the relationship is between characteristics

of the innovation and the organisation. In their article, Downs and Mohr (1976) state that primary attributes that are inherent to an innovation like cost can classify an innovation without reference to a specified organisation or individual. As opposed to Downs and Mohr, Tornatzky and Klein argue that real objective attributes of an innovation do not exist. They state that the adopter will always evaluate the attribute to its own system of values (Tornatzky & Klein, 1982). So, one adopter may perceive the price of an innovation as expensive, whereas another may perceive the same amount of money as inexpensive. Downs and Mohr (1976) typify these subjective innovation characteristics as secondary attributes. In order to arrive at more stable innovation research, they suggest to think of secondary attributes 'not as being composed wholly of characteristics of the innovation or the organisation but as characterising the *relationship* between the two' (Downs & Mohr, 1976: p.706). In Rogers' model of the innovation decision process (**figure 2.1**), the innovations' attributes are evaluated by the adopter in the context of *prior conditions* (previous practice, felt needs/problems, innovativeness, and norms of the social system) and *characteristics of the decision-making unit* (socio-economic characteristics, personality variables, and communication behaviour) (Rogers, 1995). These adopter-related factors influence the way in which the characteristics of an innovation are perceived. For example, relevant previous practice may positively influence the perception of complexity of an innovation, and an adopter who is used to look for information on new technologies will be better equipped to judge an innovation's benefits. In IS research, several authors argue that TAM should include organisational and social factors to enhance predictive power on system use and improve an understanding of a user's attitude (Legris et al., 2003; Plouffe et al., 2001; Dishaw & Strong, 1999). For example, individual responses to new technologies are likely to differ depending on the context within which they are encountered (Plouffe et al., 2001). Taylor and Todd (1995) and Karahanna, Straub and Cherveny (1999) have found that there are some significant differences in the relative influence of the determinants of usage depending on user experience with the system.

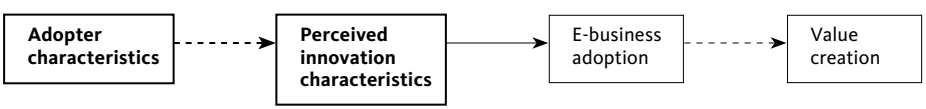
Usually an innovation is defined broadly as 'an idea, practice, or object that is perceived as new by an individual or other unit of adoption' (Rogers, 1995:p. 11). The study of innovation characteristics supposes that the adopter or adopting unit is able to assess the innovation's attributes. The innovation at hand has

known features, or it is assumed that adopters have a relatively good sense of what to expect. By definition, the adopter attributes certain characteristics to the innovation. If the adoption of one particular innovation is studied in several organisations, it is assumed that the innovation is largely the same and possesses rather stable features. However, innovations can be flexible in nature, in the sense that they are 're-invented', changed or modified, by many adopters who implement them in a wide variety of different ways. Adopting an innovation is not necessarily the passive role of just implementing a standard template of the new idea (Rogers, 1995). Each adopter assesses the possibilities with ICT technologies in their own context. Therefore, it is not about accepting or rejecting the adoption of a well-defined and already developed innovation that is being offered. Every organisation 're-invents' the possibilities with Internet and e-mail to suit its own situation. Rogers' view on innovations in organisations sheds a different light on technology adoption. He uses the term 'social constructionism' to indicate that an innovation is gradually shaped by the organisations' members so that it becomes theirs. In the process perceptions of the organisation's need for innovation and the innovation come together and are modified (Rogers, 1995: p.396). Rogers notes that especially in the case of innovations from external sources, the exact form that the innovation takes can be extremely flexible and a good deal of re-invention may take place. In the case of business computing Attewell (1992) states that even when the knowledge and skill burden on the end-user is minimal (given the range of service provision, the simplification of software, etc.), there remains the task of learning how to best apply the technology in the business context. Users need to find ways in which the technology can change how their firm does business. I believe this is also the case for e-business adoption, as ICT technologies merely form the basis for new business opportunities. In order to create business, the adopter needs to find a profitable way to apply the technology. Anyway, 'the' Internet does not exist. For example, Internet adoption for adopter A means browsing the WWW for information on suppliers, thus increasing efficiency. For adopter B, Internet adoption implies having a website with an interactive product catalogue, hoping to attract a new group of customers. Each adopter assesses the characteristics of Internet in its own context. In this example, adopter A and B do not assess Internet itself. They assess the opportunity the Internet creates for them to create business value. It is about what they can *do* with Internet. If I would ask

both adopters to assess the Internet's relative advantage for instance in terms of cost reduction, I actually measure the adopter's ingenuity in finding ways to reduce cost with the help of Internet. Again, this is in line with my earlier observation (in **2.3.1**) that the opportunity for value creation is inseparably related to the concept of e-business adoption.

Most innovation research to date has focused on explaining the implementation and diffusion of already-developed innovations (Van de Ven, Polley, Garud & Venkataraman, 1999). In the literature I surveyed, the authors hardly touch upon the subject of re-invention or user-determined features of the innovation at hand or explicitly investigate the origination of the adopter's attitude. Treating the adoption of Internet-related technologies like the adoption of relatively well-defined innovations, denies the influence of the adopter. Therefore I argue that the perception of an innovation is subject to the adopter's characteristics and the context in which the innovation is considered. The possible influence of the adopter's characteristics on the perception of innovation characteristics is depicted in the illustration below (**figure 2.6**). A dashed arrow represents the hypothesised relationship.

Figure 2.6 The relation between adopter characteristics and perceived innovation characteristics



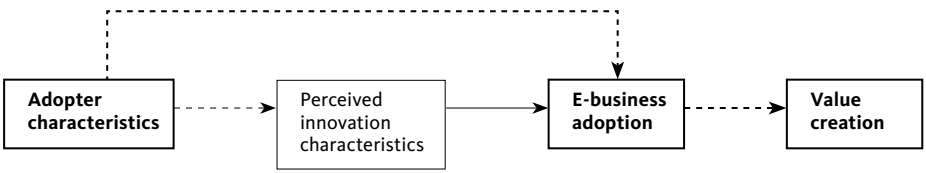
In innovation adoption literature, it is implicitly assumed that an organisation adopts an innovation when the innovation is evaluated as advantageous to the firm. Several reviewers of innovation literature have noted this pro-innovation bias (Downs & Mohr, 1976; Van de Ven, 1986; Abrahamson, 1991; Rogers, 1995). However, even if the adopter has a positive perception of the innovation,

adoption may not follow as a matter of course. Rogers labels this phenomenon 'KAP-gap', where a relatively high level of knowledge about an innovation (K) and a favourable attitude (A) do not result into adoption of the practice (P) (Rogers, 1995). The reverse situation is also imaginable: the innovation is adopted even though the adopter does not have the knowledge or a positive attitude. Adoptions prone to a KAP-gap often involve innovations that are adopted at one point in time to either ensure advantages, or avoid possible risks in future. In the case of e-business, it is conceivable that firms adopt because they do not want to 'miss the boat'. Especially when the adopter perceives external pressure to adopt from customers or competitors, adoption is possibly expedited. At the height of the Internet hype, roughly at the end of the 90s, entrepreneurs just wanted to have an Internet website regardless of its actual benefits for their company. Therefore, a company's perception of e-business attributes may not always be the driving force behind e-business adoption.

In most e-business studies, a variety of adopter characteristics is used to explain e-business adoption in addition to perceived innovation characteristics. In these studies evidence has been found that adopter characteristics rather than perceived innovation characteristics have a strong causal relation with e-business adoption. LaRose and Hoag (1996) found that the adoption of related IT-innovations and the presence of an in-house champion correlate with adoption much stronger than conventional measures of perceived innovation attributes. Cheung, Chang and Lai (2000) found that facilitating conditions (resources and support) and social factors (the subjective norm in a firm) are more important determinants of Internet usage than perceived consequences and complexity. The study was repeated in 2002 with similar results (Cheng, Cheung & Chang, 2002). Nambisan and Wang (2000) show that variables related to organisational learning and the involvement of a supply side institution provide significant additional explanatory power to the traditional innovation attributes. Raymond (2001) found that innovation characteristics influence website implementation, but especially the link with strategic implementation is rather weak. He concludes that a small firm's organisational context and especially its marketing strategy determine the extent to which electronic commerce is assimilated in a strategic or competitive manner. These studies indicate that adopter characteristics (including perceived influences from its network) rather than perceived

innovation characteristics may have a direct influence on e-business adoption. This possible relationship between adopter characteristics and e-business adoption is depicted in **figure 2.7** below.

Figure 2.7 Direct influences of adopter characteristics on e-business adoption



Adopter characteristics

Apparently, characteristics of the adopter play a role in the adoption of e-business either through the perception of the attributes of e-business or directly. In the e-business literature reviewed, I distinguished six groups of adopter characteristics that were found to be related to the adoption of e-business: the organisation's relevant knowledge and experience, organisational size, perceived network pressure, network orientation and entrepreneurship.

In order to interpret and underpin these findings, and look for coherence in the identified adopter characteristics and their relation to adoption, I consult the general literature on organisational innovativeness. This body of knowledge deals with characteristics of adopters receptive to innovation. Innovativeness, or organisational innovation, relates to the rate of adoption of innovations, usually defined as the number of innovations in a given period (Damanpour, 1991; Subramanian & Nilakanta, 1996). In innovation literature, a multitude of firm characteristics is identified as determinants of innovativeness (Damanpour, 1991). Going through literature on innovativeness, I observed that the adopter characteristics found in e-business literature all revert to four main categories of factors: (a) Knowledge and experience, (b) Network influence, (c) The attitude towards change, and (d) Internal characteristics of organisational structure.

Knowledge and experience

In the innovation decision process as conceptualised by Rogers, collecting and processing information[3] is essential in forming an attitude toward innovation, leading to a decision to adopt. As Attewell (1992) observes, in the traditional diffusion models the emphasis is on the communication or 'signalling' of the existence and potential benefits of an innovation, assuming that knowledge about the innovation is more or less transferable to other organisations. This awareness of an innovation persuades the potential adopter to adopt. However, especially in the case of more complex technologies, the emphasis should be on the learning capabilities of the potential adopter with regard to technical knowledge. These capabilities are required to successfully use the innovation and places far greater demands on potential users (Attewell, 1992). Organisations accumulate knowledge[4] throughout their existence and can be seen as a reservoir of knowledge and skills (Kogut & Zander, 1992; Spender, 1996). The ability to evaluate and utilise outside knowledge, also known as 'absorptive capacity', is largely a function of the level of prior related knowledge. A broad knowledge base in a firm creates an 'overlap' with new knowledge (Cohen & Levinthal, 1990). With existing knowledge, new knowledge can be assimilated or created through learning (Cohen & Levinthal, 1990; Kogut & Zander, 1992). In this knowledge-based view of the organisation, innovation can be seen, in Schumpeterian tradition, as a recombination of existing knowledge and other resources (Kogut & Zander, 1992; Pennings & Harianto, 1992; Lipparini & Sobrero, 1994; Yli-Renko, Autio & Sapienza, 2001). The ease of learning, and thus technology adoption, is affected by the degree to which an innovation is related to the pre-existing knowledge base of prospective users (Dewar & Dutton, 1986; Cohen & Levinthal, 1990). It is also affected by the organisation's experience with exploring new knowledge that creates variety in organisational routines and approaches to technologies, markets, products, or processes (McGrath, 2001), and managing that learning process (Tidd, Bessant & Pavitt, 1997). Tushman and Nadler (1986) describe innovative organisations as 'effective learning systems: they maximise both their ability to acquire information about customers, competitors,

3 Nonaka and Takeuchi (1995) explain the difference between information and knowledge. Knowledge is 'justified true belief'. Creating knowledge is a process of justifying personal belief toward the 'truth'. Information provides a new point of view for interpreting objects or events, thus affecting the process of knowledge creation by adding something to it, or restructuring it (p. 58).

4 Knowledge can be distinguished in two categories. Knowledge as information implies knowing what something means. Knowledge as know-how is a description of knowing how to do something (Kogut & Zander, 1992), referring to experience as accumulated practical skill or expertise.

technology, and their ability to process that information.' (Tushman & Nadler, 1986: p. 81). In line with Tushman and Nadler, Frambach (1993) emphasises absorptive capacity as an important adopter characteristic. He argues that the potential adopter should have the knowledge and ability to judge and process certain potentially valuable information. In this respect, the role of experience with related innovations can be ambiguous. On the one hand, relevant experience can support judging an innovation when, for instance, previous experience with IT provides a basis for judging the added value of e-business. On the other hand, experience can keep an adopter from non-routine and unfamiliar innovation. In IS literature, it was established that the level of knowledge and experience with IT positively affected the rate of adoption of information technologies (Boynton, Zmud & Jacobs, 1994; Iacovou, Benbasat & Dexter, 1995; Thong & Yap, 1995). In e-business literature, the role of relevant knowledge and experience to the adoption of e-business has also been observed (LaRose & Hoag, 1996; Nambisan & Wang, 2000; Mehrtens, Cragg & Mills, 2001; Lal, 2002).

In sum, firm characteristics that stimulate innovativeness, and hence the adoption of innovations revolve around the ability to acquire knowledge about new ideas that are non-routine to the company, and leverage existing knowledge and experience to develop these ideas and form a positive attitude toward innovation.

Network influence

A few e-business studies mention the influence of the company's social network on e-business adoption. In innovation literature, the role of the firm's social network is extensively discussed. In this social context various external actors can be distinguished, for example competitors, family and friends, customers, and suppliers. Networks of relationships provide a valuable resource for the conduct of social affairs. The actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit, can be defined as social capital (Nahapiet & Ghoshal, 1997). Tsai and Ghoshal (1998) show that social capital facilitates the ability of a firm to create value in the form of innovations as it supports the exchange and combination of resources like knowledge, people, products, support, and information. As such, this view focuses on social capital as a resource located in the external

linkages of an actor (Adler & Kwon, 2002). Burt emphasises not *who* to reach to get access to resources, but *how* to reach them. The structure of the actor's network and the location of the actor's contacts in the social structure may provide competitive advantage. In particular, non-redundant contacts (contacts not leading to the same people) separated by 'structural holes', provide the benefit of reaching additional, rather than complementary information (Burt, 2000). In particular, strong and trusted ties[5] to customers and suppliers can provide a firm with a source of new ideas, knowledge, support, and other resources (Von Hippel, 1988; Larson, 1992; Karakaya & Kobu, 1994). In this way, an active external orientation in the form of networking is helpful in acquiring additional external knowledge to further leverage existing knowledge (Abetti & Stuart, 1986; Pennings & Harianto, 1992; Lipparini & Sobrero, 1994). Close 'embedded' relationships characterised by trust promote the transfer of knowledge and learning, and joint problem solving, thereby creating economic opportunities (Uzzi, 1997). Environmental scanning and external contacts provide new angles of problems, so the organisation may become aware of a need, or find new and creative ways to address that need (Moss Kanter, 1988). Rothwell (1992) stresses the importance of inter-firm networking as innovation increasingly derives from a network of companies.

Groen (1994) shows that in the adoption of environmentally related innovations SMEs use a variety of network actors to acquire information. Especially in the awareness phase of the innovation decision process, the businesses turned in particular to trusted parties like their municipality, accountant, sector-organisation, and supplier. Cooke and Wills (1999) demonstrate that SMEs associate social capital built up through inter-firm collaboration with enhanced business, knowledge and innovation performance. Soh (2003) provides further evidence that collaboration with repeatedly the same partners enhances new product performance through reciprocal exchange of information. In IS research, Ramamurthy, Premkumar and Crum (1999) found that customers actually provided support and expertise in setting up EDI links, consequently stim-

5 Ties are interpersonal relationships of which the 'strength' is a combination of the amount of time invested, intimacy, emotional intensity and reciprocal services (Granovetter, 1973). 'Strong' ties may provide specific information, advice or resources for example through dyadic business relationships (Håkansson & Snehota, 1995) or friendship. 'Weak' ties often represent sources from which new information can be tapped. These indirect social ties often provide a bridge to other relatively unfamiliar networks of actors (Granovetter, 1973). In the innovation process, weak ties can therefore be useful to find new ideas.

ulating adoption. Support by vendors and consultants facilitate companies in adopting IT by providing training and expertise (Gable, 1991; Soh, Sing Yap & Raman, 1992; Igbaria, Zinatelli, Cragg & Cavaye, 1997). With respect to e-business, I observed that adoption is facilitated by a network orientation (**2.2.2**). Information, training and support are acquired through a firm's social network by means of environmental scanning or collaboration (Premkumar & Roberts, 1999; Nambisan & Wang, 2000; De Berranger, Tucker & Jones, 2001; Lal, 2002).

One of the consistent themes in literature on innovation success and failure concerns the need to understand user needs (Rothwell, 1992; Tidd, Bessant & Pavitt, 1997). According to Van de Ven (1986) it is crucial to the management of innovation that people pay attention to non-routine ideas and invest effort in their development. He suggests direct personal confrontation with problem sources like demanding customers. Moss Kanter (1988) poses that effective innovation derives from active awareness of changing user needs and sometimes from direct user demands or solutions. Structural and social connections with (potential) customers and (potential) suppliers benefit this process. Rothwell (1992) emphasises effective linkages with leading edge customers as they can make a significant contribution to, for example, product development. Yli-Renko, Autio and Sapienza (2001) found that firms that acquired greater market and technological knowledge through their key customer relationships produced a greater number of new products and greater technological distinctiveness. So, the adopter's network orientation should include a market orientation to become aware of customer needs. In sum, an adopter characteristic beneficial to innovation has external linkages with customers, suppliers, partners etc. to acquire information and resources.

In the review of e-business literature however, I observed another role of the firm's social network: motivation. The dominant perspective in innovation literature assumes that adopters make independent, rational choices guided by goals of technical efficiency (Abrahamson, 1991). This perspective holds two assumptions. First, the adopter is relatively certain about its goals, and is able to foresee the consequences of an innovation, and assess how efficient the innovation will be in attaining those goals. Second, the adopter is able to make this assessment of the innovation independently of other actors in its social net-

work, like competitors, customers, and agencies. Both assumptions may have limited validity in the context of e-business. First, although the adopter's goals manifest themselves in the assessment of, for example, the benefits of e-business, it may be unsure whether the adopter is (a) certain about these goals and the consequences of adopting e-business, *or* (b) imitating other organisations (Abrahamson, 1991) *or* (c) exhibiting entrepreneurial 'irrational' decision-making, and following a 'gut-feeling'. Second, the adopter is not an isolated entity, but is 'embedded' in a social context or system, which assumes that the adopter's behaviour to be analysed is not independent, but constrained by ongoing social relations (Granovetter, 1985; Rogers, 1995).

Especially under conditions of uncertainty and unclear goals, an organisation's perception of an innovation may be influenced by the adoption decisions made by others, or their opinions. In this dimension, two types of social network influence can be distinguished (Kraut, Rice, Cool & Fish, 1998; Frambach & Schillewaert, 2002). First, the value of the innovation may increase because of network externalities. In the adoption of interactive innovations like communication technologies, a 'critical mass' of users is an important determinant (e.g. Rogers, 1995; Kraut, Rice, Cool & Fish, 1998). The number of people that uses the innovation influences the benefits and costs associated with using the innovation, and thus its utility (Markus, 1990; Kraut, Rice, Cool & Fish, 1998). Second, use by others may persuade an adopter to use the innovation as he or she values their opinions of the innovation (Markus, 1990; Kraut, Rice, Cool & Fish, 1998; Lee & Runge, 2001). Social or economic pressure may persuade organisations, regardless of the actual advantage of the innovation, to imitate other group members in adoption or rejection (Abrahamson, 1991). Also experts, change agents, and consultants may play a part in the evaluation of an innovation (respectively Leonard-Barton, 1985; Rogers, 1995; Bessant & Rush, 1995). Competitive pressures and supplier incentives can stimulate adoption as well (Gatignon & Robertson, 1989). In IS research there is evidence of the influence of perceived external social pressure from competitors (Dos Santos & Peffers, 1998; Ramamurty, Premkumar & Crum, 1999; Chwelos, Benbasat & Dexter, 2001; Waarts, Van Everdingen & Van Hillegersberg, 2002), trading partners (Iacovou, Benbasat & Dexter, 1995; Chwelos, Benbasat & Dexter, 2001), government (Kuan & Chau, 2001), industry associations (Damsgaard & Lyytinen, 2001), and suppli-

ers (Dos Santos & Peffers, 1998; Frambach, Barkema, Nooteboom & Wedel, 1998). In the studies I reviewed (**2.2.2**), positive relations were established between perceived pressure from trading partners, competitors, suppliers and customers, and e-business adoption.

In sum, in the social network of an adopter many types of actors are present, each contributing to the development of the adopter's perception of an innovation by providing knowledge, resources or motivation. Even so, the extent to which the social network influences the adopter in evaluating and adopting the innovation is dependent on the adopter. For example, the more focussed an adopter is on satisfying customer needs, the more influence customers' opinion will have on the adopter's perception of a particular innovation. It is important to note that in all empirical research, the influence of external factors is conceptualised and measured as perceptions of the adopter.

Attitude towards change

In the e-business review, some studies mention the importance of a positive and encouraging attitude towards change in the firm. In innovation literature, Rothwell (1992: p. 224) stresses that 'innovation is essentially a "peoples process" and simply attempting to substitute formal management techniques for managerial talent and entrepreneurial flair is not a viable option'. He poses that organisational structure, control mechanisms, formal decision-making processes, and the like are not sufficient conditions for successful innovation (Rothwell, 1992). The organisation should support innovation, not only by providing resources like time and money, but also by favouring change as a culture (Moss Kanter, 1988). A favourable attitude towards change leads to an internal climate conducive to innovation (Damanpour, 1991), and a willingness to take on external ideas (Rothwell, 1992). In e-business studies I found a positive relationship between organisational support and e-business adoption (**2.2.2**).

Organisations that want to innovate benefit from the presence of individuals that have the quality to appreciate new ideas, like to explore new knowledge, and bring it into the organisation. In innovation literature, the presence of individuals fulfilling two specific roles is stressed as especially important in the innovation process (Rothwell 1992). A 'gatekeeper' acquires new knowledge about the possibilities of innovations, and internally communicates information.

An organisation's capacity to acquire and assimilate new knowledge will depend on the absorptive capacities of its individual members (Cohen & Levinthal, 1990). A direct interface with the external environment provides the organisation with new information. Without gatekeepers, organisations are deaf to outside sources of information that are so vital for innovation (Tushman & Nadler, 1986, p. 89). In addition, these 'specialised actors' may care for the transfer of information within the organisation (Cohen & Levinthal, 1990). Another influential role is the 'champion' or 'entrepreneur' (Rothwell 1992). A champion is an individual that is able to initiate a process of departing from the organisation's established routines (Moss Kanter, 1988). This person translates innovation ideas into concrete innovation opportunities, and supports and 'pushes' their realisation. Champions can be considered internal entrepreneurs, bringing ideas to life (Tushman & Nadler, 1986). Two studies actually established the influence of the 'champion' role in the adoption of e-business (LaRose & Hoag, 1996; Mehrtens et al., 2001).

Tidd, Bessant & Pavitt (1997) stress the importance of a shared vision, leadership and the will to innovate. Members of the organisation need to feel motivated to look for innovative ideas, and acquire and process new knowledge, and consequently fulfil champion-roles. Not surprisingly, in e-business literature I found indications that adoption is facilitated when a firm considers innovation as strategically important (**2.2.2**). A positive attitude towards change is not enough to drive adoption. Organisations do not innovate for the sake of innovating; innovation is not a goal in itself. A strong motivation for innovation is a performance gap. A discrepancy between an organisation's expectations and its actual performance can trigger the innovation process (Rogers, 1995). Usually, the performance gap involves the recognition of a problem or need by the organisation that leads to the search for a solution, or the knowledge of the existence of an innovation that leads to the search for a matching problem or need (Rogers, 1995). In both instances, the innovation is a tool that can create value for the organisation for example by improving efficiency in operations, offer additional services to customers, or attract new customers. In my view, it is the recognition of an opportunity to create value that drives the adoption of e-business. This entrepreneurial aspect to innovation adoption is underexposed in innovation literature.

In summary, innovation is facilitated by a favourable attitude towards change within the firm. Important elements are organisational support for innovation, the presence of innovation champions and an entrepreneurial vision on innovation.

Internal characteristics of organisational structure

From the preceding sections it appears that innovation requires an organisation that has a sound knowledge base, is able to acquire and process knowledge, establishes effective external linkages, and encourages innovation. In innovation literature, several authors deal with organisational attributes that enhance organisational innovativeness (Damanpour, 1991). In his meta-analysis on determinants of organisational innovation, Damanpour finds ten statistically significant associations. In the preceding sections I dealt with the importance of knowledge resources, external communication, and a positive attitude towards change. The majority of determinants however deal with internal structural characteristics of the organisation: specialisation, functional differentiation, professionalism, centralisation, administrative intensity, slack resources, and internal communication. Specialisation, differentiation, and professionalism represent the firm's complexity (Damanpour, 1991). Rogers reports relations between organisational innovativeness and a group of structural variables comparable to Damanpour: complexity, centralisation, formalisation, organisational slack, interconnectedness, and size (Rogers, 1995). However, Rogers states that several hundreds of studies show rather low correlations of each of the independent variables with organisational innovativeness. The reason is that the relation of each of the variables with innovativeness may change direction during the innovation process (Rogers, 1995). For example, low centralisation, high complexity, and low formalisation are beneficial during the initiation phases of the innovation process, but may hinder efficient implementation (Zaltman, Duncan & Holbek, 1973).

An exception to this supposition is the variable organisational size. Organisational size frequently turns up in innovation adoption studies (e.g. Gauvin & Sinha, 1993; Subramanian & Nilakanta, 1996; Frambach, Barkema, Nooteboom & Wedel, 1998; Lal, 1999). In innovation literature, size has been found consistently and positively related to organisational innovativeness (Damanpour, 1992;

Rogers, 1995). In his meta-analysis Damanpour concludes that size is a broad organisational variable that not only affects innovation directly, but also indirectly, through its effects on other organisational properties like complexity and centralisation. Rogers (1995) suggests that size is one of the best predictors of innovativeness, because it is easily measured and it probably is 'a surrogate measure of several dimensions that lead to innovation: total resources, slack resources, technical expertise of employees, organisational structure, and so on.' (Rogers, 1995; p. 379). Further, he states that size is 'a convenient stand-in for other variables of interest'. Damanpour however notes that the type of organisation and stage of adoption influences the effect of size on innovation. Damanpour established that size is more positively related to innovation in manufacturing than in service, and in profit, rather than in non-profit. Also, size is more strongly related to the implementation than to the initiation of innovations in an organisation (Damanpour, 1992). In studies on e-business, the role of firm size on adoption has been investigated with inconsistent result (2.2.2). Interestingly, Daniel and Grimshaw (2002) conclude that small businesses, in comparison to large firms, succeed in realising benefits from e-business despite their modest resources, indicating that e-business is resource insensitive.

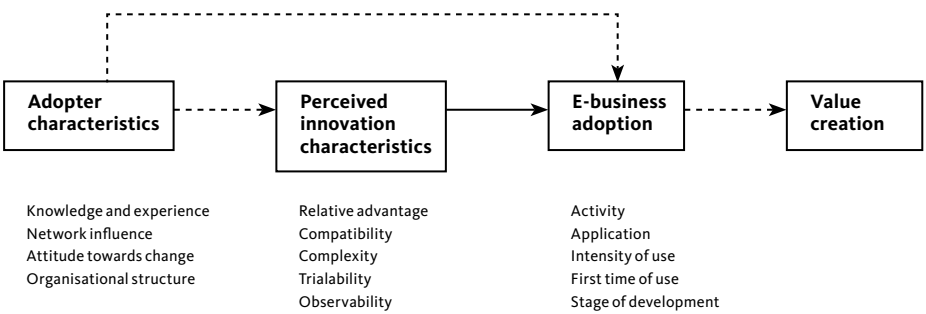
As Tidd, Beassant and Pavitt (1997: p. 18) state: 'there is no 'best' model for organising innovation; the key task is to find the most appropriate fit for a set of contingencies'. In view of my research question, the organisational context should facilitate the recognition and development of possibilities to adopt ICT technologies to create business. Research into adopter characteristics revealed the influence of firm size on adoption. Organisational size seems to be a convenient alternative for measuring the effect of other internal variables of organisational structure on innovativeness, with the type of organisation and stage of adoption as mediating variables. However, from e-business literature it is unclear if and how firm size influences adoption. Also, using size as an alternative hides from view the effect of more meaningful organisational variables like complexity and centralisation on innovativeness.

2.4 Conclusion

In this chapter I reviewed e-business studies in the context of innovation adoption literature to better comprehend e-business findings and find a coherent set of factors related to e-business-adoption. From the review and the subsequent discussion on the findings, a model emerges of e-business adoption from an innovation adoption perspective. This model of e-business adoption is presented in **figure 2.8**. Note that the relation between perceived innovation characteristics and e-business adoption has been found repeatedly in literate and is therefore represented by a continuous arrow. The other relationships (dashed arrows) are hypothetical and need further exploration.

My first aim of this review was to gain insight into the conceptualisation and measurement of e-business adoption. Surprisingly, in general, not many explanatory studies pay attention to this issue. Innovation literature and, in particular, IS literature suggest to use a multidimensional measure for innovation adoption. In e-business literature, e-business adoption is typically measured by listing a number of business activities that are electronically supported, complemented by looking at which ICT applications are used and what business value is created. From the review I conclude that the conceptualisation of e-business adoption goes beyond the observation of implemented technologies and includes what type of business value is created or anticipated.

Figure 2.8 E-business adoption: the innovation adoption perspective



My second objective was to examine how e-business adoption has been explained in literature. Most explanatory e-business studies are based on Rogers' sequential model of innovation adoption or the TAM model by Davis et al. However, they do not provide a comprehensive understanding of e-business adoption. Using literature on organisational innovativeness as a frame of reference, I discuss e-business findings and arrive at a set of factors that relate to e-business adoption. In existing literature, innovation adoption is mainly explained by the attitude towards the innovation conceptualised as perceived innovation characteristics. For e-business adoption, the innovation characteristics most commonly used are perceived relative advantage, complexity and compatibility, and to a lesser extent observability and trialability. As discussed, I assume this perception is dependent on the characteristics of the adopter in its social network. Especially in the case of e-business, the adopter largely determines the characteristics of the innovation by deciding in what way ICT technologies offer opportunities for value creation in the firm. The object of consideration by the adopter is not the technology, but the opportunity that the technology can offer the adopter in order to create value. The organisation appraises the attributes of an innovation in its own context. Part of this context is the organisation's social network consisting of customers, suppliers, competitors, friends and family, etc. This social network provides knowledge, motivation, and other resources that are drawn in the assessment of the innovation. The decision to deploy or reject the innovation in the organisation is the outcome of this evaluation. Firm properties that promote innovation adoption basically deal with an organisation's capacity to acquire, evaluate and use knowledge. New knowledge is combined with existing knowledge to arrive at new combinations of knowledge and resources. Linkages with the social network facilitate this process. In particular, close contacts with (potential) customers may lead to the discovery of business opportunities. I argue that e-business adoption is facilitated by the following adopter characteristics: relevant knowledge and experience, perceived network influence, a positive and entrepreneurial attitude towards change, and an appropriate internal structure.

Innovation literature provides a context for the findings from the e-business literature that I reviewed. It shows that researchers use concepts and ideas from previous innovation research and apply them to the context of e-business.

However, I observe four issues that need to be addressed when an innovation adoption perspective is used to assess and explain e-business adoption:

1 ***The nature of e-business***
E-business is not a well-defined innovation with known features. E-business is the application of certain ICT technologies to support business activities in a way that creates value. When considering adoption, the adopter needs to assess in what way ICT technologies are beneficial to the organisation. This implies that each adopter assesses the innovation in its own context, and that the innovations' features are largely determined by the adopter. Consequently, to really understand the adopter's attitude towards e-business, usually conceptualised as perceived innovation characteristics, it is essential to also investigate the adopter's context. Perceived innovation characteristics can then be viewed as the outcome of the adopter's evaluation of the opportunities that ICT technologies offer for creating value.

2 ***The entrepreneurial aspect of innovation***
Innovation is not a goal in itself, but a tool to create value for the organisation. In my view, it is the recognition of an opportunity to create value that drives the adoption of e-business. This entrepreneurial aspect to innovation adoption is underexposed in innovation literature. E-business studies however indicate that adoption is positively influenced when the adopter sees innovation, and e-business in particular, as strategically important.

3 ***The influence of the social network***
In innovation literature, the dominant perspective assumes a rational adopter making independent choices. However, the adopter is embedded in a social network of various external actors like competitors, family and friends, customers, and suppliers. This social network contributes to the development of an attitude towards an innovation by providing the organisation with knowledge, resources and motivation. In the case of e-business, special attention should be given to the role of network externalities, as in the adoption of interactive innovations like communication technologies a 'critical mass' of users is an important determinant. Also, social or economic pressure may persuade organisations, regardless of their perceived actual advantage of the innovation, to adopt or reject e-business.

4 The KAP-gap

In innovation adoption literature, it is implicitly assumed that a positive attitude towards an innovation brings on its adoption. However, situations may arise where adopters decide to reject an innovation, regardless of its benefits, or decide to adopt, regardless of its drawbacks. As a consequence, it may be assumed that other factors besides perceived innovation characteristics affect adoption.

Concluding, the innovation adoption perspective gives an insight into e-business adoption. However, electronic business is not a ready-to-use concept. Therefore I argue that its adoption cannot be viewed as classic adoption i.e. of a relatively well-defined innovation. Following the implicit definition from the review, electronic business is about supporting business activities by adopting ICT technologies to gain certain benefits. I presume that a certain level of entrepreneurship is needed for adopters to assess what business opportunities Internet-related technologies have to offer for their company. Therefore, in the next chapter, I introduce and explore the entrepreneurship perspective to e-business adoption.

3 The entrepreneurship perspective

From the review in **chapter 2** I concluded that adopting e-business is more about finding ways to deploy technological innovations like Internet to create business, than rejecting or adopting a technology. As I observed in the literature review, most authors explain Internet-related adoption from innovation adoption theory. However, as I argued in the previous chapter, e-business has an entrepreneurial aspect as the recognition of opportunities for business is at the heart of e-business adoption. Business creation has been studied extensively in entrepreneurship literature. In some e-business studies entrepreneurship and e-business innovation have been connected (Amit & Zott, 2001; Kickul & Walters, 2002; Lal, 2002, Zahra & George, 2002), but the relation is not theoretically deepened. In this chapter I will introduce entrepreneurship literature[1] and discuss the relationship between entrepreneurship and innovation (**3.1**). The opportunity concept is discussed (**3.2**) as well as opportunity recognition (**3.3**). I explore how knowledge on entrepreneurship, and more specifically on opportunity recognition, can contribute to the assessment and explanation of e-business adoption. In **3.4**, the literature on explaining opportunity recognition is explored. Subsequently, the findings are discussed in the light of the research questions (**3.5**), and conclusions are drawn (**3.6**).

1 Part of this section is reproduced from 'Understanding the entrepreneurial process' (Van der Veen & Wakkee, 2004)

3.1 Entrepreneurship and innovation

What can be the rationale for an entrepreneurship perspective on e-business adoption? Most importantly, innovation and entrepreneurship have a strong relationship. This leads many authors to evade discrimination between the concepts and use the concepts interchangeably (Sexton & Camp, 1993). In order to understand the relationship between entrepreneurship and innovation it is important to understand what connects the two concepts as a well as what discriminates them.

In this research, our main interest is to explore the link between entrepreneurship, opportunities and innovation. Barton Cunningham and Lischeron (1991) typify this view on entrepreneurship as the 'Classical School'[2]. In this school of thought, innovation, creativity, and discovery are the key factors. It was Schumpeter that pointed at innovativeness as the key ingredient of entrepreneurship (Schumpeter, 1934). He defined innovation as the introduction of a new product or a new quality of a product, a new method of production, a new market, a new source of supply of raw materials or half-manufactured goods, and finally implementing the new organisation of any industry (Schumpeter, 1934). In the early works of Schumpeter, much attention is paid to the role of the entrepreneur as the personification of innovation. It is the entrepreneur that introduces new combinations (Hagedoorn, 1996; McDaniel, 2000). In line with this view, entrepreneurship has been defined as the creation of new business, initiated by individuals (for example, Gartner, 1985; Low & MacMillan, 1988). Research into this type of entrepreneurship focused on psychological and sociocultural factors of individuals discriminating entrepreneurs from non-entrepreneurs (Van der Veen & Wakkee, 2004).

In his later work[3], Schumpeter recognised that 'the entrepreneurial function need not be embodied in a physical person and in particular in a single physical person. Every social environment has its own ways of filling the entrepre-

2 Other schools of thought in entrepreneurship that Barton Cunningham and Lischeron (1991) distinguish are the "Great Person", and the Psychological Characteristics School (assessing personal qualities of entrepreneurs), The Management, and Leadership School (studying the way entrepreneurs act and manage a venture), and the Intrapreneurship School (studies the need for adapting an existing organisation).

3 See Hagendoorn (1996) for an overview on the development of Schumpeter's range of ideas.

neurial function.' (Schumpeter, 1989: p. 260). The focus in research shifted from the entrepreneur to entrepreneurship. In most present-day research, entrepreneurship is treated as the process of recognising and exploiting opportunities (Van der Veen & Wakkee, 2004). The majority of definitions of entrepreneurship indeed focus on the pursuit of opportunity, a concept that will be dealt with in the next section (Kirzner, 1979; Stevenson & Gumpert, 1985; Stevenson, Roberts & Grousbeck, 1989; Sexton & Camp, 1993; Churchill & Muzyka, 1994; Venkataraman, 1997; Timmons, 1999; Shane & Venkataraman, 2000). Often cited is the definition by Stevenson, Roberts and Grousbeck (1989). They define entrepreneurship as a process, by which individuals -either on their own or inside organisations- pursue opportunities without regard of the resources they currently control. Entrepreneurship is studied on many different levels of analysis and in many different settings. As Churchill and Muzyka (1994, p: 17) put it: 'it is the act and its outcome, not the environment nor the setting, that is the essence of entrepreneurship'. Research however is dominated by micro-level analysis using the individual or the firm as level of analysis (Davidsson & Wiklund, 2001). Entrepreneurship on firm level is generally called corporate entrepreneurship (for an overview Saly, 2001) and refers to new venture creation by individuals or teams within the firm, or strategic renewal i.e. wealth creation through the new combinations of resources (Guth & Ginsberg, 1990). Stopford and Baden-Fuller (1994) conclude that most authors accept that all types of entrepreneurship are based on innovations that require changes in the pattern of resource deployment and the creation of new capabilities to add new possibilities for positioning in markets. Wiklund defines entrepreneurship as 'taking advantage of opportunities by novel combinations of resources in ways that have impact on the market' (Wiklund, 1998:p. 13). Evidently, entrepreneurship centres around innovation as Schumpeter intended: new combinations. All entrepreneurial behaviour can be considered innovative as it entails the discovery and implementation of new ideas. However, innovation does not always result in the creation of profit or wealth (Guth & Ginsberg), or an impact on the market (Wiklund, Stopford & Baden-Fuller). It is the exploitation of opportunities resulting in economic value creation that separates entrepreneurship from innovation (Sexton & Camp, 1993; Churchill & Muzyka, 1994).

Thus, from an entrepreneurship perspective, the adoption of e-business may be considered an entrepreneurial act when it results in the exploitation of an opportunity. The concept opportunity purposively connects innovation to value creation. Consequently, an entrepreneurship perspective focuses on how the adoption of ICTs creates business value. In the next section, the concept opportunity and the conceptualisation of e-business adoption as an opportunity is discussed.

3.2 The opportunity concept

In the entrepreneurial process, opportunities play a central role. De Bono describes an opportunity as 'something you do not yet know that you want to do – and can' (De Bono, 1978:p. 15). Singh (2000, p. 9) states that '"Opportunity" is very much like "love", – everyone knows what it is, but it is difficult to define because it means different things to different people'. Indeed, although the concept is frequently used, only a few authors have defined opportunities. Stevenson and Jarillo define an opportunity as a desirable future state that is different from the current state and that is deemed feasible to achieve, regardless of the firm's current resources (Stevenson & Jarillo, 1990). This definition, however, does not distinguish business opportunities from general opportunities. In a business context, Sexton and Camp define opportunities as 'creative ideas that possess a known and accessible potential for generating pure profit or economic wealth' (Sexton & Camp, 1993:p. 199). Christensen, Madsen and Peterson (1994) define an opportunity as a possibility for new profit potential, through (a) the founding and formation of a new venture, or (b) the significant improvement of an existing venture. Casson's definition elaborates on the possibility for new profit potential by defining opportunities as those situations in which new goods, services, raw materials and organising methods can be introduced and sold at greater than their cost of production (Casson, 1982). Kirzner states that entrepreneurial opportunities differ from the larger set of business opportunities for profit because the former only require the discovery of new means-end relationships, whereas the latter also involves optimisation within existing means-end relationships (Kirzner, 1997). Eckhardt and Shane (2003) stress that the creation of new means-end frameworks is a crucial part of the difference

between entrepreneurial opportunities and situations in which profit can be generated by optimising within previously established means-end frameworks. Davidsson, Delmar and Wiklund, (2002) and Wiklund (1998) present a similar view and only accept innovations as instances of entrepreneurship when they actually affect what is offered on the market. Pursuing an opportunity should at least be worth the effort in some way (Singh, 2000). The (expected) payoff of pursuing the opportunity will stimulate the entrepreneur or firm to invest time and effort (Casson, 1982; Herron & Robinson, 1993; Singh, 2000). Usually the profit potential of an opportunity is economically evaluated. The exploitation of opportunities is a means to improve the financial performance of a firm. Note that some opportunities offer competitive advantage that only in time will improve the company's financial performance (Zahra & Covin, 1995). In essence, the various definitions of opportunity differ on how economic value is created. Basically, entrepreneurial opportunities can stem from Schumpeter's five different loci of change: new products of services, new geographical markets, new raw materials, new methods of production and new ways of organising (Eckhardt & Shane, 2003). As a rule, opportunities are not considered entrepreneurial when exploiting them only results in optimisation of existing ways of working. Further, the exploitation of entrepreneurial opportunities should result in economic value creation (Churchill & Muzyka, 1994).

The introduction of ICTs in a firm opens up opportunities and may lead to different types of value creation. The adoption of e-business may incrementally improve existing ways of working, but may also open up new markets or generate new products or services. In this study, e-business adoption is considered entrepreneurial when economic value is created from a new means-end framework resulting in new ways of working for the firm that have an impact on what is offered on the market.

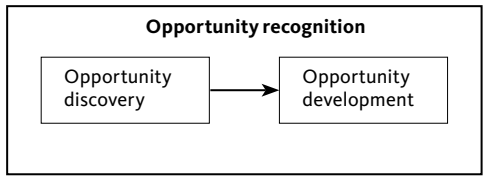
3.3 Opportunity recognition

Before an innovation can be exploited, an opportunity must be perceived by the firm (Shane, 2000). Opportunity recognition is considered the important first step in the entrepreneurial process. Moreover, opportunity recognition

has been called 'the core of entrepreneurship' (Kirzner, 1973; Timmons, Muzyka, Stevenson & Bygrave, 1987). In entrepreneurship research specific attention has been given to the process of opportunity recognition (a.o. Timmons et al. 1987, Christensen 1990; Gaglio 1997, Hills, Lumpkin & Singh, 1997; Singh, Hills & Lumpkin, 1999; Schwartz & Teach, 2000). Most knowledge on opportunity recognition has been accumulated on the level of the individual entrepreneur. However, the opportunity recognition process can also take place at firm level (De Koning & Brown, 2001; Colarelli O'Connor & Rice, 2000; Karlsson & Junehed, 2000; Schwartz & Teach, 2000; Teach, Schwartz & Tarpley, 1989). In order to effectively use the existing body of knowledge, I will review opportunity recognition literature amassed on the individual level and subsequently discuss its applicability on firm-level behaviour.

Long and McMullan (1984), Bhave (1994), De Koning (1999), Sigrist (1999), Lumpkin, Hills and Shrader (2001), and Puhakka (2002) have modelled the opportunity recognition process. Although they each use different terms, the essence of the process is that an initial idea for creating new business is discovered and subsequently developed into a viable business opportunity (Van der Veen & Wakkee, 2004). Although the opportunity recognition process has been modelled in various stages and phases, the process is not linear, but rather evolutionary and iterative (De Koning, 1999; Lumpkin, Hills & Shrader, 2001). In this study, the opportunity recognition process is subdivided into two phases: opportunity discovery and opportunity development (see **figure 3.1**).

Figure 3.1 The opportunity recognition process



Opportunity discovery

The process of opportunity recognition begins when an individual gets an initial idea for new business. Studies on *how* opportunities are discovered revealed that entrepreneurs encounter ideas either by chance or through deliberate search (Vesper, 1989; Vesper, Shragge & McMullan, 1989; Gaglio, 1997; Ardichvili & Cardozo, 2000; Chandler, Dahlquist & Davidsson, 2002). The concept of entrepreneurial alertness is worth mentioning in this context. Kirzner defines this concept as 'the ability to notice – without search – opportunities that have been hitherto overlooked' (Kirzner, 1979:48). He stresses the element of surprise. An individual may discover a previously undiscovered opportunity in 'sheer' ignorance (Kirzner, 1997). Deliberate search or the active quest for new business ideas deals with scanning the environment and the acquisition of knowledge. Entrepreneurs analyse the competitive arena to recognise a new business idea, and then try to proactively create an opportunity that would create new value in the near future (Puhakka, 2002). Perhaps the most interesting view on opportunity recognition is to take on an interactive viewpoint (Sigrist, 1999; Puhakka, 2002). In this viewpoint opportunity recognition is seen as an interactive event, in which accidental luck of finding, seeing and/or understanding new business is based on intensive and rational working in the field (Martello, 1994).

The 'search' for a new business idea can be motivated in roughly two ways (Koller, 1988; Bhave, 1994). First, the wish to start new business precedes the discovery of an idea. As Herron and Sapienza (1992) explain, the motivation to

search for opportunities may arise from an intolerable level of dissatisfaction arising from for example job loss or a lack of money. In other words, the entrepreneur actively finds a problem to solve and the new business activities are the answer. Consequently, a market is created (Sigrist, 1999). Bhave (1994) labels this idea, rather confusingly to my idea, as *externally* stimulated opportunity recognition. Second, the recognition of a gap in the market precedes the entrepreneur's wish to start new business activities, labelled by Bhave as *internally* stimulated opportunity recognition, (Bhave, 1994). So, the entrepreneur identifies an opportunity and reacts by providing a solution to an existing need. In this case, the entrepreneur responds to a market (Sigrist, 1999).

Opportunity development

Having an initial idea for new business is only the starting point of the entrepreneurial process. Many authors show that considerable development, incubation or elaboration is necessary to turn an initial idea into a full-fledged business opportunity (e.g. Long & McMullan, 1984, Bhave, 1994; De Koning, 1999; Lumpkin, Hills & Shrader, 2001). The objective of elaboration or incubation is to develop the idea to the point where anticipated problems are overcome and potential value creation is maximised (Long & McMullan, 1984; Lumpkin, Hills & Shrader, 2001). Sigrist (1999) refers to this development process as 'specialisation', which introduces the entrepreneur to a new domain, opens a new market, or challenges old solutions. The entrepreneur enters a learning process and acquires new knowledge. This enables the entrepreneur to break up with the existing situation, form an 'own personal line', search strategically for external resources and open up a market niche. In this process, the entrepreneur aligns new and existing knowledge, experience, skills and other resources with market needs (Bhave, 1994). The initial idea is being checked against possibilities and information is gathered to make sure there is a gap in the market, and that the created opportunity will fill this gap (Puhakka, 2002). The evaluation of opportunities is an important aspect of developing initial ideas into business opportunities. Insights are evaluated and the feasibility and desirability of the opportunity are checked (Hills, Shrader & Lumpkin, 1999; Lumpkin, Hills & Shrader, 2001). Christensen, Madsen and Petersen (1994) point out that 'feasible' refers to technical and economic factors, or, in short, for an opportunity to exist it must be possible to deliver (Singh, 2000). The desirability of an opportunity involves subjec-

tive preferences. The opportunity must be 'wanted', both by potential customers (Singh, 2001), and the entrepreneur (Christensen, Madsen & Petersen, 1994). Some authors focus specifically on the more formal evaluation of opportunities (Timmons et al., 1987; Vesper 1989; Zimmerer & Scarborough, 1998; Timmons & Muzyka, 1994; Timmons, 1999). Evaluation criteria include market and financial analysis, risk assessment, and the qualities of the management team.

In sum, opportunity recognition is the process of developing an initial idea into a feasible and desirable business opportunity. In this process, the perceived market need and the (attainable) resources are assessed. The entrepreneur considers the opportunity's potential to create value and decides to proceed with exploitation of the opportunity or not. As far as e-business adoption is concerned, it is not very difficult to see the relation with opportunity recognition. In order to exploit the possibilities of ICTs and create economic value, an opportunity for e-business must be perceived. The desirability and feasibility of the opportunity depend on the existing and attainable resources and an assessment of the market need.

Now, the premise of this study is that different individuals or firms have different abilities to discover and develop opportunities. In the next section, I will review literature that aims to explain differences in opportunity recognition behaviour.

3.4 Explaining opportunity recognition

In entrepreneurship literature there is an abundance of research that is aimed at explaining entrepreneurship. Traditionally, the explanation was sought in (stable) psychological traits, focussing on the entrepreneur as an individual and intended to distinguish entrepreneurs from other individuals. Swedberg (2000) roughly divides these studies in two groups: one where the main goal is to isolate the entrepreneurial personality, and another, where the personality of the entrepreneur is seen as decisively shaped by something from the outside. Despite significant attention to social and psychological attributes in the last three decades, the results have at best been inconclusive with respect to

the effect of personality on entrepreneurial behaviour (Gartner, 1988; Chell, Hayworth & Brearly, 1991; Shaver & Scott, 1991; Krueger, Reilly & Carsrud, 2000). Eckhardt and Shane (2003) argue that a much more fruitful approach to explaining entrepreneurial activity is to move away from the 'entrepreneurial type' paradigm to a paradigm of entrepreneurship that is based on differences in information that individuals possess about opportunities. Seeing entrepreneurship as behaviour opens up the possibility to study the phenomenon in different settings like teams, institutions, or firms. Also, understanding the mechanism behind entrepreneurship offers the possibility of intervention by means of education or training or through change agents or policy makers.

In opportunity recognition literature, most authors seek to explain opportunity recognition behaviour in knowledge and information differences, and cognitive differences between individuals. In general, many studies are exploratory and use qualitative methods like case studies, to propose and explore relations between certain characteristics and factors, and opportunity recognition (e.g. Christensen, 1990; De Koning, 1999, 2000; Sigrist, 1999; Ardichvili & Cardozo, 2000; Colarelli O'Connor & Rice, 2000; Karlsson & Junehed, 2000; Shane, 2000). Some exploratory studies focus on comparing entrepreneurs with non-entrepreneurs like company executives, managers and financiers to discover specifics of entrepreneurial opportunity recognition behaviour (e.g. Kaish & Gilad, 1991; Gaglio & Taub, 1992; Zietsma, 1999; Craig & Lindsay, 2001). Only recently, empirical evidence concerning opportunity recognition has been found in quantitative studies relying on data gathered in surveys (a.o. Hills, Lumpkin & Singh, 1997; Singh, Hills & Lumpkin, 2000; De Koning & Brown, 2001; Kickul & Walters. 2002; Puhakka, 2002). In these studies, I roughly discern four major factors that influence the recognition of opportunities: knowledge and experience, network contacts, cognitive style and a pro-active attitude.

Knowledge & experience

Reviewing articles in opportunity recognition research, it was found that prior knowledge and experience facilitate the discovery and development of entrepreneurial opportunities (Van der Veen & Wakkee, 2004). Knowledge and experience may for instance serve as a source of ideas for new business or as a frame of reference for further development of those ideas (for example Koller, 1988;

Cooper, Folta & Woo, 1995; Fiet, 1996; Sigrist 1999, Shane, 2000). Knowledge and experience facilitate both the fortuitous discovery and the intentional search for new business ideas. Shane suggests that people do not discover entrepreneurial opportunities through search, but through recognition of the value of new information that they happen to receive through other means (Shane, 2000). Ardichvili, Cardozo and Ray (2003) propose that prior knowledge heightens the level of entrepreneurial alertness[4]. New information is more easily assessed when it is related to knowledge already in possession (Venkataraman, 1997). Although many entrepreneurs attribute the initial idea to serendipity, Gaglio (1997) notes that work experience often plays an important role. The direction of search for ideas and the level of aspiration are subconsciously influenced by the skills, past achievements, and personality of the entrepreneur, in interaction with environmental context and societal values (Herron & Sapienza, 1992; Long & McMullan, 1984). Experience and knowledge that an entrepreneur brings to the opportunity recognition process forms a knowledge base, a domain of interest and curiosity as it were, to draw on to identify opportunities. Within this domain of interest, a sensitivity is developed for issues and problems (Hills, Shrader & Lumpkin, 1999; Lumpkin, Hills & Shrader, 2001). Thus, the entrepreneur's knowledge and experience influence alertness for entrepreneurial ideas and the chance of a fortuitous discovery of an opportunity.

Eckhardt and Shane (2003) argue that it is the possession of particular information that leads to the existence and identification of entrepreneurial opportunities. Shane shows that especially knowledge about markets, ways to serve markets and customer problems are related to opportunity recognition (Shane, 2000). Likewise Puhakka (2002) demonstrates in his dissertation that knowledge and experience play an important role in opportunity recognition with respect to knowledge acquisition and competitive scanning. In contrast to Shane, Puhakka finds that formal knowledge (education and technical skills) in this respect is more important than knowledge about the domain. Also, experience with entrepreneurial actions and organising resources is helpful in scanning the competitive arena and interpreting valuable information.

The role of knowledge and experience in opportunity recognition may yet be ambiguous. Knowledge and knowledge from experiences can provide a bridge

4 Ardichvili, Cardozo and Ray (2003, p:113) define entrepreneurial alertness as 'a propensity to notice and be sensitive to information about objects, incidents, and patterns of behaviour in the environment, with special sensitivity to maker and user problems, unmet interests and needs, and novel combinations of resources'.

to new knowledge as well as form a fence that constrains thinking (Ward, 2004). Experience seems to lead to overconfidence, hindering the acquisition of new knowledge, discussing the business with others and restricting innovative behaviour (Puhakka, 2002).

Network contacts

Several authors propose that being embedded in a social context supports the process of opportunity recognition (Greve, 1995; De Koning, 1999, 2000; Burt, 2000; Jack & Anderson, 2002). It was found that entrepreneurs consistently use their network to get ideas and gather information to discover and develop entrepreneurial opportunities (Smeltzer, Van Hook & Hutt, 1991; De Koning, 1999; Singh, Hills, Hybels & Lumpkin, 1999; Singh, 2000). A number of studies identify the social network as a source of ideas (Koller, 1988; Birley, 1985, Aldrich & Zimmer, 1986; Christensen & Peterson, 1990; Hills, Lumpkin & Singh, 1997; Hills & Shrader, 1998). Sigrist (1999) concludes that some entrepreneurs seem to recognise or actually invent a truly novel business concept themselves without any help from others, whereas others have a capacity to find opportunities through copying others, guided by personal contacts. To develop an opportunity, the entrepreneur interacts with the network to obtain information on what is available, advice on how to proceed best, reassurance that it will work, and resources of equipment, space and money (Birley, 1985). De Koning (1999, 2000) demonstrates that opportunity recognition is rooted in the social context, and each socially grounded cognitive activity seems to require a qualitatively different social context. On the basis of case studies, she shows that entrepreneurs activate different types of contacts during different steps in the opportunity development process. For example, weak ties provide information about new technologies, whereas more familiar contacts are used for feedback. In a large quantitative study Singh (2000) shows that many entrepreneurs had obtained the idea for their business from business associates, friends, or family. To subsequently develop the idea the entrepreneurs contacted potential clients, discussed their ideas with friends and family, and/or sought information or feedback from business associates. Singh states that a large majority of the respondents marked at least one of these social network activities as being part of the opportunity recognition process. In his further analysis, Singh shows that social networks significantly explain variance in the number of ideas and opportunities recognised,

the number of opportunities pursued, and the number of opportunities unrelated to the entrepreneur's current business.

Cognitive style

Research into cognitive style focuses on understanding differences in the way individuals process information cues (Allinson, Chell & Hayes, 2000). The individual's state of mind directs attention and determines how the entrepreneur uses his experience to develop a business concept into a new venture (Bird, 1988). Baron (2004) proposes to better understand opportunity recognition by using a cognitive perspective. Overlooking research on cognitive differences that may explain opportunity recognition behaviour, two concepts stand out: alertness and creativity.

Entrepreneurial alertness was first defined by Kirzner as 'the ability to notice without search opportunities that have hitherto been overlooked' (1979, p. 48). Later work by notably Gaglio, describes alertness as a distinctive set of perceptual and information-processing skills (Gaglio & Katz, 2001; Gaglio, 1997; Gaglio & Taub, 1992). Gaglio and Katz (2001) suggest that alertness drives opportunity recognition by directing attention (towards the novel, unusual or contrary) and guiding information processing (towards the integration of the unusual event even if it means rethinking the existing means-ends framework or the way things are done). They state that unlike most market actors, who accept information as given, alert individuals may simply have a habit of being contrary and/or looking for change. Several studies explored and translated ideas about alertness into measurable properties, yet with equivocal results (Kaish & Gilad, 1991; Cooper, Folta & Woo, 1995; Busenitz, 1996; Baron, 1998; Baron & Markman, 1999).

Creativity is basically the ability to come up with new ideas for product, services, or processes, which result in commercially viable opportunities for the organisation (Ward, 2004; Eckhardt & Shane, 2003). Hills, Shrader and Lumpkin (1999) explicitly model the opportunity recognition process as a creative process. Lumpkin, Hills, and Shrader (2001) found that entrepreneurs strongly associate creativity with opportunity recognition. Puhakka (2002) found that creativity is especially important when scanning the competitive environment and searching proactively for opportunities. In essence, creativity helps to

connect pieces of information and find new ways of interpreting information cues (Sigrist, 1999).

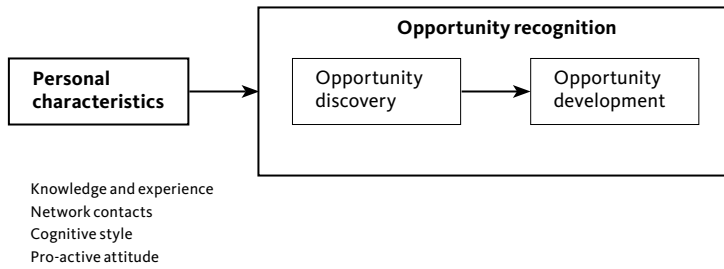
Some authors consider creativity to be a personality trait (Ardichvili, Cardozo, & Ray, 2003). However, it may be argued that creativity skills can be taught (Lumpkin, Hills & Shrader, 2001). Similarly, entrepreneurial alertness refers to thinking style and rules and may therefore be influenced by training (Gaglio & Taub, 1992). Also, alertness may be influenced by the acquisition of knowledge and experience (Ardichvili, Cardozo & Ray, 2003).

Pro-active attitude

Opportunity recognition is basically an intentional process (Krueger, Reilly & Carsrud, 2000). The process is motivated either by the will to start a new venture, or by the will to provide a solution to an existing need (Bhave, 1994). If there were no intention, the entrepreneur would not pay attention to information cues, nor use knowledge and experience to develop an opportunity. De Bono (1978) argues that discovering opportunities is often related to problem finding (active) rather than problem solving (re-active). Research into the antecedents of entrepreneurial behaviour shows the importance of a pro-active attitude oriented towards identifying opportunities and valuing innovation (a.o. De Koning, 1999; Kickul & Gundry, 2000; Kickul & Walters, 2002; Puhakka, 2002). The premise of a pro-active attitude to opportunity recognition is that entrepreneurs actively search and interpret information that could lead to the discovery of an opportunity (Cooper, Folta & Woo, 1995). Fiet (1996) proposes that entrepreneurial discovery depends upon the entrepreneur investing pro-actively in specific information. Singh (2000) shows that entrepreneurs that actually utilise a great number of social network contacts find significantly more new business ideas and recognise more opportunities than those who do not. Ardichvili, Cardozo and Ray (2003) stress that opportunity recognition is not about the discovery of an opportunity already formed, but involves pro-active efforts to develop an opportunity i.e. seek risk-reducing information. Yet, entrepreneurs have the ability to think strategically, and proceed with tentative, incomplete information (Christensen, Madsen & Peterson, 1994). They try to envision what will happen in the future, and act before the changes have happened in reality (Puhakka, 2002).

In sum, knowledge and experience, network contacts, cognitive style and a pro-active attitude can explain opportunity recognition behaviour on an individual level (depicted in **figure 3.2**).

Figure 3.2 Individual level opportunity recognition



3.5 Discussion

My research question focuses on firm behaviour in existing businesses. Prominent in opportunity recognition literature however is the focus on the individual entrepreneur starting a business. Looking at my research question, there are two issues concerning the applicability of opportunity recognition knowledge that need to be addressed. First, the opportunity recognition process has been mainly described from the perspective of *business creation*. The question is to what extent the antecedents of opportunity recognition in existing firms differ from new ventures? Studies concerned with opportunity recognition in existing firms are rare. An exception is the real-time study in four high-growth small firms by Karlsson and Junehed (2000). They propose that the opportunity development process in start-up situations is probably more distinct and rapid than in existing firms, where several opportunities could be developing gradually at the same time. Another interesting finding in their study is that the early stages of

opportunity development seem to be driven by a determination to reach a certain goal, like business growth, rather than by a specific idea that the entrepreneur wishes to pursue. They emphasise the function of 'intent' or 'the willingness to reach a certain future state' (p. 88). Colarelli O'Connor and Rice (2000) studied opportunity recognition in ten large established firms. They found that opportunity recognition depends on individual initiative that can be characterised as either proactive or reactive. Opportunity recognisers use internal as well as external sources of knowledge and information. They have the capacity to make a 'cognitive leap' away from routine practices of the firm, and manage to get support from the management. Both studies indicate that opportunity recognition in existing firms resembles that of new ventures.

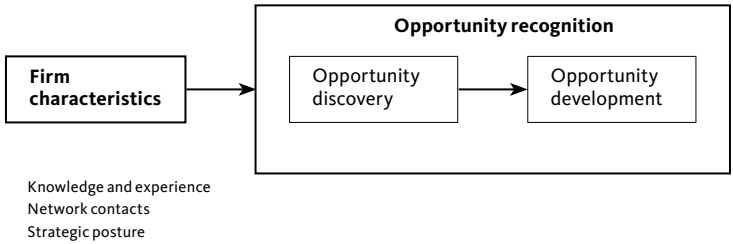
Second, although Schumpeter recognised that every social environment has its own ways of filling the entrepreneurial function (Schumpeter, 1989: p. 260), opportunity recognition research has hardly touched upon the subject on *firm level*. An exception is the longitudinal study by Schwartz and Teach (Teach, Schwartz & Tarpley, 1989; Schwartz & Teach, 2000). Their analysis is on firm level, although they do not discuss their choice for this level of analysis. De Koning and Brown (2001) are explicit in their choice for firm-level analysis. They show that it is possible and fruitful to do research into opportunity recognition antecedents on firm level when firm-level constructs are used. They establish that entrepreneurial orientation and customer orientation have a significant positive impact on entrepreneurial alertness. Actually, De Koning and Brown establish the effect of these factors on the firm's scanning behaviour in different contexts. They operationalise alertness using five measures that investigate how different information sources are used to identify opportunities, for example 'we scan the industry for opportunities' and 'we survey customers for opportunities'. In my view, De Koning and Brown in fact observed rather intentional external search behaviour as their operationalisation of alertness hardly refers to Kirzner's discovery of opportunity in 'sheer' ignorance (Kirzner, 1997). Kickul and Gundry (2000) studied opportunity recognition behaviour among firms that conduct their business on the Internet. They found that Internet firms display externally oriented search behaviour (using the social network) rather than internally oriented search behaviour (with colleagues) to locate new business ideas, leading to the introduction of innovations. They have an entrepreneur-

ial strategic orientation, that is, they value innovation and rapid response to change, and favour the development of inter-firm relationships. Another study of Internet firms by Kickul and Walters (2002) confirmed the importance of a firm's strategic posture oriented towards innovation and a willingness to act upon opportunities.

In these studies there are suggestions that knowledge and experience, network contacts, innovativeness and pro-activeness are important. However the attention for the firm's strategic orientation stands out. Entrepreneurial behaviour is driven by opportunities, which entails an external (market) orientation rather than an internal (resource) orientation. Furthermore, entrepreneurial behaviour is oriented towards opportunity pursuit. Acting rapidly upon opportunities involves risk-taking, creativity, and innovativeness (Stevenson & Gumpert, 1985). Miller (1983) and Covin and Slevin (1991) suggest innovation, risk-taking, and pro-activeness are key dimensions of entrepreneurial activity focused on the discovery and pursuit of opportunities.

The number of studies explaining opportunity recognition on firm level is small. Yet, it appears to me that the following firm factors are equivalent to the individual factors explaining opportunity recognition found in the literature. Knowledge and experience accumulated in the firm serve as a source of ideas and a frame of reference for the development of opportunities. Network contacts may provide new business ideas, information, feedback and resources. Alertness is very much an individual propensity (Gaglio, 1997). To me, its firm equivalent refers to a firm's propensity to notice and be sensitive about information cues, especially in relation to opportunities in the market. In this respect, the number of external social contacts matters as well as the firm's strategic posture. Its strategic orientation should be pro-active, not averse to taking risks, and innovative. In sum, knowledge and experience, network contacts, and strategic posture may explain opportunity recognition on firm level (depicted in **figure 3.3**).

Figure 3.3 Firm level opportunity recognition



How can an entrepreneurship perspective contribute to explaining the adoption of e-business? In entrepreneurship research, and especially in research on opportunity recognition, the focus is on the recognition and pursuit of opportunities in order to create value. Research on opportunity recognition gives insight into factors that affect the ability to successfully identify and develop these opportunities. Internet is a technological development that entrepreneurs can capitalise on to create new economic activity. The technology is an innovation that forms the basis for an entrepreneurial opportunity. Opportunity recognition literature provides us with an understanding of this process. In my opinion, the entrepreneurship perspective clarifies *why* firms innovate. This is an important addition to innovation theory as it puts innovation into perspective. De Bono (1978: p. 53) poses: 'With a problem you search for the solution, with an opportunity you search for the benefit'. Electronic business is about adopting Internet-related technologies for the sake of *doing business*. The entrepreneurial perspective puts e-business innovation in an explicit market context with a focus on value creation for both customers and firm. The body of knowledge on opportunity recognition specifies the importance of the firm's knowledge and experience, strategic posture and social network contacts in this process.

3.6 Conclusion

Entrepreneurship and innovation are strongly related, yet they are different concepts. Entrepreneurship and innovation are separated by the exploitation of opportunities resulting in economic value creation. Thus, from an entrepreneurship perspective, the adoption of e-business may be considered an entrepreneurial act when it results in the exploitation of an opportunity. The introduction of ICTs in a firm opens up opportunities for e-business and may lead to different types of value creation. E-business may incrementally improve existing ways of working, but may also open up new markets or generate new products or services. In this study, E-business adoption is considered entrepreneurial when economic value is created from a new means-end framework resulting in new ways of working for the firm.

In order to exploit the possibilities of ICTs and create economic value, an opportunity for e-business must be perceived. In this entrepreneurship view, e-business adoption is about recognising how the application of ICTs can create business value. This presumption implies that in order to explain e-business adoption we need to investigate which firm characteristics enable a firm to recognise business opportunities based on ICTs. Opportunity recognition is the process of discovering an initial idea for new business and developing it into a feasible and desirable business opportunity. In this process, the desirability and feasibility of the opportunity are evaluated keeping in mind existing and attainable resources and an assessment of the market need. In the literature, opportunity recognition has been mainly explained on an individual level. From the few studies on firm level I conclude that three major factors are important: knowledge and experience, network contacts and strategic posture.

4 Theoretical model

In **chapter 2**, the conceptualisation and explanation of e-business adoption have been discussed from an innovation adoption perspective. I concluded that perceived innovation characteristics and certain firm characteristics influence the adoption of ICTs for e-business resulting in the creation of value. As e-business is about generating business with ICT, the entrepreneurship perspective on e-business adoption was explored in **chapter 3**. In order to exploit the possibilities of ICTs and create economic value, a business opportunity must be perceived by the firm. From this perspective, differences in e-business adoption may arise from differences in the firm's ability to discover and develop opportunities. From the literature review, I concluded that firm characteristics that explain opportunity recognition behaviour on firm level focus on the role of knowledge and experience, network contacts and strategic posture. So, both perspectives provide insight into factors that explain differences in e-business adoption on firm level. In this chapter, knowledge from both perspectives is combined to build a theoretical model aimed at explaining differences in e-business adoption between SMEs.

First the main elements of the theoretical model for e-business adoption in this study will be outlined (**4.1**). In the next section (**4.2**) the elements in the model

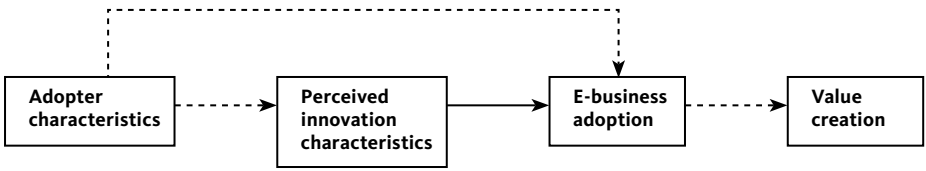
are described, and relationships are introduced (propositions). Moreover, the selection of these elements is explicated and expected causality between variables is discussed. In section **4.3** an overview of propositions is given.

4.1 A model for e-business adoption

From the review of e-business adoption literature in the context of innovation adoption literature (**chapter 2**), a model of e-business adoption emerged. This model is depicted in **figure 4.1**. Summarising, on firm level e-business adoption is typically measured by listing a number of business activities that are electronically supported, complemented by looking at which ICT applications are used. From the review I concluded that the conceptualisation of e-business adoption goes beyond the observation of implemented technologies and includes what type of business value is created or anticipated. In the literature, e-business adoption is mainly explained by the attitude towards the innovation conceptualised as perceived innovation characteristics. On firm level, these characteristics are determined by deciding in what way ICT technologies offer opportunities for value creation in the firm. The object of consideration by the firm is not the technology, but the opportunity. Perceived innovation characteristics can be viewed as the outcome of the firm's evaluation of the opportunities that ICT technologies offer for creating value. In innovation adoption literature, it is implicitly assumed that a positive attitude towards an innovation brings on its adoption. However, situations may arise where firms decide to reject an innovation, regardless of its benefits, or decide to adopt regardless of its drawbacks. For example, a firm's perceived relative advantage of an innovation can be influenced by a pressure to adopt from customers or competitors. The organisation appraises the attributes in its own context. Part of this context is the firm's social network consisting of customers, suppliers, competitors, friends and family, etc. This social network provides knowledge, motivation, and other resources that are drawn in the assessment of the innovation. Firm characteristics that promote innovation adoption basically deal with a firm's capacity to acquire, evaluate and use new knowledge. Linkages with the social network facilitate this process. In particular, close contact with (potential) customers may lead to the discovery of business opportunities. From the innovation adoption perspective,

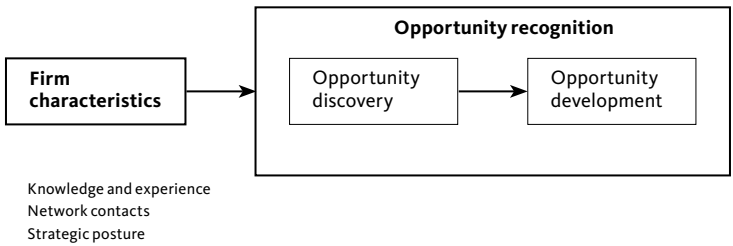
e-business adoption is facilitated by the following firm characteristics: relevant knowledge and experience, perceived network influence, a positive and entrepreneurial attitude towards change, and an appropriate internal structure.

Figure 4.1 E-business adoption: the innovation adoption perspective



In **chapter 3**, I explored how entrepreneurship literature can contribute to assessing and explaining e-business adoption on firm level. In entrepreneurship literature and notably in literature on opportunity recognition, the focus is on the discovery, development and pursuit of business opportunities. E-business can be conceptualised as a business opportunity on the basis of ICTs that offers a firm the possibility to create economic value. I concluded that the body of knowledge on opportunity recognition specifies the importance of the firm's knowledge and experience, strategic posture, and social network in the discovery and development of business opportunities. The basic model that emerged from **chapter 3** is in **figure 4.2**.

Figure 4.2 Explaining opportunity recognition on firm level



This research aims to answer which firm characteristics explain e-business adoption in firms. The basic proposition in this study is that the ability of a firm to recognise and develop business opportunities for the application of ICTs is an essential factor in explaining e-business adoption. Evident from both the innovation adoption and the entrepreneurship perspective is the role of knowledge and experience, the role of network contacts, and the importance of a positive attitude towards change in the adoption of e-business on firm level.

The entrepreneurship perspective emphasises that the recognition of opportunities for e-business is facilitated by firm behaviour involving innovation, risk-taking and pro-activeness. Strategically, the entrepreneurial firm is externally oriented and focused on creating value in the market rather than internally oriented and focused on resources. An entrepreneurial strategic posture is therefore more comprehensive than merely a positive attitude towards change. Moreover, the strategic posture of a firm defines its goal orientation and directs its behaviour.

In innovation literature, organisational innovativeness is often related to the internal structure of an organisation. In this study, I choose not to select the internal organisational structure as a factor in my theoretical model of e-business adoption. In his extensive review, Rogers (1995) found rather weak correla-

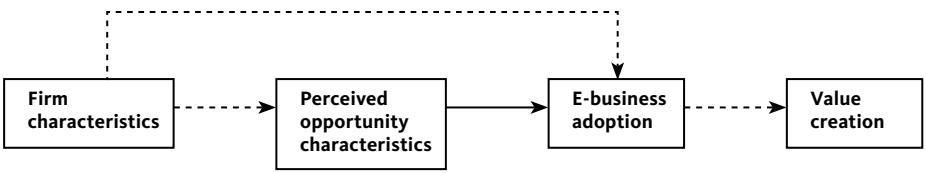
tion between organisational innovativeness and various structural variables like differentiation, centralisation, formalisation etc. More importantly, organisational structure is a non-behavioural organisational attribute, and as such does not make a firm entrepreneurial (Covin & Slevin, 1991). Miller and Friesen (1982) found that determinants of innovation in a firm are to a very great extent a function of the strategy that is being pursued. They found, for example, that a high level of differentiation was positively correlated with innovation in conservative firms, but slightly negatively correlated with innovation in entrepreneurial firms. Miller and Friesen explain this difference by pointing at the apparent weight of the strategy followed. As strategic posture is explicitly included in the theoretical model, I expect little additional value of the internal organisational structure to explaining e-business adoption. I take the view that it is justifiable to leave the internal organisational structure out of the model.

So, three major firm characteristics remain from the review of innovation adoption and entrepreneurship literature that relate to e-business adoption: knowledge and experience, social network contacts, and strategic posture. From innovation adoption literature I concluded that the attitude towards the innovation, conceptualised as perceived innovation characteristics, plays a major role in explaining adoption. A firm evaluates the business opportunity that ICT creates rather than the technological innovation itself. In other words, the assessment of ICT does not concern the technological innovation in itself, but rather the opportunity to create value for the firm by exploiting the innovation. Therefore I propose to talk about perceived *opportunity* characteristics in the model. Further, I assume that these perceived opportunity characteristics are the result of an evaluation of the business opportunity by a firm in its context. More specifically, knowledge and experience, social network contacts and strategic posture play a role in the formation of an attitude towards e-business. As such, the characteristics of the business opportunity offered by ICT as perceived by the adopting firm are logically connected to the characteristics of the firm. As in Rogers' model of the innovation decision process (Rogers, 1995), I assume that the characteristics of the firm influence the development of a perception of using the innovation in the firm. However, as I argued in **chapter 2**, there are situations conceivable where a positive attitude does not lead to e-business adoption. Thus, in the model, I need to allow for firm characteristics to have a direct influence on

e-business adoption. Finally, e-business adoption results in value creation when the business opportunities offered by ICT are exploited. This way, the entrepreneurship perspective on e-business adoption is expressed in the model.

The theoretical model is depicted in **figure 4.3**. E-business adoption and consecutive value creation are both regarded as dependent variables in the model. Firm characteristics and perceived opportunity characteristics are the independent variables.

Figure 4.3 Theoretical model of e-business adoption



In the review on opportunity recognition literature (**chapter 3**), two stages were identified in the process of opportunity recognition: opportunity discovery and opportunity development. Discovery is the starting point of the opportunity recognition process and concerns 'finding' an initial idea for new business. Opportunity development deals with elaborating this initial idea into a feasible and desirable business opportunity. Research indicates that opportunity development requires information and network contacts that are different from opportunity discovery (De Koning, 1999; Singh, 2001). For example, weak ties are used to obtain knowledge on new technologies, whereas stronger ties provide feedback. The information used to turn initial ideas into opportunities for e-business is more specific as the firm needs to assess and evaluate how ICTs can create value for *them*. This requires knowledge about the possibilities of ICTs for

e-business. Analogously in innovation adoption literature, Rogers distinguishes the knowledge stage and the persuasion stage in the innovation decision process. In the knowledge stage, the adopter collects general knowledge on how the innovation works, and how to use it properly. In the following persuasion stage, knowledge is sought that provides innovation-evaluation information to reduce uncertainty about an innovation's expected consequences. In view of these findings, I propose to distinguish general firm characteristics from specific firm characteristics that relate to e-business. General firm characteristics then represent attributes of a firm that in general enable the discovery of business opportunities. These firm attributes pertain to general knowledge and experience, network contacts and the firm's strategic posture. Specific firm characteristics facilitate the development of e-business opportunities and pertain to e-business-related knowledge and experience, and network contacts. In **table 4.1** an overview is presented of the general and specific firm characteristics selected for the theoretical model. In the following sections, I will discuss why I have selected these factors and how I expect these factors to relate to e-business adoption.

Table 4.1 The selected firm characteristics

Firm characteristics	General firm characteristics	Specific firm characteristics
Knowledge and experience	Level of formal education IT knowledge and experience	E-business-related knowledge Presence of innovation roles Perceived dedication of resources
Network contacts	Customer and competitor orientation Environment as a source of ideas	Activated information network Perceived external pressure
Strategic posture	Entrepreneurial orientation	

4.2 Elements of e-business adoption theory

In this section the selection of the elements of the theoretical model for e-business adoption is elaborated. First, I will deal with the dependent variables of the model: value creation and e-business adoption. Subsequently the independent variables come up: perceived opportunity characteristics, general firm characteristics and specific firm characteristics. In the discussion I will argue why the constructs have been chosen as a part of the theoretical model for e-business adoption. In addition, proposed causal relationships will be identified and discussed.

4.2.1 Value creation

As I discussed in my review on e-business adoption literature (**2.3.1**), e-business is generally associated with supporting business activities by the use of ICT technologies *to gain a certain benefit*. So, conceptualising e-business adoption in my view involves not only the actual use of ICTs, but also the value that is created. As I observed in my review on entrepreneurship literature (**3.2**), an opportunity can be interpreted as a situation where an innovation can be exploited. Conceptualising e-business adoption as an opportunity puts the innovation of using ICTs into a purposeful perspective. In my view, the economic value created is therefore an essential part of the conceptualisation of e-business adoption. However, with e-business new economic value can be created in a number of ways and from a number of sources (Amit & Zott, 2001). Based on Hammer and Mangurian (1987) Riggins distinguishes three categories of value creation for e-business (Riggins, 1999; Riggins & Mitra, 2001):

- Improving efficiency (time and cost-related),
- Improving effectiveness (related to communication) and
- Strategic benefits (related to products, markets and services).

Efficiency and effectiveness benefits refer to the improvement of the existing organisation by the deployment of ICT. In this instance, economic value is created by optimising existing means-end relationships and generally in the literature, is not considered entrepreneurial (Kirzner, 1997; Davidsson et al., 2002; Eckhardt & Shane, 2003). Strategic benefits however relate to changes in products, markets and services and involve the creation of new means-end relation-

ships for the firm. In this study, e-business adoption is regarded an entrepreneurial act when the economic value created can be labelled as strategic.
So a distinction is made between two types of value creation:

- ***Organisational value creation:*** the adoption of e-business leads to value creation related to time, cost, and/or communication,
- ***Strategic value creation:*** the adoption of e-business leads to value creation related to products, markets, and services.

I expect e-business adoption to lead to organisational and strategic value creation (***propositions 1a en 1b***).

Hammer and Mangurian (1987) and Riggins (1999) present three categories of value creation for ICTs (efficiency, effectiveness and strategic benefits), but do not elaborate on any order or relation between the types of value creation. In innovation literature, two main types of innovation are distinguished: *product* innovation, resulting in new products or services, and *process* innovation, changing the ways in which products or services are created and delivered (Tidd, Bessant & Pavitt, 1997). Utterback and Abernathy (1975) investigated the relationship between product and process innovation and concluded that, in industry, product development precedes process innovation. In the first phase of the 'product life cycle' new technologies are developed and embodied in new products. In the second phase, products are improved and, to reply to increasing demands, production methods are standardised. In the third phase, the focus is on reducing production costs. In contrast to this sequence of events in industry is the development of innovations in services. Barras (1986) studied the introduction of information technologies in the service industry and found a reverse development of innovations. In services, the innovation process follows a 'reverse product cycle'. Barras argues that the application of new technologies starts with process improvements to increase efficiency of delivery of existing services, moves to process innovations, which improve service quality, and then leads to product innovations through the generation of new types of services. The 'reverse product cycle' has been observed for example in case of the adoption of EDI in the transportation industry (Kerkhof, 1994). In the adoption of e-business new ICTs are being applied to existing businesses and therefore I expect the development of innovations to follow a reverse product cycle. Consequently, organisational value creation, related to process innovation, is

expected to precede strategic value creation, related to new products, services and markets, in the specific situation of e-business adoption (***proposition 1c***).

4.2.2 E-business adoption

In my review on measuring innovation adoption (**2.3.2**) I concluded that both innovation adoption research and information systems research suggest to use a measure that indicates a degree of adoption or extent of use of an innovation rather than a dichotomous yes/no adoption variable. Adoption thus refers to deployment and use of an innovation, which indicates actual use much more meaningful than the purchasing of an information system or the adoption decision alone. The dimensions of adoption indicated as particularly important to investigate are:

- The diffusion of the adoption of the innovation in the organisation
- The number of different uses for the innovation,
- The amount or volume of the innovation used

In the studies on e-business adoption (**2.2.1**), I discerned six different dimensions: activity, application, intensity of use, first time of use and stage of development. I prefer not to include 'first time of use' into my conceptualisation of e-business adoption, as my study intends to record the use of e-business at a certain moment. In addition, by observing to what extent ICTs are used within a company, it will become visible whether a company pioneers or lags behind compared to others. For the same reason, I will not include 'stage of development' into my conceptualisation of e-business adoption. Measuring the deployment and use of e-business within different companies will demonstrate at what stage of development a company is compared to other companies.

In sum, conceptualising e-business adoption implies looking at the diffusion of the adoption of the innovation in the organisation, the number of different uses for the innovation, and the amount or volume of the innovation used. In other words, using the suggested dimensions found in e-business adoption literature, e-business adoption includes:

- The number and nature of business processes supported by ICTs
- The type of ICT applications used, and
- The intensity with which these ICTs are used.

4.2.3 Perceived opportunity characteristics

In many innovation adoption studies, the perceived attributes of the innovation at hand play a decisive role in the adoption decision. However, as Moore and Benbasat (1991) note, most authors use Rogers' definitions of perceived innovation characteristics, which are based on perceptions of the innovation itself, and not on perceptions of actually using the innovation. In the case of electronic business, I argue that it is not the ICT-related innovation itself that is being assessed. Companies judge the *opportunity* that ICTs create for them. For example, Rogers states that 'perceived relative advantage' is often expressed as economic profitability, social prestige, or other benefits (Rogers, 1995). As such, adopters judge in what way the use of ICTs is advantageous to the firm. A firm will evaluate the attributes of this opportunity in terms of possible value creation for the market and the firm, and feasibility for the company.

In entrepreneurship literature several authors focus specifically on evaluation of opportunities (Timmons et al., 1987; Vesper, 1989; Zimmerer & Scarborough, 1998; Timmons, 1999). They mainly focus on business plans or investment opportunities and deal with criteria like market and financial analysis, risk assessment, and the qualities of the management team. Based on discussions with Syntens consultants, I am not convinced many SMEs rationally weigh their options, no matter how sensible such considerations would be for e-business opportunities. I argue that ultimately the *perceived* value of the opportunity determines the likelihood of exploitation. Attributes are always evaluated in reference to some internalised system of values or cognitive framework; the result is a subjective rating of the 'fact' (Tornatzky & Klein, 1982). Secondary attributes of e-business opportunities, like for example its relative advantage to the firm, are therefore to be considered with respect to each organisation (Downs & Mohr, 1976).

With regard to the selection of attributes that are relevant to assess, Rogers (1995) identified five attributes of innovations: relative advantage, compatibility, complexity, observability, and trialability. In a meta-analysis of 75 articles concerned with innovation characteristics and their relation to innovation adoption, Tornatzky and Klein (1982) found a total of 30 different innovation characteristics (including the ones identified by Rogers). After using meta-analytic statistical techniques to assess the generality and consistency of the

empirical findings, they conclude that three innovation characteristics had the most consistent significant relationships to innovation adoption: perceived relative advantage, compatibility, and complexity. Moore and Benbasat (1991) confirmed the importance of these particular characteristics as they explained the largest variance in the adoption of personal workstations compared to the other attributes identified by Tornatzky and Klein (see **2.3.2**). In my review on e-business adoption, I found further confirmation of the importance of these three perceived characteristics (see **2.1.2**). I contend that the results from these studies are usable, because the perceptions measured in these studies often concern the opportunity rather than the technological innovation itself. For these reasons I choose to select relative advantage, compatibility, and complexity as perceived characteristics of the opportunity.

Perceived relative advantage

Perceived relative advantage was originally conceptualised by Rogers (1995) as the degree to which an innovation is perceived as being better than the idea it supersedes. Tornatzky and Klein conclude that relative advantage is an ambiguous term, as criteria for judging relative advantage are often failing. They typify relative advantage as the garbage pail characteristic into which any number of innovation characteristics is dumped. Moore and Benbasat (1991) advocate the use of relative advantage by arguing that innovations typically are developed with certain purposes in mind, and that they must be perceived to fulfil their intended purposes better than their precursors if they are to be adopted. For example, Davis' TAM-construct 'perceived usefulness' is defined as 'the prospective user's subjective probability that using a specific application system will increase his or her job performance within an organisational context.' (Davis, Bagozzi & Warshaw, 1989: p.985). This construct resembles relative advantage, but refers to the benefits of *using* the innovation for a certain purpose, rather than the innovation itself.

The e-business opportunity only exists when the potential adopter perceives a possibility for creating value with ICTs. Therefore, perceived relative advantage is conceptualised as the degree to which an organisation believes that with e-business value can be created. I propose that the perceived relative advantage of the opportunity is positively related to adoption (***proposition 2a***).

Compatibility

Compatibility was originally conceptualised by Rogers (1995) as the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters. Moore and Benbasat (1991: p.199) comment on Rogers' conceptualisation that 'the inclusion of "needs" is considered as a source of confounding with relative advantage, as there can be no advantage to an innovation that does not reflect an adopter's needs'. Therefore they suggest to eliminate reference to adopters' needs from compatibility. Tornatzky and Klein (1982) observe in their meta-analysis that available research has typically failed to distinguish between the two definitions of compatibility. First, compatibility may refer to compatibility with the values or norms of the potential adopter (compatibility with what people feel and think about a technology). Second, compatibility also represents congruence with the existing practices of an adopter (compatibility with what people do). In the context of e-business, existing practices include the product or service that the company offers. Some products or services are deemed better suited for e-business than others. It is easier to imagine possibilities with Internet when you are selling standard software instead of customised jewellery where personal contact is necessary. In e-business, compatibility extends beyond the company itself. After all, an important part of e-business is about supporting the sales process (e-commerce) and supply process (e-procurement) with ICTs. In these processes, customers and suppliers are involved. The company's perception of compatibility therefore includes the compatibility of e-business with the practices of these business partners as well.

In my theoretical model, I conceptualise perceived compatibility as the degree to which an organisation believes that e-business is congruent with the values and norms in the company, and with existing practices within the company and its value chain. I expect the perceived compatibility of the opportunity to be positively related to adoption (***proposition 2b***).

Complexity

Rogers (1995) defined complexity as the degree to which an innovation is perceived as relatively difficult to understand and use. Complexity refers to what makes people perceive the innovation as complex (Tornatzky & Klein, 1982).

Davis' construct 'perceived ease of use' (Davis, Bagozzi & Warshaw, 1989) is the antonym of complexity (Moore & Benbasat, 1991). It is defined as 'the degree to which a prospective user expects a target system to be free of effort' (Davis, Bagozzi & Warshaw, 1989: p. 985). This effort refers to physical and mental effort (Moore & Benbasat, 1991). Complexity thus refers to more than the difficulty of understanding and operating an innovation. Exemplary is the inclusion of 'cumbersome to use' and 'frustrating to use' in the ease of use scale by Moore and Benbasat (1991). Regarding e-business, I argue that issues like security, user lock-in, and technology-dependency could make an adopter perceive an e-business opportunity as complex. These issues regard the comprehensibility and the difficulty of overseeing the consequences of using Internet-related technologies for business. Thus I conceptualise perceived complexity as the degree to which an organisation believes that e-business is difficult to understand, oversee and use. A negative relationship between perceived complexity and adoption is expected (***proposition 2c***).

4.2.4 General firm characteristics

What activates opportunity recognition in firms? What triggers the search for opportunities in some, but not in others? Many ideas for opportunities are connected with prior knowledge and work experience (Cooper, Folta & Woo, 1995; Sigrist, 1999; Shane, 2000). Prior knowledge is a result of relevant education, experience, or a combination of both (Ardichvili & Cardozo, 2000). The possession of unique information may provide an advantage over others (Hayek, 1945). This knowledge may direct attention to certain potential opportunities, and determine alertness for (entrepreneurial) opportunities (Ardichvili, Cardozo & Ray, 2003). Also, specific knowledge may instigate a deliberate search for business opportunities (Herron & Sapienza, 1992). In an organisation, the entrepreneur and other members of a firm bring experience and knowledge to the opportunity recognition process. This knowledge base forms the 'preparation' and background for opportunity recognition and is derived from personal backgrounds, training, work experience, and knowledge of a field (Lumpkin, Hills & Shrader, 2001). Organisations amass knowledge throughout their existence and can be seen as a reservoir of knowledge and skills (Kogut & Zander, 1992). With this existing knowledge, new knowledge can be assimilated or created through learning[1] (Cohen & Levinthal, 1990; Kogut & Zander, 1992). Lumpkin, Lichtenstein

and Shrader (2003) contend that opportunity recognition can be viewed as an example of organisational learning. Opportunity recognition involves the conversion of information into knowledge: Ideas are generated and evaluated for their quality and viability in the same way that information is analysed and combined in order to create knowledge. So a base of relevant knowledge and experience can facilitate the absorption and creation of new knowledge, and consequently, the recognition of new combinations of existing and new knowledge (or opportunities).

To find interesting new knowledge, the entrepreneur and members of the firm may benefit from a pro-active attitude and network contacts towards finding new ideas. As De Koning (1999) finds in her study, scanning the environment for information, either deliberate or accidental, is mainly the mechanism to start opportunity recognition. In innovation literature it was found that across types of innovations and organisations the ability of a company to be in contact with and scan its environment is positively related to organisational innovation (Damanpour, 1991). An active external orientation facilitates the acquisition of new knowledge to leverage the existing base of knowledge and experience.

In sum, the company's base of knowledge and experience, its network contacts and pro-active external orientation determine the point of departure for opportunity recognition. In the following sections, I will elaborate on the factors I have chosen to serve as antecedents of opportunity recognition for e-business, and describe and discuss the relations that I expect with the adoption of e-business.

The level of formal knowledge

Several researchers demonstrate that a higher level of formal knowledge will most likely characterise innovative organisations and promote innovation (Brancheau & Wetherbe, 1990; Groen, 1994; Rogers, 1995; Tabak & Barr, 1999). The indicator reflects professional knowledge of organisational members, which increases boundary-spanning activity, self-confidence, and a commitment to move beyond the status quo (Damanpour 1991). In general, knowledge enables people to open up to new ideas. Puhakka (2002) concludes in his study into the role of intellectual capital on opportunity recognition that formal knowledge and skills provide general abilities that can turn new bits of information into

1 Organisational learning can be defined as an experiential process of acquiring knowledge about action-outcome relationships and the effects of environmental events on these relationships (Polley & Van de Ven, 1996).

useable knowledge. Unexpectedly, he found that only formal knowledge (degree of formal education and amount of technical skills) was of significant importance to knowledge acquisition relevant to market opportunities. Domain knowledge, management experience, creativity, and intrinsic motivation were not significant. Puhakka also found formal knowledge to significantly enhance the ability to analyse the competition and find a 'hole in the market'. He notes that formal knowledge probably provides the analytical tools to analyse the competition. However, creativity is needed to see clues to opportunities that others do not.

Formal knowledge seems to facilitate a deliberate search for opportunities as well as their unexpected discovery. It provides a basis for the interpretation of new information and its conversion to new knowledge. I expect the level of formal knowledge in a firm to have a positive relation with e-business adoption (***proposition 3a***).

IT knowledge and experience

In the opportunity recognition process the collection and processing of information plays an important part. Cooper, Woo and Dunkelberg (1989), Christensen (1990) and Shane (2000) found that prior knowledge and experience influence the discovery of entrepreneurial opportunities. When an innovation corresponds with existing knowledge and practices of the firm, the firm may easier recognise business opportunities. A firm considering an innovation can better judge and process new, possibly valuable information when it relates to its knowledge base (Cohen & Levinthal, 1990; Frambach, 1993). Cohen and Levinthal (1990) explain that accumulated prior knowledge enhances the ability to put new knowledge into memory, and the ability to recall and use it. An accumulation of knowledge makes it possible to see connections between different categories of existing knowledge and associate new knowledge with existing knowledge. Appropriate contextual knowledge makes new knowledge comprehensible.

In the case of e-business, knowledge about similar information technologies may facilitate the acquisition of knowledge about related new technologies, like e-mail and the Internet, and their applications. LaRose and Hoag (1996) actually established that the adoption of clusters of related innovations in information technology was positively related to the adoption of the Internet by organisations.

In addition to prior knowledge, there is an effect of prior experience in learning on the acquisition of new knowledge (Cohen & Levinthal, 1990; Van de Ven et al., 1999). It may be that a set of learning skills is transferable from one 'learning task' to the other. For example, a firm may have learned how to implement an IT application and acquired knowledge about selecting and implementing hard- and software, and new ways of working. I suppose that this learning experience is analogous to adopting Internet-related technologies for e-business. New knowledge about information technology needed to be acquired, and subsequently the organisation considered, accepted, and implemented its adoption. The firm gained experience in the acquisition of new knowledge and 'learned to learn'. In addition, problems were encountered and dealt with during this learning process, adding to the experience of dealing with new knowledge.

In sum, possessing relevant prior knowledge and experience allows a firm to see associations and linkages between existing knowledge and new knowledge. Relevant prior knowledge and skills therefore facilitate the acquisition of new knowledge. This ability enables a firm to discover new opportunities for business by combing new knowledge with existing knowledge. I propose that the knowledge and experience with IT in a firm is a positive antecedent for e-business adoption (***proposition 3b***).

Customer and competitor orientation

The opportunity recognition process can start in two distinctly different ways. Externally stimulated opportunity recognition refers to a situation in which a decision to start a venture is followed by a deliberate search for opportunities (Herron & Sapienza, 1992; Bhave, 1994). Internally stimulated opportunity recognition starts when a problem or need is perceived that cannot easily be fulfilled through available means. Subsequently, the entrepreneur or firm tries to find a solution to satisfy this need (Bhave, 1994). Rogers (1995) observes a comparable start of the innovation decision process. In some cases the knowledge of an innovation creates the motivation to adopt it. The adopter then 'finds' or creates a need or problem that may be solved by the innovation. Especially when certain innovations are regarded as 'fashionable' and *in vogue*, the organisation will want to adopt, even before identifying a need or problem (Abrahamson, 1991). In other cases, a perceived need or problem precedes the innovation.

De Bono (1978) argues that finding opportunities is often related to problem finding (active) rather than problem solving (re-active). Problem finding involves a search for things that could be improved or for new things that need doing. By perceiving such needs firms create for themselves the problem of satisfying those needs. In short, an entrepreneur or firm creates a market or responds to one (Sigrist, 1999). Either way, opportunity recognition starts when a possibility to exploit an innovation has been found, knowingly or accidentally, active or re-active.

In an entrepreneurship perspective on innovation adoption, only the market provides opportunities to exploit an innovation and create value. By definition, an opportunity can only be considered entrepreneurial when it changes what is available on the market (Davidsson et al., 2002). In this view, a possibility to exploit an innovation always includes a perceived need in the market. As Shane (2000: p. 466) concludes in his study: 'before technological change can influence output, an individual must perceive an entrepreneurial opportunity'. This explicit market context puts innovation (adoption) into a purposeful perspective. An innovation is adopted *in order* to create value in the market, instigated by a perceived need in the market.

Von Hippel (1988) argues that any supplier, user, manufacturer, or even distributor can be a source of innovation as they benefit in some way from innovation. However, particularly customers and potential customers form a likely source of innovation (Von Hippel, 1988). Effective innovation derives from active awareness of changing user needs and sometimes from direct user demands or solutions (Moss Kanter, 1988; Rothwell, 1992; Tidd, Bessant & Pavitt, 1997). Shane (2000) demonstrates that prior knowledge of markets, ways to serve markets and customer problems promote the discovery of opportunities. A focus on markets and customers increases the probability of recognising entrepreneurial opportunities (Christensen & Peterson, 1990; Hills & Shrader, 1998; Singh, 2000; De Koning & Brown, 2001). In addition, direct personal confrontations with problem sources direct attention to customer needs and increase the likelihood that a threshold of concern and appreciation is reached motivating people to act (Van de Ven, 1986). Recapitulating, a focus on the market and customers facilitates the recognition of (entrepreneurial) opportunities.

To conceptualise a focus on the market and on customers, it seems obvious to turn to the (marketing) concept of market orientation. However, many explanations exist on what a market orientation contains and there is still no one single definition (for a review, Van Raaij, 2001). Van Raaij effectively conveys the 'relatively simple message' of the discussion in marketing literature about market orientation: 'market oriented organisations are organisations that are well informed about the market and that have the ability to use that information advantage to create superior customer value' (Van Raaij, 2001: p. 275). This core message fits well with the notion in entrepreneurship literature that the possession of unique market information facilitates the discovery of opportunities to create value. A market orientation is usually defined as 'the business culture that most effectively and efficiently creates superior value for customers' (Narver & Slater, 1990: p. 20). Narver and Slater (1990) divide market orientation in three subconstructs: customer orientation, competitor orientation, and interfunctional co-ordination. Customer and competitor orientation specifically include all activities involved in acquiring information about buyers and competitors in the market (Narver & Slater, 1990), and therefore adequately cover a market focus as is meant in entrepreneurship and innovation literature. Interfunctional co-ordination however refers to the co-ordinated utilisation of company resources in creating superior value for target customers. This part of the market orientation concept does not logically connect with the acquisition of market knowledge and the discovery of opportunities. Therefore I choose to conceptualise a market and customer focus as a customer and competitor orientation. Of course, this conceptualisation does not in any way pretend to cover market orientation as discussed in the marketing literature. I expect a customer and competitor orientation to positively influence e-business adoption (***proposition 3c***).

Environment as a source of ideas

The environment, and more specifically the social network acts as a source of ideas and information (Aldrich & Zimmer, 1986; Christensen & Peterson, 1990; Hills et al., 1997). Entrepreneurs consistently use their social network to get ideas and gather information to recognise entrepreneurial opportunities (Birley, 1985; Moss Kanter, 1988; Smeltzer et al., 1991; Singh, Hills, Hybels & Lumpkin, 1999; De Koning, 1999; Singh, 2000). A focus on customers and competitors

provides a company with information about what customers want (or might need) and what is offered in the market (and what not). However, other social encounters may also provide ideas (Von Hippel, 1988; Christensen & Peterson, 1990; Hills & Shrader, 1998). To facilitate innovation Moss Kanter (1988) emphasises the importance of contact with those who take new angles of problems, not only to become aware of need, but also to construct new ways to address the need. This may provide the firm with information about new (technological) innovations that could be a basis for an opportunity. As I described before, the opportunity recognition process may start with an innovation as a solution for which a 'matching' need is sought. In that case, the solution rather than the problem drives the innovation process (Rogers, 1995). Keeping up to date with technological and market developments may lead to the discovery of an opportunity (Christensen & Peterson, 1990). For example, at a trade exhibition a company learns about the possibilities with text messaging. Next, the company may think of offering its customers confirmation of ordered goods by mobile phone. Frambach, Barkema, Nooteboom and Wedel (1998) demonstrate that suppliers who actively position an innovation in the market, and explicitly communicate its distinctive properties, positively influence the probability of adoption. Kickul and Walters (2002) found that the adoption of a 'prospector strategy' in a firm, continually searching the market place for new products, services and technologies, positively correlates with opportunity recognition behaviour.

The collaboration with other firms may also provide new ideas for business. Collaboration can be a means of accessing market or technological know-how, but also an opportunity to learn new market and technological competencies (Tidd et al., 1997). The ability to use external resources widens the company's resource base (Christensen, 1990; Anand, Glick & Manz, 2002).

In short, the ability of a firm to use the environment as a source of ideas, acts as a positive antecedent to e-business adoption (***proposition 3d***).

Entrepreneurial orientation

A firm with a solid base of relevant knowledge and experience, and an external orientation towards possible sources of ideas for opportunities, needs a motivation and the ability to really act upon those cues. Moss Kanter (1988) identi-

fies several conditions at the organisational level that facilitate the ability to see new opportunities. One of these conditions is that the organisation should support innovation, not only by providing resources like time and money, but also by favouring change as a culture. A positive attitude towards innovation and change has a positive relationship with opportunity recognition (Damanpour, 1991; Colarelli O'Connor & Rice, 2000; Kickul & Gundry, 2000). Christensen (1990) proposes that opportunities pursued in the past influence future opportunities that are possible to perceive and pursue. His argument is that, although individual opportunities are important, the most interesting aspect of opportunity recognition may often be the learning process rather than individual opportunities. Basically, opportunities pursued in the past reflect an underlying learning process, where capabilities and cognitive abilities are developed. The firm experienced how to deal with uncertainties and risk involved in opportunity pursuit. The degree of learning is highest when the opportunities pursued involved large changes and a high degree of novelty (Christensen, 1990). Also, Christensen (1990) found that the ability to turn customer problems into opportunities, or in general, the ability to turn adverse situations into advantageous situations or threats into opportunities, is instrumental in opportunity recognition. This pro-active mentality towards opportunities facilitates taking advantage of a firm's knowledge base and newly acquired information.

In brief, a firm's past entrepreneurial experience creates an antecedent for future opportunity recognition. Several authors made attempts to measure a firm's entrepreneurial behaviour. The most widely used construct in this respect is 'entrepreneurial orientation' (for an overview, Lyon, Lumpkin & Dess, 2000). Miller (1983) originally suggested that a firm's degree of entrepreneurship could be seen as the extent to which they take risks, innovate and act pro-actively. This experience in entrepreneurship indicates that a firm has the motivation and the ability to really act upon opportunities. De Koning and Brown (2001) confirmed a positive relationship between the recognition of opportunities and a firm's entrepreneurial orientation. I therefore propose that a firm's entrepreneurial orientation is positively correlated with e-business adoption (***proposition 3e***).

4.2.5 Specific firm characteristics

In opportunity recognition literature many authors discuss the development of opportunities (e.g. Long & McMullan, 1984; Bhave, 1994; De Koning, 1999; Lumpkin, Hills & Shrader, 2001). Bhave (1994) concludes in his exploratory research that entrepreneurs go through a process of elaborating, filtering and refining opportunities before they decide on pursuing a certain business opportunity. In this process, the entrepreneur matches knowledge, experience, skills and other resources with market needs. In her investigation, De Koning (1999) concludes that opportunities are basically 'formed' through an iterative process in which the entrepreneur discusses the desirability and feasibility of opportunities with network ties and seeks feedback information from experts. Also, the assessment of resources is part of this process. Lumpkin, Hills and Shrader (2001) point out that 'good ideas' must be formed into viable business opportunities through selection, evaluation and refinement. Information is required about necessary and attainable resources and skills, and market need.

Nambisan and Wang (2000) argue that with the emergence of more knowledge-intensive technologies like the Internet, opportunities for their exploitation are not so clearly defined and apparent and are often highly context and firm specific. The range of uses for, for example, Internet technology is wide. So, in order to develop e-business opportunities, knowledge and experience are needed to assess the possibilities of ICTs in the context of the company and its value chain. Information is sought to reduce uncertainty about the consequences of adopting e-business for the firm. As pointed out earlier, network contacts play an important part in providing information and resources.

In short, firm characteristics that facilitate the development of e-business opportunities refer to e-business-related knowledge, experience, and network contacts.

E-business-related knowledge

The possibilities of ICTs are endless, and outside knowledge is often hardly targeted to the specific needs and concerns of the firm. Especially for new technologies the information available will be focussed on the technology (know what) and less on the possibilities for application (know how). The less targeted the

information available is, the more important it is to have knowledge inside the firm permitting it to recognise the value of this outside knowledge, assimilate it, and exploit it (Cohen & Levinthal, 1990, p. 140). For a company to be able to turn an initial idea into an opportunity for e-business, it is important to obtain specific knowledge on the possibilities for e-business. Specific knowledge of ICT technologies and applications facilitates combing new knowledge with existing knowledge, and makes it easier to consider the possibilities for the firm. Fichman and Kemerer (1999) emphasise that the acquisition of information technology does not equal actual deployment. Rapid acquisition of for example Internet technology may be driven by unrealistic expectations, arising from promises of increasing returns. However, actually using this technology effectively in the organisation may be hindered by the effort of the organisational learning required to obtain the necessary knowledge and skills. These so-called knowledge barriers arise because the technological and managerial knowledge required to successfully deploy the technology goes beyond simple awareness of an innovation and its potential benefits (Attewell, 1992; Fichman & Kemerer, 1999; Nambisan & Wang, 2000). Mehrtens et al. (2001) found indications that the presence of organisational members having specific knowledge about e-business can support the recognition of e-business opportunities. I therefore expect that the presence of knowledge about e-business facilitates the development of e-business opportunities, and therefore the adoption of e-business (***proposition 4a***).

The presence of innovation roles

One of the basic problems of innovation is the management of attention to non-routine ideas, as organisations are largely designed to focus on, harvest, and protect existing practices (Van de Ven, 1986). Organisations that want to innovate benefit from the presence of individuals that pay attention to new ideas, needs, and opportunities. People that have the quality to appreciate new ideas, like to explore new knowledge, and bring it into the organisation can facilitate the opportunity recognition process. In innovation literature often the presence of individuals fulfilling two specific roles is stressed as especially important in the innovation process (Rothwell, 1992). A 'gatekeeper' acquires new knowledge about the possibilities of ICT-related innovations, and internally communicates information. An organisation's capacity to acquire and assimilate new knowledge will depend on the absorptive capacities of its individual members (Cohen

& Levinthal, 1990). A direct interface with the external environment provides the organisation with new information. Without gatekeepers, organisations are deaf to outside sources of information so vital for innovation (Tushman & Nadler, 1986, p. 89). In addition, these 'specialised actors' may care for the transfer of information within the organisation (Cohen & Levinthal, 1990). Showing the organisation new angles on existing problems may spur opportunity recognition.

Another influential role is the 'champion' or 'entrepreneur' (Rothwell 1992). A champion is an individual who is able to initiate a process of departing from the organisation's established routines (Moss Kanter, 1988). This person translates innovation ideas into concrete innovation opportunities, and supports and 'pushes' their realisation. Organisations need employees who are both capable and motivated to recognise opportunities and carry them forward (Colarelli O'Connor & Rice, 2000). De Koning (1999) identifies concept creation as an important step in the development of business opportunities. Champions can be considered internal entrepreneurs, bringing ideas to life (Tushman & Nadler, 1986). Therefore, I argue it is important for the organisation's ability to recognise opportunities, to have someone in the organisation that believes e-business is desirable and feasible. Two studies actually established the influence of the 'champion' role in the adoption of Internet (Mehrtens et al., 2001; LaRose & Hoag, 1996). I propose that the presence of both innovation roles, the gatekeeper and the champion, contributes to the recognition of e-business opportunities, and therefore facilitates e-business adoption (***proposition 4b***).

The perceived dedication of resources for e-business

Turning ideas for innovation into business opportunities requires an organisation to play a role in activating or stimulating opportunity development. One way to facilitate this opportunity recognition process is to make sure people in the organisation can rely on the release of time and money, when necessary (Moss Kanter, 1988). Remarkably, in entrepreneurship literature, the influence of the availability of resources or access to them on opportunity recognition is not explicitly discussed. The access to finance comes up later in the entrepreneurial process, when the exploitation of opportunities is prepared (Van der Veen & Wakkee, 2004). In innovation literature, the influence of resource avail-

ability is raised. Awareness of organisational resource availability reinforces the perceptions of affordability of experimentation with innovations (Tabak & Barr, 1999). Slack resources, both financial and human, will positively influence innovation (Damanpour, 1991; Tabak & Barr, 1999). Size, in terms of people and revenue, is sometimes used as a proxy for the availability of resources in a company (e.g. Chwelos et al., 2001). I contend that it is not the actual amount of money or time available, but the perception of their expected availability, that encourages people to think about possible application of ICTs. Consequently, I suggest that the perceived dedication of resources for e-business is positively associated with e-business adoption (***proposition 4c***).

An activated information network

To develop an initial idea into an opportunity for e-business, a company needs information about the innovation and its possibilities for value creation. Essential in acquiring and assessing information is the environment of the company, and in particular its social network. Birley (1985) concludes that during opportunity development the entrepreneur uses the network to obtain information on what is available, advice on how to best proceed, reassurance that it will work, and resources. In her in-depth study on opportunity recognition, De Koning (1999) found that each activity in this process requires a qualitatively different social context. After finding an initial idea, the entrepreneur 'thinks through talking' about the idea, usually in a series of conversations with a few long-term, strong ties, often a family member. As the idea takes shape through the dialogue, and the entrepreneur begins to sense it is worth pursuing, the entrepreneur seeks out information from 'experts', to efficiently answer key questions. As the concept of a business opportunity is created, the entrepreneur also seeks out potential resources and assesses them in terms of the opportunity. This part of the process seems enhanced by a network of weak ties with many potential resource providers (De Koning, 1999). Singh (2000) concludes that social networks play a vital role in the opportunity recognition process.
He found that entrepreneurs discuss their ideas with potential clients and customers, friends and family, and seek information and feedback from business associates. Singh suggests that the information and feedback the social contacts provide help to verify the significance of an opportunity and refine it into a better opportunity.

The use of interpersonal relationships, especially a mix of strong and weak ties, may provide the firm with specific information that aids the development of business opportunities (De Koning, 1999; Singh, 2000). Puhakka (2002) concludes that the *amount* of personal social interactions increases the likelihood of development of knowledge. He suggests that a wide base of social relationships encourages entrepreneurs to use these contacts to find and understand information. Pro-actively tapping these outside linkages provides a firm with access to different types of knowledge and sources of information useful to the development of business opportunities (Anand, Glick & Manz, 2002). For example, research into the adoption of www technologies indicates an important role for supply-side institutions like external consultants or intermediaries. Their involvement impacts adoption time by providing information and help to explore and adopt www technologies by lowering 'knowledge barriers' (Nambisan & Wang, 2000).

I expect that the opportunity recognition process is facilitated when the firm actively approaches several social contacts for information regarding e-business. This 'activated information network' facilitates e-business adoption (***proposition 4d***).

Perceived external pressure

All innovations carry a degree of uncertainty and the adopter has a need for social reinforcement of its attitude towards the new idea (Birley 1985; Rogers 1995). The adopter's environment and social network supports the evaluation of the innovation's benefit, appropriateness, and complexity; not only by providing knowledge and information, but also by providing motivation and support. Singh (2000) established that entrepreneurs contacted potential clients, friends and family, and business associates to obtain feedback to develop an initial idea into a feasible and desirable business opportunity. In e-business research the influence of several external parties has been investigated, notably competitive pressure. Some authors found competitive pressure of insignificant importance (Nambisan & Wang, 2000; Sadowski et al., 2002). Others did find a significant effect from partners in the value chain like customers, competitors or suppli-

ers on adoption of Internet-related technologies (Griffin, 2001; Premkumar & Roberts, 1999; Mehrtens et al., 2001).

As I put forward in **chapter 2**, the social network of the firm may influence the firm's perception of an innovation, as it is not an isolated entity. Adoption may be more attractive when customers or suppliers are interested in e-business, thus increasing the value of adoption. The perception of social pressure from for example competitors, change agents, or sector-organisations, can play a part in the evaluation of e-business opportunities. This perceived external pressure might even induce a firm to adopt, even when the actual advantages of e-business to the firm are unclear, and create a 'KAP-gap'. In short, I expect perceived external pressure to be positively related to e-business adoption (***proposition 4e***).

4.3 Overview of propositions

Theory has now provided a provisional answer to the question: *Which firm characteristics explain the adoption of e-business in SMEs?* The propositions specify which firm characteristics I expect to explain e-business adoption. In **figure 4.4**, an overview of the constructs and the proposed relations between them is presented. For each proposition, the expected nature of the relationship between the constructs is indicated. The number between brackets is the number of the proposition as has been indicated in the preceding sections.

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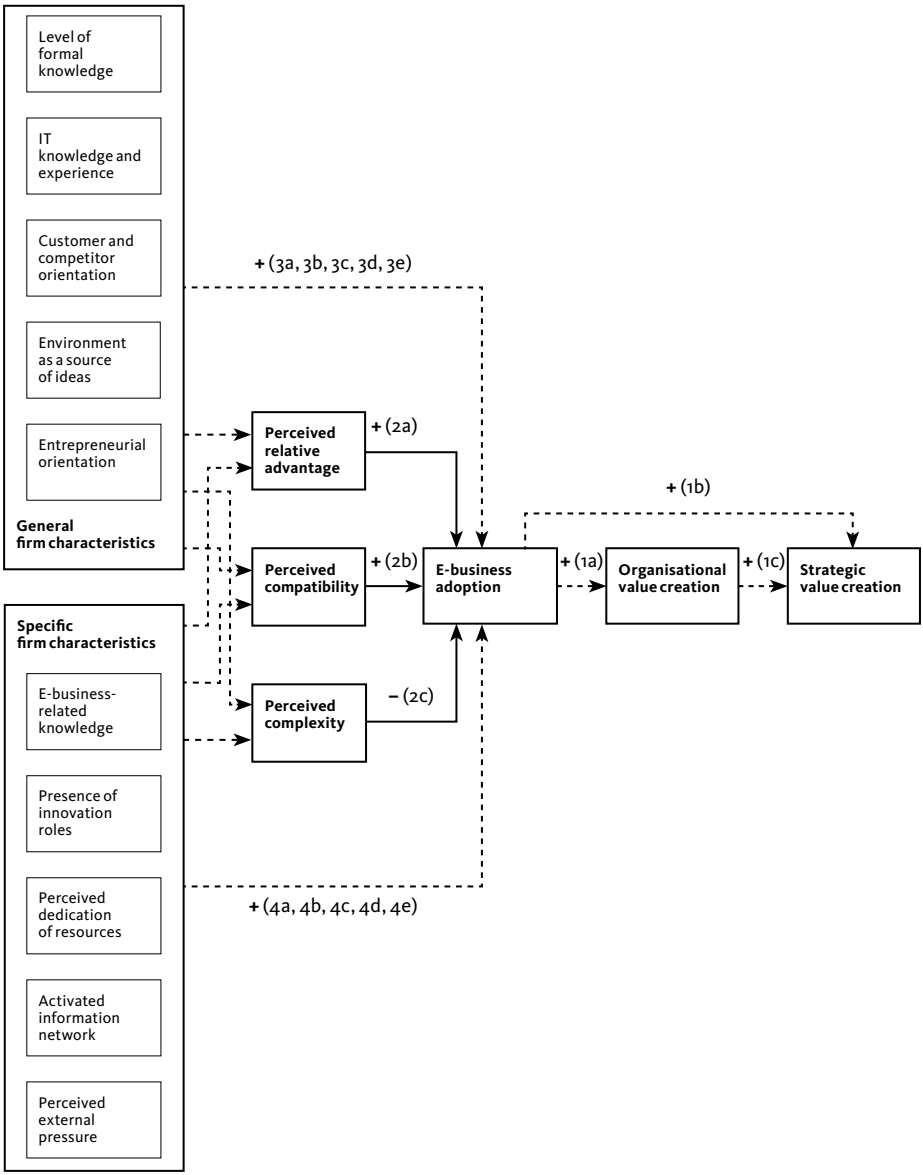
Figure 4.4 Overview of propositions



In sum (from right to left in **figure 4.4**), e-business adoption is expected to lead to two types of value creation: strategic value creation and organisational value creation (***propositions 1a, and 1b***). In addition, I expect strategic value creation to succeed organisational value creation (***proposition 1c***). Also, a relationship is anticipated between the firm's attitude towards the opportunities that e-business adoption offers (perceived opportunity characteristics) and e-business adoption (***propositions 2a, 2b, and 2c***). Next, I propose that firm attributes that relate to knowledge and experience, network contacts and the firm's strategic posture positively relate to e-business adoption (***propositions 3a to 3e, and 4a to 4e***). In this respect, general firm characteristics represent firm attributes that *in general* enable opportunity recognition. Specific firm characteristics refer to firm attributes that facilitate the development of *e-business* opportunities. Finally, these general and specific firm characteristics are presumed to play a role in the formation of an attitude towards e-business. As such, I expect relationships between the characteristics of the firm and perceived opportunity characteristics.

Specific propositions regarding the relations between the specified firm attributes and perceived opportunity characteristics have not been formulated, mainly because I did not find any studies that analyse the origin of perceived innovation characteristics. In the e-business adoption literature reviewed, I did not find studies that could provide explicit information on the relations between particular firm attributes and perceived innovation characteristics. Further, general innovation adoption literature referring to perceived innovation characteristics did not clarify their origin either. For example, Rogers indicates in his model of the innovation decision process that characteristics of the decision-making unit, like socio-economic characteristics and communication behaviour, influence the development of perceptions of an innovation in the knowledge and persuasion stage (Rogers, 1995:p. 163). However, he does not explicitly discuss in what way these firm characteristics influence the formation of an attitude towards the innovation and its subsequent adoption. Now, I could theorize about the relations between perceived opportunity characteristics and firm attributes. However, that may be a bit precarious. For example, I could expect a firm's experience with IT to contribute to a positive perception of the relative advantage of e-business adoption, presuming that the use of IT proved beneficial

to the company. At the same time however, the experience may well have been very unpleasant involving large investments and little return, having a negative effect on the perceived relative advantage of e-business adoption. Therefore in this study, I prefer to *explore* the relationships between firm characteristics and perceived characteristics of e-business opportunities, using empirical data.

To test the theoretical model and the proposed relations, empirical observations are needed. In the next chapters, the method and research design (**chapter 5**), and the operationalisation of the constructs into measurable indicators (**chapter 6**) are discussed. In **chapter 7** the empirical results will be presented.

5 Method

In the previous chapter a theoretical model has been built in which a selection of firm characteristics is proposed to explain e-business adoption and value creation. The objective of *this* chapter is to describe the methodological choices that make it possible to test this model and measure the various elements of the model. In addition, I am interested in observing differences in explaining e-business adoption between the innovation adoption perspective on the one hand, and the entrepreneurship perspective on the other.

First, the research design is presented (**5.1**). Here, the choice for a survey design is explained. The next sections deal with the population and sample (**5.2**), the data collection process and response pattern (**5.3**), non-response analysis (**5.4**), the questionnaire and pilot test (**5.5**). In section **5.6**, the reliability and validity of the survey are discussed.

5.1 Research design

In view of the research questions, this study can be qualified as explanatory research. Theoretical literature is used to specify the dependent variables

(e-business adoption and value creation), to identify possible explanatory variables and to formulate propositions regarding the relations between those variables. As such the objective is to test proposed relations between variables as specified in the theoretical model (**chapter 4**).

The empirical investigation is executed in collaboration with Syntens. Syntens is a national, independent, not for profit organisation that advises SMEs on the subject of innovation, and is funded by the Dutch Ministry of Economic Affairs. With fifteen branches, and around 300 consultants, Syntens has a local presence throughout the Netherlands. Syntens' largest project is *Nederland gaat Digitaal* ('The Netherlands goes Digital') with a total budget of around 36 million Euros (2002-2005). The project is aimed at encouraging Dutch SMEs to use the Internet, e-mail, and other ICTs in their businesses. The goal is to reach around 15000 SMEs through workshops, and individual consultancy. The project, the Syntens consultants involved, and the participating companies are used in this research as a rich source of information and feedback. Their specific role in this research will be clarified in the next sections.

To test propositions and find variation in e-business adoption and firm characteristics as well, quantitative analysis of a large sample of firms is necessary. The obvious choice for a survey was opportune also as Syntens offered to fund a one-time survey. Syntens' interest in the research project is to acquire useful knowledge that can be applied in consulting their target group of SMEs. In addition, I was offered the possibility to use EIM's[1] business panel consisting of 1596 SMEs for a one-shot survey. This representative sample of SMEs was randomly drawn from the population of SMEs in the Netherlands, and stratified according to class of size and sector. As the sample is fairly large and covers different sectors and firm sizes, I assume that variation is present in e-business adoption as well as in firm characteristics. The expected variation in the variables and the size of the survey will enable to test hypotheses.

This study aims to explain the phenomenon of e-business adoption on firm level. The level of analysis in this study, firm level, is dominant and well accepted in entrepreneurship research (Davidsson & Wiklund, 2001). However, consistency in the level of analysis is important. To this end, firm level characteristics are

1 EIM is a Dutch research agency (www.eim.nl). They are carrying out a long-term research program on smes and entrepreneurship. eim co-ordinates the Observatory of European smes and participates in the Global Entrepreneurship Monitor.

connected to firm level outcomes in terms of e-business adoption and value creation. In order to collect firm level data in a practical and feasible manner, a representative of each firm was contacted to fill out the questionnaire. The questionnaire was filled out either on the Internet and electronically returned, or on paper and returned by mail. The survey can be typified as a self-administered survey in which the respondents are asked to report their perception of their firm's situation and behaviour. This way of collecting data is based on the assumption that the representative is well informed about e-business adoption in the firm. The respondents of the EIM business panel consist mainly of directors or owners of SMEs, whom I expect to be well informed about their company. Participants of the business panel are motivated to fill out questionnaires regularly on a voluntary basis, and receive the results of the survey in return. The whole survey has been carried out by EIM. EIM regularly conducts professional surveys and consequently has great professional experience in collecting and processing large quantities of data. As such, I did not intervene or have any control over the situation.

The choice for a survey and the circumstances of the study entail several issues that could influence the quality of the research. First, both Syntens and EIM requested to limit the length of the questionnaire to 15 minutes. The main reason is that both organisations do not want to offend busy entrepreneurs with long questionnaires. This way the depth of the research is limited. Second, Syntens set a time limit to the development of the questionnaire. Syntens wanted the questionnaire to be finished in order to use it in their project. As a result, some choices regarding the construction of the list of questions, had to be made by necessity. Consequences of both issues will be dealt with in **chapter 6** on operationalisation. Third, in a one-shot survey it is impossible to measure perceived opportunity characteristics prior to the adoption. So, the measured perception may be influenced by the perceiver's knowledge of that decision. Despite the theoretically valid objection to retrospective one-shot surveys, most studies on innovation adoption use this design (Tornatzky & Klein, 1982). Just as in this study, practical considerations usually ground this choice. This issue is further discussed in **section 8.5** on limitations.

5.2 Population and sample

In order to collect data, an existing panel of entrepreneurs was used, the '*MKB-beleidspanel*' (SME policy panel) of EIM. This panel is frequently used to gather data on knowledge, attitudes and opinion of SME entrepreneurs concerning government policy. The sample frame for the panel was taken from the Direct Marketing Compact Disc[2] (DM-CD®). This disc provides all private enterprises in the Netherlands. In **table 5.1** the characteristics of the Dutch SME population are given. From the total population of SMEs (companies with less than 100 employees) a random sample was taken from eight different sectors by using a two-digit sector-code (BIK/SBI): industry, building industry, trade, hotel and catering industry, transport, business services, financial services, and personal services. The sample was stratified for three classes of size: 0-9, 10-49, and 50-99 employees. In the Netherlands, these particular classes of size are customary in small business research (CBS, NIPO, EIM). Stratification was necessary to ensure that all the sub-populations were represented in the sample. This is especially important for size, as the distribution of Dutch SMEs over the three classes of size is very skewed (see **table 5.1**). EIM contacted selected companies by phone to participate in the panel. The survey was carried out in July and August 2002. At that time, the panel consisted of 1596 companies.

Differences were anticipated in e-business application in the trade sector, and so the trade sector was divided into wholesale trade and retail. So, the sample used for this research consists of nine sectors, and three classes of size.
As a basis for this classification, the information on the DM-CD® was used. However, for the response group EIM corrected the sector-codes and size-classes using additional information on the panel that is gathered yearly by EIM. This information, about the main activities and the number of employees of the companies (in FTE), is more accurate than the data provided by the DM-CD®. It was determined that the sample contained 58 companies with 100 employees or more. These companies were taken out of the sample in further analysis. In **table 5.2** the sample characteristics are given.

2 The Direct Marketing Compact Disc (DM-CD®) by MarktSelect is a well accepted source of data on firms in the Netherlands.

Table 5.1 The Dutch SME population

Sector	Number of firms by class size			
	0-9	10-49	50-99	Total
Industry	35.460	7.690	1.470	44.620
Building industry	61.205	6.840	760	68.805
Wholesale trade	56.858	7.224	846	64.928
Retail	93.697	4.706	394	98.797
Hotel and catering industry	37.570	2.365	155	40.090
Transport	24.585	3.420	520	28.525
Business services	129.630	7.625	1.010	138.265
Financial services	14.920	975	135	16.030
Personal services	24.010	480	30	24.520
Total number of firms	477.935	41.325	5.320	524.580

Source: EIM/BLISS, September 2002

Table 5.2 Sample characteristics

Sector	Sector code	Number of firms by class size			
		0-9	10-49	50-99	Total
Industry	15-37	47	81	57	185
Building industry	45	67	77	64	208
Wholesale trade	51	22	29	35	86
Retail	50, 52	46	41	39	126
Hotel and catering ind.	55	72	96	45	213
Transport	60-64	53	76	56	185
Business services	70 - 74	72	83	46	201
Financial services	65-67	33	61	73	167
Personal services	92, 93	84	68	15	167
Total number of firms		496	612	430	1538

Source: EIM/BLISS, September 2002

5.3 Data collection process and response pattern

Each company with a known e-mail address was presented with an on-line questionnaire. The companies without an e-mail address were sent a paper version of the questionnaire by post. In total 652 questionnaires were returned, of which 614 were usable. The response rates are presented in **table 5.3**.

Table 5.3 Response rates

	Number of firms by class of size		
Sector	**Sample**	**Response group**	**Response rate**
Industry	185	75	41%
Building industry	208	75	36%
Wholesale trade	86	42	49%
Retail	126	57	45%
Hotel and catering industry	213	69	32%
Transport	185	77	42%
Business services	201	93	46%
Financial services	167	50	30%
Personal services	167	76	46%
Total number of firms	**1538**	**614**	**40%**
Class of size			
0-9 employees	496	200	40%
10-49 employees	612	246	40%
50-99 employees	430	168	39%
Total number of firms	**1538**	**614**	**40%**
Contacted by...			
e-mail	1262	508	40%
post	276	106	38%
Total number of firms	**1538**	**614**	**40%**

The average response rate was 40%. The 38 questionnaires that were filled out incompletely (people had stopped answering near question 19), were ignored for further analysis. The distribution of the response group over sectors and size-classes is represented in **table 5.4**. The response group shows variation in sector as well as size. The relation of firm size to organisational innovativeness is well noted (Damanpour, 1992). In effect, certain firm characteristics enabling innovation vary with size like organisational slack, or the number of specialists in the firm. As such, variation is expected in firm characteristics (the independent variables) when firms of different sizes are considered. The business opportunities for ICT are dissimilar for different lines of business. Consequently, the application of ICTs in various sectors is notably different (European Commission, 2003c). Hence, in this sample variation is expected in the adoption of e-business and value creation (the dependent variables) as the respondents represent nine different sectors. Two sectors are relatively underrepresented in the sample: the hotel and catering industry and financial services with response rates of 32% and 30% respectively. Presumably, respondents in these sectors are less interested in e-business compared to respondents in other sectors. This however is of no importance to conclusions that will be drawn from the survey with respect to explaining e-business adoption.

Table 5.4 Characteristics of response group

	Number of firms by class of size			
Sector	**0-9**	**10-49**	**50-99**	**Total**
Industry	16	34	25	75
Building industry	23	29	23	75
Wholesale trade	11	15	16	42
Retail	20	19	18	57
Hotel and catering industry	20	35	14	69
Transport	25	29	23	77
Business services	36	40	17	93
Financial services	6	15	29	50
Personal services	43	30	3	76
Total number of firms	**200**	**246**	**168**	**614**

The lower part of **table 5.3** further demonstrates that variation in e-business adoption is expected. Respondents that did not have an e-mail address at the time of the survey (contacted by post) are part of the response group. These respondents are not likely to have adopted e-business to a large extent.
The respondents were mainly owner-managers or managing directors of the firm (83%) (**table 5.5**). This supports the assumption that the respondents represent the company well, and are well informed about the company.

Table 5.5 Position of the respondents

Position	Number of respondents	In %
Director/owner	410	67%
Director	97	16%
Works manager	25	4%
Manager/Head of department	29	5%
Other	44	7%
Not reported	9	1%
Total number of respondents	**614**	**100%**

5.4 Non-response analysis

To check for possible response bias, I compared the companies that responded (response group) with the companies that did not (non-response group). Pearson chi-square tests revealed neither a significant relationship between the class of size of the company and being a respondent. However, there is a possible relationship between being a respondent and the sector of the company (**table 5.6**). This is due to the fact that response percentages from the sectors financial services and hotel and catering industry are relatively low. There is no significant relationship between sector and respondent when financial services and hotel and catering industry are left out of the Pearson chi-square test (Pearson chi-square: value=7,429, df=6, asymptotic significance (2-sided)= 0,283).

I also checked for response-bias between the respondents and non-respondents that were contacted by post (106 companies), and the respondents that were contacted by e-mail to fill out the questionnaire on the Internet (508 companies). Based on a Yates corrected chi-square test, I found no significant relation between being a respondent and the type of questionnaire that was offered (online or through the post).

Table 5.6 Comparison of respondents and non-respondents

Class of size	Non-Respondents		Respondents		Total	
0-9 employees	296	60%	200	40%	496	100%
10-49 employees	366	60%	246	40%	612	100%
50-99 employees	262	61%	168	39%	430	100%
Total number of firms	**924**	**60%**	**614**	**40%**	**1538**	**100%**

Pearson chi-square: value=0,183, df=2, asymptotic significance (2-sided)= 0,913

Sector	Non-Respondents		Respondents		Total	
Industry	110	59%	75	41%	185	100%
Building industry	133	64%	75	36%	208	100%
Wholesale trade	44	51%	42	49%	86	100%
Retail	69	55%	57	45%	126	100%
Hotel and catering industry	144	68%	69	32%	213	100%
Transport	108	58%	77	42%	185	100%
Business services	108	54%	93	46%	201	100%
Financial services	117	70%	50	30%	167	100%
Personal services	91	54%	76	46%	167	100%
Total number of firms	**924**	**60%**	**614**	**40%**	**1538**	**100%**

Pearson chi-square: value=23,401, df=8, asymptotic significance (2-sided)= 0,003

Type of questionnaire	Non-Respondents		Respondents		Total	
Internet	754	60%	508	40%	1262	100%
Post	170	62%	106	38%	276	100%
Total number of firms	**924**	**60%**	**614**	**40%**	**1538**	**100%**

Yates' corrected chi-square: value=0,250, df=1, asymptotic significance (2-sided)= 0,617

The results of the chi-square tests in **table 5.6** indicate that the respondents reliably reflect the population in terms of class of size, and type of questionnaire. Consequently, the research findings of the sample may be generalised to the population of Dutch SMEs with less then 100 employees. Differences between or within the three classes of firm size (0-9, 10-49, and 50-99 employees) will not be investigated in this research. With respect to the different sectors, the statistical generalisation of the results is limited. The sample does not reflect the population for the sectors financial services and hotel and catering industry. The response rates from the financial service sector, and the catering and hotel industry were relatively low compared to the other sectors. For the other sectors, the results may be generalised to the population of Dutch SMEs. Differences within and between sectors will not be investigated in this study.

5.5 Questionnaire development and pilot test

For the study a questionnaire has been used, consisting of 9 pages (the paper version is in **appendix 5.1**). The development of the questionnaire was subject to several requirements and constraints. First, time restrictions were imposed by EIM. In order to be allowed to use the EIM business panel, I was asked to restrict the time for filling out the questionnaire to 15 minutes. Second, Syntens required the questionnaire to be suitable for SME in various sectors. Consequently, the questions needed to be in Dutch and general enough to be relevant and comprehensible to respondents from various lines of business. Third, acceptance of the questionnaire (length, relevance and comprehensibility) by Syntens consultants was important for Syntens as the questionnaire was going to be part of the 'toolkit' for consultants in the 'Netherlands goes Digital' project[3].

In order to verify to what extent the questionnaire satisfied the requirements and constraints a pilot test was executed. A master student executed the pilot test in two rounds in 13 SME-firms (Wessels, 2002). The firms were selected based on differences in sector and size. The practical evaluation of the questionnaire had two main goals. First, the relevance of the questions to the SME and the comprehensibility of the terms were tested (content). Second, the layout and time consumption of the questionnaire were tested (form). In each firm, the direc-

3 From April 2003, participant SMEs are asked to fill out the questionnaire before taking part in the 'Netherlands goes Digital' project. In August 2003, the questionnaire went online complemented by a benchmarking tool.

tor or owner filled out the questionnaire. Afterwards, the master student conducted an interview with the respondent to verify to what extent the described situation resembled the situation emerging from the answers in the questionnaire. Unclear issues were then discussed. Although rather subjective, this way of working confirmed that the questionnaire represented the situation of the firm well. Further, the respondents hardly experienced difficulties in understanding the questions and terms used. The pilot tests revealed that the average time to fill out the questionnaire was little over 15 minutes (Wessels, 2002). After the first round of the pilot test, the questionnaire was slightly altered based on the pilot test as well as on recommendations by EIM, and Syntens consultants. Details of adaptations in the questionnaire are available in Wessels (2002).

5.6 Reliability and validity of the survey

In the next chapter (**6**), I will discuss the operationalisation of each construct in the theoretical model as described in **chapter 4**. Operationalisation refers to the selection of an empirical variable[4] that represents a theoretical construct[5] as best as possible (Swanborn, 1987). Between the concept-as-measured (variable) and the concept-as-intended (construct) there is a gap, caused by the occurrence of random error and bias in a study. To judge the quality of the research design, two main criteria need to be discussed: reliability and validity (Swanborn, 1987).

Reliability

Reliability concerns the extent to which an experiment, test, or any measuring procedure yields the same results on repeated trials (Carmines & Zeller, 1979). In general, there are two ways to analyse reliability: replication or a retest method, and internal consistency (Carmines & Zeller, 1979; De Heus, Van der Leeden & Gazendam, 1995). In this study, data are collected at one point in time, thus ruling out the possibility of replication. However, when the different items of a scale intend to measure the same phenomenon, they can be regarded as repeated measurements. Although repeated measurements of the same phenomenon never precisely duplicate each other, they tend to be consistent from measurement to measurement (Carmines & Zeller, 1979). In that case, the

4 A variable is an observed unit which is operationalised empirically by measurement (Bacharach, 1989).

5 A construct is an approximated unit which by its nature cannot be observed directly (e.g. centralisation, or culture) (Bacharach, 1989).

popular Chronbach's alpha (α) can be used to measure internal consistency and estimate reliability (Carmines & Zeller, 1979). Internal consistency or a high degree of interrelatedness between scale items is a necessary but not sufficient condition for homogeneity. In other words, even if a scale has a high alpha, and hence free of error associated with the use of different items, it does not mean it has a straightforward or unambiguous interpretation (Cortina, 1993). To determine the unidimensionality of a scale I use Principal Component Analysis (PCA). A scale is homogenous when the eigenvalue of the first component (λ_1) is larger than 1, and the eigenvalues of the next components are smaller than 1 (De Heus et al., 1995). In essence, alpha can be used as a confirmatory measure of unidimensionality or as a measure of the strength of a dimension once the existence of a single factor has been determined (Cortina, 1993). The value of Chronbach's alpha is usually judged by using a rule of thumb. As a rule[6], recommended critical values are 0,70 for Cronbach's alpha (Cortina, 1993). Others consider Chronbach's alpha very good when greater than 0,80, acceptable when alpha is between 0,60 and 0,80 and, unacceptable when below 0,60 (De Heus et al., 1995). In **chapter 6** I will discuss the reliability for each scale in detail.

Validity

Validity concerns the crucial relationship between concept and indicator. Validity can be defined as the extent to which any measuring instrument measures what it is intended to measure (Carmines & Zeller, 1979). In other words, does the concept-as-measured represent the concept-as-intented (De Groot, 1961; Swanborn, 1987). There are several types of validity that are considered relevant in the social sciences like external validity, content validity, construct validity, and internal validity (Swanborn, 1987; Yin, 1994).

External validity refers to the generalisability of the research findings or the extent to which the conclusions are valid beyond this study. The generalisability of the findings of this study was discussed under the non-response analysis (section **5.6**). Content validity depends on the extent to which an empirical measurement reflects a specific domain of content (Carmines & Zeller, 1979; Swanborn, 1987). Construct validity is concerned with the extent to which a particular measure (concept-as-measured) relates to the theoretical construct (concept-as-intended) (Swanborn, 1987;Yin, 1994). Hutjes and Van Buuren (1996)

6 Important when interpreting alpha is to keep in mind that alpha depends on the number of items in the scale, and the average interitem correlation (Carmines & Zeller, 1979; Cortina, 1993). A high alpha may coincide with low interitem correlation or a high number of items.

propose two tactics to enhance content validity ('face value') and construct validity: *peer debriefing* and *member check*. *Peer debriefing* means asking fellow researchers and experts to check interpretations and tailor the questionnaire to the SME domain and e-business content. The draft-questionnaire has been discussed with five Syntens consultants, two commercial SME consultants, and EIM. In addition, two master students[7] dedicated their thesis research to the development and evaluation of (part of) the questionnaire. *Member ch*eck involves asking the parties involved in the study to check interpretations and data. The aforementioned master students presented and discussed concepts and the questionnaire with several SME owners/directors. As Swanborn (1987) suggests, the interviews involved discussing the given answers with the entrepreneurs to make sure that language and meanings used in the questionnaire are common in their daily life, and questions and terms were unambiguous. For example, both peer debriefing and member check revealed that the entrepreneurial orientation scale of American origin contained language that in American culture does not raise eyebrows, but has rather negative connotation in the Dutch culture. Both peer debriefing and member check enhanced the face validity of the questionnaire. The comments collected on the draft-questionnaire have been used in the final version. The comments will be discussed in detail under their respective constructs.

Internal validity concerns the quality of the conclusion from the entire research design. Yin (1994, p. 33) defines internal validity as 'establishing a causal relationship, whereby certain conditions are shown to lead to other conditions, as distinguished from spurious relationship'. Two types of internal validity can be distinguished (Swanborn, 1987). Statistical conclusion validity refers to the correctness of the conclusion that a statistical relation is presence or absent. Validity of causal interpretation refers to the acceptability of the conclusion that a statistical relation can be interpreted as causal. In principle, directly observing causal relationships in a cross-sectional survey is impossible, as all data have been collected at one point in time. However, causal relations may be inferred in this type of research when three conditions are met (Swanborn, 1987). First, there has to be a statistical relation. Evidently, statistical analysis can demonstrate hypothesised relationships between variables. Second, as all variables are measured at the same time, we do not know anything about the time order.

7 Pieter Peelen's thesis dealt with measuring e-business adoption in trade processes (Peelen, 2001). Piet Wessels tested and evaluated the questionnaire used in this study (Wessels, 2002).

As such, in addition to statistical relations I use theory to support causal directions among variables. Third, I need to ascertain that the statistical relationships found between two variables are not caused by one or more other variables. In **chapters 7** and **8**, I will discuss the consistency and completeness of the theoretical model used on the basis of the research findings.

6 Operationalisation of constructs

In this chapter, the constructs from the theoretical model **(chapter 4)** are operationalised into measurable variables. For each construct as described theoretically in **chapter 4**, one or more indicators are selected and measurement is discussed. Factor analysis and Chronbach's alpha are used to test unidimensionality and inter-item reliability where indicators consist of different items (details on factor analysis can be found in **appendix 6.1**). For some constructs existing scales are used, however for many constructs new scales are developed. SMEs and SME experts were consulted to enhance the validity of the indicators used. As I will discuss in detail, this procedure resulted in the adaptation of some of the existing scales and the development of new measurements. In addition, I will go into the limitations of each operationalisation. To illustrate the operationalisation of the constructs into empirical variables, the descriptive results from the survey are used. In addition, some illustrative examples from Syntens' consultancy practice related to the project 'Nederland gaat Digitaal' (*The Netherlands goes Digital*) are presented. At the end of the chapter an overview will be presented with all the constructs and their respective indicators (**6.6**).

6.1 Value creation

To operationalise value creation, I used the work of Riggins (Riggins, 1999; Riggins & Mitra, 2001), complemented by other sources of literature and empirical research (for example Chappell & Feindt, 1999; Riggins, 1999; Snelders & Eecen, 2001). A list of possible consequences of e-business was composed and evaluated and supplemented through expert opinion. During the pilot test some adaptations were made to the list (Wessels, 2002). The negative consequence 'higher costs' was eliminated from the list of otherwise positive consequences. I decided to add an open question about negative consequences of e-business adoption (more on this later in this section). As a result of the test interviews the item 'improved company image' was added to organisational value creation (an example of improved company image is presented below). Some categories were combined to lower the number of options. The items 'improved communication with suppliers' and 'improved communication with customers' were combined into one option, as were the items 'new products' and 'new services'.
An overview of the final list of items is given in **appendix 6.2**.

Example Improved company image

TTE (Technical Training Equipment) is a small company specialised in building training, test and tuning equipment for the automotive industry. One of their main goals for electronic business is to position the company in the market as the European specialist for test equipment. Today, their website www.tte-international.com *gives an overview of their specialised assortment and an impression of their 'nothing-is-impossible' attitude to customised products. The company indicates that due to the website their marketing costs decreased (less brochures to be sent), their name becomes known in the market and they now register an increasing number of international visits to their website.*

In **table 6.1** the survey results for the various items of value creation are presented. Notably, the frequencies for items referring to organisational value creation are all higher than items referring to strategic value creation. Of the respondents 9% indicates that no value has been created by electronic business; 4% do not know. Closer inspection of the specified Other consequences

of e-business mentioned by 5% of the respondents, did not reveal distinct additional categories of consequences.

Table 6.1 Results for value creation (n=559)

Type of value creation	Item	%
	None	9
Organisational	Saving time/money	60
	Improved company image	49
	Improved communication with suppliers and customers	47
	Improved customer service	41
	Improved communication between employees	36
Strategic	Opening up an additional market channel	23
	Offering a new product or service	19
	Opening up a new market	18
	Higher turnover	11
	Other	5
	Don't know	4

Factor analysis of all value creation items shows that value creation clearly consists of two distinct components, labelled as organisational value creation (five items) and strategic value creation (four items). The results of the factor analysis are in **table 6.2**. Notably, a higher turnover is connected to new markets, new market channels, and new products and services. A practical example of strategic value creation is presented below. The scales for organisational value creation (VCO2) and strategic value creation (VCSTRAT2) appeared homogenous and reliable with acceptable Chronbach's alpha 0,69 and 0,67 respectively (**table 6.17**). For each scale a sum-variable is calculated by adding up the item-scores. **Table 6.17** shows the descriptive statistics for the variables.

Generally, every operationalisation is a relatively random empirical specification of the concept that, to a certain extent, covers the meaning of concept as intended (De Groot, 1961). Ergo, the operationalisation of value creation has its limitations. Most importantly, the operationalisation is qualitative, which

means we do not have insight into any quantitative effect of creating new economic activity like job creation, profit, or the number of new products.

Table 6.2 Factor analysis of value creation (n=559)[a]

	Component	
Items for value creation	**1**	**2**
Opening up a new market		0,741
Higher turnover		0,707
Opening up an additional market channel		0,692
Offering a new product or service		0,646
Improved communication with suppliers and customers	0,704	
Improved communication between employees	0,687	
Improved customer service	0,641	
Improved company image	0,627	
Saving time/money	0,600	

a Principal component analysis with Varimax rotation; all factor loadings below 0,400 are hidden.

Example: Strategic value creation

Piet Daane is a baker in the town of Vlissingen specialised in the regional speciality of the 'Zeeuwse bolus', a delicious sweet, and sticky white roll. Daane had the ambition to expand his market from his hometown to the whole of the Netherlands. He complemented his website www.zeeuwsebolus.nl with an online order-form. When customers order a number of 'bolussen' on his website before 10 AM, the delicacies are delivered the next day at their address. Viewing the guestbook on his website proves that people from all over the country now order the regional delicacy from the province of Zeeland. The entrepreneurs' matter-of-factly comment to entering new markets: 'everyone on the Net is equally big and all opportunities are equal.'

Table 6.3 displays the survey results in a crosstabulation of both types of value creation. A majority of firms (82%) indicate at least one form of organisational value creation from saving cost and time or improving communication. In contrast, only 38% of the respondents report some form of strategic value creation from e-business adoption. This indicates that the exploitation of e-business opportunities usually leads to the improvement of existing ways of working, rather than creating new ways of working. In other words, only a minority of firms succeeds in exploiting e-business opportunities in an entrepreneurial way.

Table 6.3 Crosstabulation of organisational by strategic value creation (n=540)

Strategic value creation	Organisation value creation							
	0	1	2	3	4	5	Total	
0	83	76	61	51	41	24	336	62%
1	12	14	21	25	21	10	103	19%
2	2	9	10	13	13	11	58	11%
3	1	1	4	5	10	6	27	5%
4	0	0	0	0	4	12	16	3%
Total number of firms	**98**	**100**	**96**	**94**	**89**	**63**	**540**	**100%**
	18%	**19%**	**18%**	**17%**	**17%**	**12%**	**100%**	

The list of types of value creation contains positive consequences of e-business only. However, companies may also experience negative effects like increased costs or loss of personal contact. As I could not find any empirical research into negative outcomes of e-business[1], an open question regarding possible negative consequences was added to the questionnaire. The results from the survey regarding the negative consequences of e-business adoption will not be used in further analysis, because of the low response (n=158). Nevertheless, the findings are instructive enough to report. Analysis of the results showed that 26% of the respondents reported negative consequences of e-business adoption. Analysis of the survey data revealed seven broad categories of negative consequences, presented in **table 6.4**. However, a large amount of answers (Other) were

1 Some negative consequences of e-business were investigated in a recent study by TNS-NIPO for the Ministry of Economic Affairs (Snelders, 2004). Of the 1500 respondents, 30% indicated less personal contact, 11% higher cost and 6% a higher administrative burden.

difficult to classify as they show a wide array of negative implications. Some examples: 'potential guests shop around so that prices are put under pressure', 'the number of phantom reservations, you always have to check if a reservation is correct or not', 'the expected speed of response', and 'e-mails sometimes do not arrive at the right person'. Most respondents experience the dependency on the information technology and the susceptibility to breakdown as the most negative consequence, followed by diminished personal contact and cost.

Table 6.4 Results for negative consequences of e-business adoption(n=158)

Negative consequences of e-business adoption	%
Dependency/Susceptibility to breakdown	30
Less personal contact	16
Cost	16
Virus/spam	13
Increase amount of work/time	12
No check on abuse	3
Increase in paperwork	3
Other	21

6.2 E-business adoption

E-business adoption is operationalised using two variables:

- ***Business process support:*** which business processes are supported by which ICT applications?
- ***Intensity of use:*** how much, how often or how widespread is the innovation being used in the company?

6.2.1 Business process support

The support of business processes in a firm by ICTs consists of two elements: business processes and ICT application.

Business processes

In the literature review, I found various authors that consider the support of business processes as an indicator of e-business adoption (**2.2.1**). However, none of these studies looks at a company in its entirety. Usually only one particular business process is considered, like the sales process. In addition, the list of business activities for the business process concerned is not put together in a systematic way.

In order to arrive at a structured list of business processes, I used Porter's value chain model as the basic company model: (Porter & Millar, 1985). Porter recently showed the usefulness of his model for identifying opportunities for business process support with the application of the Internet (Porter, 2001). However, some SMEs have difficulty in recognising their business in Porter's model, as it is oriented towards traditional producing companies and because well-defined 'departments' often not exist (Peelen, 2001). In IS publications, the business processes of a company are sometimes grouped by the different actors, with which information is exchanged (for example Kambil & Van Heck, 1998; Broadbent & Weill, 2000). For business use of the Internet, a categorisation is possible in three main areas: customer relations, dealing with suppliers, and internal company operations (see also Applegate, Holsapple, Kalakota, Radermacher & Whinston, 1996; Shaw, Gardner & Thomas, 1997; Chappell & Feindt, 1999; Den Hertog, Holland & Bouwman, 1999; Keating, Metz, Holcomb, Nicholson & Jones, 1999; IDC, 2002). Combining Porter's model with these views, I divided all

business processes of a company in three categories: supply, organisation and sales. Examples of supporting these processes with the Internet are presented in the text below.

Example Supporting the supply process

Many smes now order their supplies and raw materials through the Internet. However, finding and comparing suppliers and their offerings on the Internet can take a lot of time. Electronic marketplaces facilitate the supply process by offering an overview of potential suppliers. Examples of electronic marketplaces are www.verpakkingen.com *for packaging materials,* www.floweraccess.com *for flowers and plants,* www.fashionunited.com, *linking retailers to their fashion suppliers, and* www.steeltrading.com, *for the exchange of carbon steel products.*

To assess the extent of support for supply, organisation and sales by ICTs, I next identified what activities take place within these processes. In the literature review, several authors specify activities that are supported by the Internet or e-mail. The activities, usually for the supply and sales process, are often derived from commercial, exchange or trade processes. However, a systematic approach to the specification of activities is often lacking. Three models were considered to represent the activities of the trade process in general: the business market process model by Anderson and Narus (1999), the model of exchange processes by Kambil and Van Heck (1998), and the general commerce model by Nissen (1997). Comparing these models, five main activities could be identified in the trade process: search, specification, fulfilment, payment and after sales service. Next, these main activities were split up into 40 sub-activities (Peelen, 2001). As they are both trade processes, the list was used to identify the activities of the supply and sales process. Because of the time-limit set to fill out the questionnaire, the list of activities was reduced using expert opinion and relevant literature (for example Kambil & Van Heck, 1998; Van Doorne & Verheijen, 2000; Porter, 2001).

Example Supporting the sales process

Elka Air has over thirty years of experience in air humidification. To improve their turnover, Elka decided to set up a website primarily targeted at informing potential international customers, as in general little is known about air humidification. On their website www.elka-air.com e*xtensive multi-lingual information can be found on atomisers, humidifiers, air dryers, and so on. The site now generates an increasing amount of international requests.*

Few specific e-business studies exist, to help specify the third category of business processes: organisation. In the literature review, I noticed that e-business is usually limited to the support of supply (e-procurement) and sales processes (e-commerce) by ICTs. Although the support of intra-organisational processes by ICTs may not strictly be regarded as 'business', I nevertheless include the support of the organisation for two reasons. First, benefits are just as well to be gained by supporting the internal organisation with for instance the Internet (for example Applegate et al., 1996; DTI, 2001; Porter, 2001). The example of Pranger below illustrates this point. The importance of sharing information within the organisation is also recognised in literature on market orientation and business success (Narver & Slater, 1990). Second, it was observed that positive experience with for example e-mail and the Internet within the organisation can motivate SMEs to support processes with external parties as well (Wessels, 2002).

Example Supporting the internal organisation

*Pranger Credit Management (*www.pranger.nl*) offers bailiff and collecting services and employs around 35 people. Pranger had the ambition to improve their efficiency and customer service by supporting their business processes with ICTs. The company managed to improve its turnover and at the same time cut costs by realising a nearly paperless office. Clients of the company can now monitor the status of their outstanding bills on a secured website, 24 hours a day, seven days a week.*

Within each organisation, important processes like human resources management, operations, general management and, quality management take place. Yet, for different types of organisations, different business processes will be relevant. For example, a machine manufacturer relies heavily on its R&D department, whereas a consultancy firm will not. I discussed the relevance of various intra-organisational processes for different lines of business with consultants. I also asked them to particularly consider, for which business activity electronic business could be beneficial. This procedure led to a final list of activities for the three distinguished categories of business processes: supply, organisation and sales (see **appendix 6.2**).

ICT application

Business processes can be supported by various ICT applications. In practice, entrepreneurs do not restrict their perception of electronic business to the use of Internet-based e-mail or the Internet. For example, SMEs often mention electronic banking as a way of doing electronic business, either via the Internet or through direct access (Snelders & Eecen, 2001). With regard to electronic business, most authors look at the use of Internet-related applications (**chapter 2**). The use of various terminologies like www, 'the' Internet, e-mail, intranet, can be confusing. According to Applegate et al. (1996), we look at different levels of electronic commerce. In my view, focussing too much on correct technical terminology could divert the attention from the purpose of the investigation. This research is aimed at assessing *how* business processes are supported. In that respect it is relevant to know what applications are used to support those processes. However, I could find, for example, a company using e-mail facilities on an internal network (LAN) for its internal communication. In that case, the fact is accepted that the network is not based on the Internet-protocol, and thus this type of e-mail is regarded as electronic business as well. Consequently, spoken language is preferred to identify applications instead of technical terms. In this study, the focus is on the use of e-mail and the Internet to support business processes.

I combined the three business processes and the two types of ICT applications into six variables (E21TOT, I21TOT, E23TOT, I23TOT, E25TOT, and I25TOT). Each variable indicates the use of either e-mail or Internet in the supply, internal or sales

process. The scales consist of 8 to 9 items representing the business activities for each respective business process. For each business activity the respondent indicates if e-mail or Internet is used (dichotomous measurement level: 0/1). Scale statistics show that the scales are homogenous and reliable with Chronbach's alphas between 0,80 and 0,85 (see **table 6.17**).

The results of the survey for all six scales are presented in **table 6.5**. For each business process and their respective activities, there are clear differences in ICT support. In the supply process, e-mail is mainly used to request quotations (57%) and order products or services (53%); Internet is used in particular as a source of information on suppliers (80%) and products or services (67%), and for electronic banking (63%). Overall, within the organisation the frequencies of business activities support are lower compared to the supply and sales process. In the internal process, e-mail is mainly used to support internal communication (49%); the Internet is also used as a means to recruit new personnel (38%) and for knowledge management (31%), and. In the sales process, e-mail mainly supports quotations (51%) and the provision of information on the company and its products or services (46%). The Internet provides a source of information on customers and competitors for most firms (71%). Most firms use the Internet as a means to provide information on their company and products or services (63%). Overall, the 'passive' use of the Internet predominates in Dutch SMEs, for example as a source of information on suppliers and customers or for electronic banking. More 'active' use is found less frequently, for example when a firm uses the Internet to provide information about its products or recruit new personnel.

Table 6.5 Results for business process and activities support (n=614)

Percentage of firms

Business process		Orginal Items	E-mail	Internet
Supply process	1	Searching information about suppliers	43%	80%
	2	Selecting products/services	25%	67%
	3	Requesting quotations	57%	36%
	4	Ordering a product or service	53%	36%
	5	Inquiring about logistics	35%	37%
	6	Receiving invoices	16%	7%
	7	Payment of supplies/ electronic banking	8%	63%
	8	Electronically receiving products/services	34%	34%
	9	After sales-service	48%	36%
Internal process	1	Human resource management	20%	29%
	2	Quality management	23%	30%
	3	General management	29%	22%
	4	Process management	17%	15%
	5	Communication between employees	49%	17%
	6	Recruitment of new personnel	18%	38%
	7	Teleworking	15%	20%
	8	Knowledge management	28%	31%
	9	Taking courses and education	7%	14%
	10	Electronic approval of contracts, invoices, etc.	15%	9%
Sales process	1	Looking for information on customers and/or competitors	22%	71%
	2	Offering information on the company and its products/services	46%	63%
	3	Assisting customers with purchasing	35%	29%
	4	Quoting	51%	13%
	5	Receiving orders	39%	18%
	6	Offering logistics information	27%	18%
	7	Sending invoices	9%	3%
	8	Offering the possibility of electronic payment	6%	23%
	9	Electronic delivery of products or services	17%	14%
	10	After-sales service	39%	18%

In order to arrive at homogenous and robust measurement scales some items were removed from the original list of items for business process support (**appendix 6.2** provides an overview of the original items and the items removed). From the original list of items for the supply process supported by e-mail (E21TOT) the item 'Paying supplies/telebanking' was dropped due to low communality and very low mean value. Apparently, initiatives like Paypal© are not commonly used. From the original 10-item scale for the supply process (I21TOT) the item 'receiving invoices' supported by Internet was removed, due to low communality and a very low mean value. Although some telephone companies present their invoices online, only a very few firms indicated this option. From the original list for the internal process supported by e-mail (E23TOT) two items were removed: 'Taking courses and education' and 'Electronic approval of contracts, invoices, certificates, etc.'. Both items had very low communalities. From the original 10-item list for the internal process supported by the Internet (I23TOT) two items were removed: 'Teleworking' and 'Electronic approval of contracts, invoices, certificates, etc.'. Both items had very low communalities. For the sales process the items 'Offering the possibility of electronic payment' and 'Sending invoices' supported by e-mail (E25TOT) were dropped as they did not fit the scale and had very low means. From the original 10-item list for the sales process supported by the Internet (I25TOT) the item 'Sending invoices' was dropped due to low communality and mean. Two factors emerged with an eigenvalue over 1 in the factor analysis for this scale, due to the very high means of two items (0,71 and 0,63) in contrast to the other items (means between 0,14 and 0,29). These items, 'Looking for information on customers and/or competitors' and 'Offering information on the company and its products/services' were frequently reported as supported by the Internet. Both items loaded high (> 0,5) on both factors. For these reasons, the lack of unidimensionality is ignored for this scale. **Table 6.17** presents the descriptive statistics for each scale.

In further analysis a sum-variable is used for each business process. For the supply, internal and sales process, a sum-variable is calculated by adding up the scores on e-mail and Internet for each item. The resulting three new variables (TOT21, TOT23, and TOT25) indicate whether either e-mail or Internet is used to support the business process. The items that were removed from the e-mail and Internet lists of items are disregarded for the new variables.

In **table 6.6** the results of the survey are presented for business process support, which is the number of business activities supported by either e-mail or Internet for each business process. The findings indicate that most firms support the supply process with e-mail or Internet. The average number of supply activities that are supported is 5,1 (of a maximum number of 8 activities). Of the 8 sales activities presented, an average of 3,7 activities is supported by e-mail/ Internet for the firms in the sample. Activities within the organisation are the least supported by e-mail or Internet. The firms in the sample indicate that out of the 9 activities presented, an average number of 3,2 activities is electronically supported. Of the total number of 25 business activities presented in the survey, firms indicate they electronically support an average of 12 activities with e-mail and/or Internet.

Table 6.6 Results for business process support (n=614)

Number of business activities supported by either e-mail or Internet	Supply process		Internal process		Sales process	
	Firms	%	Firms	%	Firms	%
0	66	11%	177	29%	99	16%
1	16	3%	65	11%	48	8%
2	36	6%	62	10%	59	10%
3	40	7%	53	9%	80	13%
4	66	11%	47	8%	76	12%
5	69	11%	39	6%	79	13%
6	90	15%	49	8%	65	11%
7	93	15%	46	8%	67	11%
8	138	23%	53	9%	41	7%
9			23	4%		
Total number of firms	**614**	**100%**	**614**	**100%**	**614**	**100%**
Average number of supported activities	**5,1**		**3,2**		**3,7**	

The main limitation of this operationalisation is the emphasis on business processes support with e-mail and the Internet. This means that the measure insufficiently addresses new products and services based on Internet-technologies. In **chapter 7**, I will use empirical findings to illustrate this issue. Further, the operationalisation is limited to the use of e-mail and the Internet. Originally, I also included applications of mobile data communication like text messaging (SMS), WAP, GPS, and applications on hand held terminals. However, only a small percentage of the respondents indicated the use of mobile data communication (around 2%) and therefore these ICTs were dropped from the analysis.

6.2.2 Intensity of use

In the e-business adoption literature review, I found some measurements that relate to frequency or volume of use (for example Teo, Lim & Lai, 1997, 1999; Busselle, Reagan, Pinkleton & Jackson, 1999; Teo & Choo, 2001). However, the fact that, for example, a salesperson uses the Internet every day does not render into a measurement of relative importance of the Internet for the job. Neither does it give us information about the amount of use of the Internet compared to more conventional methods of communication like mail, fax, or telephone. Research showed that carefully measuring the amount of use of e-business applications is possible, but very complicated and laborious (Peelen, 2001). To limit the length of the questionnaire, I decided not to answer these questions in detail. I prefer to follow the suggestion of Lassila and Brancheau (1999), to measure the *reliance* on the technology to get the job done. To assess to what extent a business process relies on the use of ICTs (in this study e-mail and Internet), I simply ask what the consequence would be for the business process, supposedly the firm cannot make use of e-mail or Internet, for example due to a defect. The reliance on ICT is measured for each type of business process: supply process, internal process and sales process. The scale measurement level is quasi-interval, and answering options are (reversed) 1 ='the business process experiences no inconvenience', 2 = 'the business process experiences little inconvenience', 3 = 'the business process experiences a lot of inconvenience', to 4='the business process is idle'. The new variable 'Reliance on ICT' (RELIAN2) was constructed by averaging the scores on the three items. Analysis shows that the scale is unidimensional and reliable with Chronbach's alpha 0,87 (**table 6.17**).

Even though the variable is reliable, it will not be used as such in further analysis. The variable 'Reliance on ICT' gives, in broad outlines, information about the dependence on ICT for the entire firm. However, the reliance on ICT may be different for each type of business process. **Table 6.7** below presents the empirical findings for the three individual items for 'Reliance on ICT'. The data indicate that, being highly dependent on ICT in the sales process does not mean a firm relies just as much on ICT for its supply process. The firms differ in their dependence on ICT for different business processes: 24% of the respondents indicate serious hindrance (a lot of inconvenience or idle) to the supply process when e-mail or the Internet would be defect. Regarding the sales and internal processes, 27% and 28% of the respondents respectively, indicate serious inconvenience for the continuation of business. For further analysis, I will therefore use the individual items of reliance on ICT, representing the intensity of ICT use in each business process (RELIANSP, RELIANIN, and RELIANSA). This information is more specific and realistic than the previously introduced variable for the overall reliance on ICT (RELIAN2) in a firm.

Table 6.7 Results for reliance on ICT by type of process (n=614)

	When e-mail or Internet fail, the business process experiences...					
Business process	**No inconvenience %**	**Little inconvenience %**	**A lot of inconvenience %**	**Is idle %**	**Don't know %**	**Total percentage of firms %**
Supply process	37	38	23	1	2	100
Internal process	45	26	27	2	1	100
Sales process	38	35	26	2	2	100

When a respondent indicated that none of the three business processes supply, organisation and sales is supported by either e-mail or the Internet, the missing values for RELIANSP, RELIANIN, and RELIANSA (73, 86 and 76 respondents respec-

tively) were recoded into answering option 1 ='the business process experiences no inconvenience'. The business processes will not be hindered by the defect of e-mail or Internet, simply because the firm does not use them for business process support. **Table 6.17** presents the descriptive statistics for the three variables. Evidently, the single item indicators are more specific, yet less reliable indicators than the three item, overall indicator for 'Reliance on ICT'(RELIAN2). Further, they give an informative but rough approximation of how much the firm depends on ICT, and do not give detailed insight into the intensity of use like the number of hours that the applications are used or the diversity of software features.

6.2.3 E-business adoption

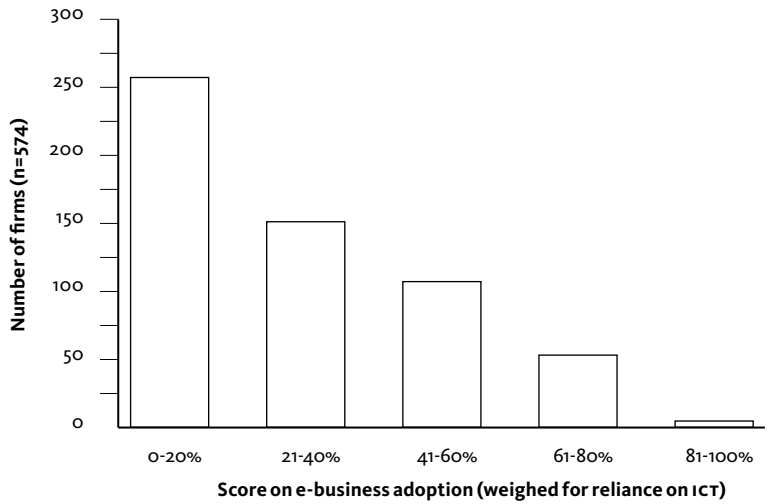
To incorporate the intensity of use into a measurement of e-business adoption, the score on each of the three variables for business process support is weighed by the score on reliance on ICT for each process respectively. The variable 'Supply process supported with e-mail/Internet' is multiplied by 'Reliance on ICT-supply process', 'Internal process supported with e-mail/Internet' is multiplied by 'Reliance on ICT-internal process', and 'Sales process supported with e-mail/Internet' is multiplied by 'Reliance on ICT-sales process'. The resulting three weighed variables (TOT21W, TOT23W, and TOT25W) are then added up to form the new variable 'E-business adoption' (EBUSADG3). **Table 6.17** shows the descriptive statistics for e-business adoption.

The variable e-business adoption represents business process support by either e-mail or Internet in the supply, internal and sales processes, where the use of ICTs is weighed by the reliance on the technologies for the respective business process. Ergo, the maximum score for e-business adoption is 100% when all business activities indicated, 8 activities for the supply process, 9 for the internal process, and 8 for the sales process, are electronically supported, *and* each process completely relies on ICT (the maximum score on reliance on ICT is 4). In the sample, the responding firms indicated they support an average of 12 out of the 25 specified activities (48%) by e-mail or the Internet (business process support). However, when the intensity of use is taken into account, and business process support is weighed by the reliance on ICT, the average supported number of activities is reduced to 6,9 out of 25 (28%)[2].

2 The maximum score on e-business adoption is the total number of supported activities per process taken into account the maximum reliance on ICT = 8*4 (supply)+9*4 (internal)+8*4 (sales)= 100. The actual weighed score on e-business adoption is 27,8. Ergo, on average 6,9 (=27,8/4) out of 25 activities are supported.

In **table 6.8** a histogram is presented of the scores on e-business adoption. By combining business process support and the reliance on ICT we get a more realistic view on e-business adoption. In effect, business process support looks at the *width* of e-business adoption, and reliance on ICT looks at the *depth* of e-business adoption (**2.3.1**) (Robertson & Gatignon, 1985). The results of the survey show that for most firms the width and depth of e-business adoption is limited.

Table 6.8 Results for e-business adoption (weighed) (n=574)



6.3 Perceived opportunity characteristics

In the review on e-business research in **chapter 2** I identified many studies that use perceived innovation characteristics as a determinant of adoption on the individual as well as the firm level. As I noticed earlier, although most studies deal with Internet, www, or e-mail, they actually look at the opportunity the technology offers rather than the technology itself. A firm will evaluate the attributes of this opportunity in terms of possible value creation for the market and the firm, and feasibility for the company. So, I used existing scales for per-

ceived relative advantage, compatibility and complexity as a basis to construct new scales concerning perceived characteristics of e-business opportunities on firm level. Point of departure for writing the items is that the perceived characteristics concern the *opportunities* that e-business offers, and not the characteristics of e-mail or the Internet. The items for the three sub-constructs have been written in close collaboration with Syntens' consultants in order to stay close to SME reality. EIM provided feedback on the final wording of the items. In this study, perceived relative advantage is conceptualised as the degree to which an organisation believes that value can be created with e-business. For this sub-construct four items were chosen. The pilot test suggested including the improvement of the company image by e-business as a perceived relative advantage of e-business (Wessels, 2002). In this study perceived compatibility refers to the degree to which an organisation believes that e-business is congruent with the values and norms of the company, and with existing practices within the company and its value chain. For perceived compatibility four items were selected. Perceived complexity is conceptualised here as the degree to which an organisation believes that e-business is difficult to understand, oversee and use. For perceived complexity two items were chosen. All items are measured on a five-point Likert-scale, where the choices range from 1 = 'totally disagree', to 5 = 'totally agree'. The list of original items can be found in **appendix 6.2**.

After factor analysis of the whole 10-item scale, one of the items for perceived complexity is removed on account of low communality (below 0,3). The item 'we do not worry about the security of e-business' does not fit well in the factor-solution. The remaining 9-item scale shows a two-factor solution after Varimax rotation (see **table 6.9**). The two factors can be labelled as perceived relative advantage and perceived compatibility. Two items however load relatively high on both factors. With hindsight, the second item for perceived complexity 'we have enough knowledge available in the company for e-business' apparently is more a measurement of compatibility than of complexity. Both this item and the item 'In our company there is a lot of interest in e-business' load on compatibility as well as perceived relative advantage. Conceptually, I choose to include both items in the compatibility variable. **Table 6.17** shows that the scales for perceived relative advantage (RELADV) and perceived compatibility (COMP) are both homogenous and reliable with Chronbach's alpha 0,86 and 0,82 respectively.

The new variables 'perceived relative advantage' and 'perceived compatibility' are constructed by averaging the scores on the individual items in their respective scales. **Table 6.17** provides the descriptive statistics for both variables. The operationalisation of perceived opportunity characteristics resulted in indicators for only two of the three conceptualised sub-constructs. The lack of a measure of perceived complexity limits the scope of the perceived opportunity characteristics to perceived relative advantage and perceived compatibility.

Table 6.9 Factor analysis of perceived opportunity characteristics[a]

Item	Component 1	Component 2
Electronic business allows a company to better serve its customers	0,845	
Electronic business can save a company costs and/or time	0,837	
Electronic business is important to keep up with the competition	0,804	
Electronic business enables new products or services	0,759	
Our customers are completely ready for electronic business		0,865
Our products or services are very suitable for electronic business		0,737
Our suppliers are completely ready for electronic business		0,699
In our company there is a lot of interest in electronic business	0,583	0,602
We have enough knowledge available in the company for electronic business	0,478	0,507

a Principal component analysis with Varimax rotation; all factor loadings below 0,350 are hidden

6.4 General firm characteristics

In my theoretical model, I proposed that the following general firm characteristics are related to e-business adoption: the level of formal education, the sophistication of IT infrastructure, customer and competitor orientation, the use of the environment as a source of ideas, and an entrepreneurial orientation. Below I discuss the operationalisation of each variable.

The level of formal education

As an indicator for the level of formal education in the firm, I choose the percentage of employees with a university or higher vocational training (PERCHOPL). To

calculate the percentage I divided the absolute number of employees with a particular education by the total number of employees in the company. In 25 cases the exact number of employees is missing. In these cases the average number of employees was calculated from the class of size. For example, in the analysis a number of 4,5 employees is taken for a firm in class of size 0 to 9 employees. Disregarded were 15 cases because the number of employees with a university or higher vocational training is greater than their total number of employees. The descriptive statistics are in **table 6.17. Table 6.10** presents the summarised empirical results (the scale from 0 to 100% was recoded into 5 classes). Evidently, in most firms (78%) less than 20% of the employees has a university degree or a higher vocational training. A high number of firms (n=257, 43%) indicate they have no employees with higher formal training. These empirical findings point out that the chosen variable is not detailed enough to show for variance in the level of formal education. The variable has a peaked and skewed distribution. Looking back on this operationalisation, I suggest for further research to make a distinction between university training, higher professional/vocational training (HBO), and vocational training (MBO). That way, the level of formal knowledge will be represented in more detail.

Table 6.10 Results for the level of formal education (n=599)

Percentage of employees with a university or higher vocational training	% of firms
0-20%	78
21 -40%	10
41-60%	5
61-80%	2
81-100%	6
Total	**100**

Sophistication of IT infrastructure

To indicate IT knowledge and experience, I prefer to consider the IT infrastructure in the company. I assume that the more sophisticated the IT infrastructure is in the firm, the more knowledge and experience with IT has been accumulated. To indicate the use of IT different IT growth-models can be used (Stroeken & Coumans, 1998). IT growth-models aim at assessing and classifying the use of information technology. Examples of these models can be found in Tan (1995), Nolan (1991), and Venkatraman (1991). As Stroeken and Coumans (1998) observe, it is difficult to assess the actual use of IT in an SME, as IT use has different aspects. They discern IT strategy, technical infrastructure, and IT organisation. Stroeken and Coumans therefore developed an IT-scenario method that is meticulous, yet laborious as it contains 27 questions.

The time restriction on the questionnaire made me decide for a single indicator. Syntens' consultants advised me to look at features of IT infrastructure that are easily identifiable by SME respondents. Respondents were presented with a multiple response question. The five items, with a dichotomous measurement level: 0/1, each describe the IT infrastructure in the firm with increasing complexity (descriptions are abridged):

0 'Not at all computerised, no computers'
1 'One or more business functions (like production or sales) are computerised'
2 'Various business functions are computerised, computers are connected in an internal network'
3 'Various business functions are computerised, we use an integrated information system'
4 'Various business functions are computerised, connected to another party in the supply chain'
5 'Do not know'

To obtain one score on the variable sophistication of IT infrastructure, some recoding was necessary. Although the question had not raised any problems in the pilot test, the multiple response character of the question apparently was not clear to some respondents. For example some respondents ticked option 3, indicating that several business processes in their firm are computerised, and their firm operates an integrated information system, but did not tick options

1 and 2. I calculated the new variable as follows. The sophistication of IT infrastructure equals:

0 when options 1 to 5 are not ticked
1 when option 1 is ticked and, options 0, and 2, 3 and 5 are not.
2 when option 2 is ticked and, options 0, 3, and 5 are not.
3 when option 3 is ticked and, options 0, 4 and 5 are not.
4 when option 4 is ticked and options 0, and 5 are not

Some 33 firms indicated that in their firm one or more functions are computerised and connected to another party in the supply chain. These firms did not indicate having either a network or information system. I chose to classify the IT infrastructure in these firms as option 1 ('One or more functions computerised'). A further 18 firms indicated that various business functions are computerised; they have a network (but not an information system) and are connected to another party in the supply chain. I chose to classify the IT infrastructure in these firms as option 2 ('Various business functions are computerised, computers are connected in an internal network'). The logic behind both reclassifications is that having an external connection only does not imply a higher, more sophisticated level of IT use. For example, a SME has an EDI connection to a large customer, however all incoming messages are manually processed as the firm does not have a network and/or information system at their disposal to automatically process the EDI information (Kerkhof, 1994).

After this transformation of the data, one score could be obtained. **Table 6.11** shows the survey results for the sophistication of IT infrastructure (ITSCORE). The descriptive statistics are in **table 6.17**. Note that 5% of the respondents did not know what to answer. Closer inspection of the data showed that 82% (27) of these respondents has less than 10 employees. Apparently, the chosen indicator for IT knowledge and experience may not be suitable for small firms. Anyway, a single indicator is limited in its ability to cover a construct. So, although the chosen indicator is capable of discriminating between firms, its ability to cover the IT knowledge and experience construct is limited.

Table 6.11 Results for sophistication of IT infrastructure (n=614)

Items	% of firms
No computers	6%
One or more functions computerised	27%
Various functions computerised +network	30%
Various functions computerised +network +information system	23%
Various functions computerised +network +information system +external connection	9%
Don't know	5%
Total	**100%**

Customer and competitor orientation

The scales for customer and competitor orientation by Narver and Slater (1990) were the basis for the items for customer and competitor orientation. To reduce the number of items in the scale, I selected four items from the original Narver and Slater scales that indicate a firm's aim to recognise opportunities in the market (see **appendix 6.2**). Factor analysis shows that the four-item scale (custorie) is homogenous and reliable with a Chronbach's alpha of 0.76 (**table 6.17**). All items are measured on a five-point Likert-scale, where the choices range from 1 = 'totally disagree', to 5 = 'totally agree'. The new variable 'customer and competitor orientation' is calculated by averaging the scores on the individual items. **Table 6.17** gives the descriptive statistics.

Environment as a source of ideas

To indicate a firm's ability to use the environment as a source of ideas, a new scale was developed. The scale (ENVIRON) consists of three items reflecting a firm's inclination to look for information and ideas for opportunities outside the firm (see **appendix 6.2**). The items are measured on a five-point Likert-scale, ranging from 1 = 'totally disagree', to 5 = 'totally agree'. The scale is homogenous, but the reliability is low with a Chronbach's alpha of 0,58 (see **table 6.17**). Chronbach's alpha is a measurement of internal consistency and assumes that the items in a scale are parallel measurements i.e. the different measurements are distinct from one another, but similar and comparable in important aspects (Carmines & Zeller, 1979). The three items in this particular scale are all measurements of using the environment as a source of ideas. However, each item concerns a different approach to do that. The first item 'Our employees regularly visit exhibitions, seminars and conferences to get ideas' refers to an active search for new ideas. The second item 'We consider collaboration with other companies impor-

tant for success' refers to the value of collaboration in attaining goals. The third item 'When confronted with a problem, we usually look outside the firm if a solution already exists' relates to an active search focused on finding solutions to a problem. The relatively low Chronbach's alpha can thus be explained by the different nature of the items resulting in a low mean inter-item correlation of 0,32. Nevertheless, the scale is informative and therefore regarded as useful for further research. The new variable 'environment as a source of ideas' is calculated by averaging the scores on the individual items. The descriptives are in **table 6.17**.

Entrepreneurial orientation

Entrepreneurial orientation is a well-known and widely used scale to measure a firm's strategic orientation reflecting the willingness to engage in entrepreneurial behaviour (Wiklund, 1998). In an extensive review of entrepreneurial orientation literature, Wiklund concluded that in the majority of literature entrepreneurial orientation is argued to consist of three separate dimensions: innovativeness, pro-activeness and risk-taking (Wiklund, 1998). In this study, the strategic posture scale by Covin and Slevin (1989) is used as a basis. Although the original scale was designed to tap three conceptually distinct dimensions (innovativeness, pro-activeness and risk-taking) the entrepreneurial orientation scale is often used as one summed index (Covin & Slevin, 1989; Brown, Davidsson & Wiklund, 2001). The scale used by Covin and Slevin was a two-sided 9-item scale with a seven-point Likert-scale and a Chronbach's alpha of 0,87. To arrive at a smaller and less time-consuming scale, I opted for a one-sided scale, with a five-point Likert-scale, where the choices range from 1 = 'totally disagree', to 5 = 'totally agree'. In previous research a one-sided scale has been successfully applied before (for example Lumpkin & Erdogan, 1999; Yoo, 2002). To save time, I also removed two items from the original 9-item scale (see **appendix 6.2**) that were identified in previous research as not fitting well with the dimensions of innovativeness, pro-activeness and risk-taking. The item 'in dealing with competitors, our company typically adopts a very competitive, "undo-the-competitors" posture' was found to tap competitive aggressiveness rather than pro-activeness as intended (Lumpkin & Dess, 2001), and is therefore dropped. The innovation item concerning 'emphasis on innovation versus marketing of tried and true products' was found to form a factor of its own in previous research

(Brown, Davidsson & Wiklund, 2001), and therefore dropped from the entrepreneurial orientation scale.

The translation into Dutch is as close to the original text as possible. However, based on comments by Syntens' consultants, I changed wording slightly[3]. For example, 'my firm typically adopts a bold, aggressive posture...' was changed into a Dutch expression (*'alles op alles zetten')* that amounts up to 'we will do everything within our power'. This way the wording is closer to our 'subdued' Dutch culture. The scale proves to be unidimensional and reliable with a Chronbach's alpha of 0,88 (see **table 6.17**). The new variable 'entrepreneurial orientation (EO)' is calculated by averaging the scores on the seven individual items. **Table 6.17** gives the descriptive statistics. Overall, the variable gives an indication of a firm's degree of entrepreneurship as it covers various elements of entrepreneurial behaviour. However, this operationalisation of entrepreneurial orientation does not give insight into the three separate dimensions of the construct.

6.5 Specific firm characteristics

In my theoretical model, I proposed that the following general firm characteristics are related to e-business adoption: e-business related training, the presence of innovation roles, the perceived dedication of resources, an activated information network and perceived external pressure. The operationalisation of each variable is discussed hereafter.

E-business-related training

To indicate the presence of specific e-business knowledge in the firm, I looked at the percentage of employees that took an e-business-related course (for example, an Internet workshop) in the past year. To calculate the percentage I divided the absolute number of employees with an e-business-related training by the total number of employees in the company. The results for e-busi-

3 Some insight into the differences between the North American and Dutch culture is provided by the interesting study by Scheer, Kumar and Steenkamp (2003) on perceived inequity in U.S. and Dutch inter-organisational relationships. When positive inequity (overcompensation) was perceived in the relationship, Dutch firms felt increased guilt whereas U.S. firms did not. Scheer et al. describe the Dutch culture as egalitarian with a strong imperative to pursue co-operation, solidarity and levelling.

ness related training are summarised in **table 6.12** below (the scale from 0 to 100% was recoded into 5 classes). Of the total number of respondents (n=473) , 56% indicated that no employees took an e-business related training in the past year. In addition, there is a large number of missing values (141). The descriptive statistics are in **table 6.17**. The empirical results indicate that the variable has a peaked and skewed distribution. As a consequence, the variable does not differentiate much between respondents.

Table 6.12 Results for e-business related training (n=473)

% of employees that took e-business related training	% of firms
0-20%	85%
21 -40%	7%
41-60%	3%
61-80%	2%
81-100%	3%
Total	**100**

The presence of innovation roles

The presence of innovation roles (INNROL) was measured using two items (see **appendix 6.2**). The first item asks whether there is (at least) one colleague in the company who is very enthusiastic and well-informed about electronic business and who tries to convey that to colleagues. This item refers to the presence of a 'gatekeeper'. The second item asks whether there is (at least) one colleague in the company who 'picks up' electronic business and makes concrete propositions. This item refers to the presence of a 'champion'. Both items were measured on a five-point Likert-scale, where the choices range from 1 = 'totally disagree', to 5 = 'totally agree'. The fact that people can perform both roles to a certain extent made me decide for a Likert-scale. Factor analysis shows that the scale is homogenous and reliable with a Chronbach's alpha of 0,92 (see **table 6.17**). The new variable 'presence of innovation roles' was calculated by averaging the score on the individual items. The descriptives are in **table 6.17**.

The perceived dedication of resources

The perceived dedication of resources (DEDRES) was measured using two items (see **appendix 6.2**). One item refers to the perception that money is being released in the company to invest in e-business. The other item refers to the release of time to implement e-business. Both items are measured on a five-point Likert-scale ranging from 1='totally agree' to 5='totally disagree'.
The scale proves to be homogenous and reliable with a Chronbach's alpha of 0,94 (see **table 6.17**). **Table 6.17** shows the descriptives for the new variable 'the perceived dedication of resources', which are obtained by averaging the scores on both individual items.

An activated information network

To investigate which social contacts the firm activated to obtain information about electronic business, the respondents were asked to indicate where the company looked for information regarding e-business. The respondents were presented a list of 11 social network actors. In addition they could opt for none, or other (free text). As a basis the list of network actors of Groen (1994) was used. The list was adapted to the situation of electronic business. For example, local government was replaced by central government, as specifically the central government promotes e-business by providing information.

Table 6.13 Results for activated information network (n=614)

Items	% of firms
None	15%
ICT-suppliers or –consultants	49%
Colleague-firms/competitors	44%
Sector-organisation	38%
Other suppliers	28%
Customers	27%
Accountant/bookkeeper	25%
Other service-providers/consultants	19%
Neighbours/family/acquaintances	15%
Central government	14%
Knowledge institutions	11%
Syntens	7%
Other	5%

In **table 6.13**, the survey results are presented for the different social contacts that were activated to get information on e-business. ICT suppliers or consultants, colleague-firms/competitors, and sector organisations are the most frequently contacted network actors for e-business. In the category Other (free text) nine respondents mention the bank as network actor providing information on e-business. **Table 6.17** shows the descriptive statistics for the new variable 'activated information network' that was calculated by counting the number of network actors contacted. Remarkable is that 15% of the respondents indicate their firm did not contact any network actor for information on e-business. The average number of network actors contacted is a low 2,83. **Table 6.14** below presents a summarised table for the number of network actors contacted. The indicator clearly focuses on the *amount* of contacts. This is a limited interpretation of the activated information network construct. The operationalisation does not take into account the importance or strength of the relation.

Table 6.14 Summarised results for activated information network (n=614)

Number of network actors contacted	% of firms
0	15%
1 to 3	52%
4 to 6	27%
7 to 9	4%
10 to 12	1%
Total	**100%**

Perceived external pressure

The perceived pressure from network contacts to adopt e-business is measured by asking the respondents which network actors motivate the company to engage in e-business. As with the activated information network, a list of 11

network actors is presented as well as a free text option (Other) and a 'none'-option. In the Other category, 31 of 62 respondents mentioned themselves, or their co-workers, as main motivators for e-business. As the objective of this question is to investigate external pressure, these answers were disregarded. The results for perceived external pressure are presented in **table 6.15**.

Table 6.15 Results for perceived external pressure (n=614)

Motivating network actors	% of firms
None	24%
Customers	45%
Colleague-firms/competitors	29%
Sector-organisation	25%
Other suppliers	23%
ICT-suppliers or –consultants	22%
Accountant/bookkeeper	19%
Other service-providers/consultants	11%
Central government	6%
Neighbours/family/acquaintances	5%
Knowledge institutions	4%
Syntens	2%
Other	5%

The new variable 'perceived external pressure' was calculated by counting the number of network contacts indicated as motivators for e-business. The descriptive statistics for this new variable are in **table 6.17. Table 6.16** presents the number of network actors that motivated the firm to engage in e-business. Remarkable is that 26,5% of the respondents indicates their firm was not motivated by any network actor. The average number of network actors contacted is a low 1,95. Again, this network related variable does not take into account the importance of the particular network contacts, and solely focuses on the amount of contacts. This is a limitation to the scope of the indicator.

Especially in SMEs it is conceivable that one large customer imposes a lot of pressure on the firm to adopt e-business.

Table 6.16 Summarised results for perceived external pressure (n=614)

Number of motivating network actors	% of firms
0	27%
1 to 3	56%
4 to 6	15%
7 to 9	2%
10 to 12	1%
Total	**100%**

6.6 Overview of constructs and variables

In this chapter all constructs in the theoretical model have been operationalised into empirical variables. **Table 6.17** presents an overview of the constructs and their variables. The operationalisation of constructs lead to the development of new and reliable scales (in Dutch) for organisational and strategic value creation, reliance on ICT, e-business adoption in the supply, internal and sales process, and entrepreneurial orientation. The descriptive results from the survey substantiate the usefulness of the indicators. Overall, the empirical results for the chosen indicators show adequate variance to differentiate firms in further analysis.

Table 6.17 Overview of constructs, variables and their descriptive statistics

Construct	Variable name	Acronym	Number of items	Chronbach's alpha	Lamda[a]	Mean	SD	Skewness	Kurtosis	Min	Theor.Max	N	missing %
Value creation	Organisational value creation	VCO2	5	0,69	2,24	2,34	1,64	0,08	-1,20	0,0	5,0	559	9%
	Strategic value creation	VCSTRAT2	4	0,67	2,03	0,70	1,08	1,54	1,54	0,0	4,0	559	9%
E-business adoption	Supply process supported with e-mail	E21TOT	8	0,83	3,64	3,12	2,53	0,21	-1,20	0,0	8,0	614	0%
	Supply process supported with Internet	I21TOT	8	0,81	3,47	3,88	2,46	0,01	-0,99	0,0	8,0	614	0%
	Internal process supported with e-mail	E23TOT	8	0,84	3,79	1,99	2,30	0,99	-0,16	0,0	8,0	614	0%
	Internal process supported with Internet	I23TOT	8	0,85	4,03	1,97	2,38	1,13	0,10	0,0	8,0	614	0%
	Sales process supported with e-mail	E25TOT	8	0,85	3,90	2,76	2,58	0,45	-1,11	0,0	8,0	614	0%
	Sales process supported with Internet	I25TOT	9	0,80	3,61	2,67	2,29	0,88	0,09	0,0	9,0	614	0%
	Supply process supported with e-mail/Internet	TOT21	8	0,84	3,91	5,07	2,60	-0,64	-0,74	0,0	8,0	614	0%
	Internal process supported with e-mail/Internet	TOT23	9	0,87	4,52	3,22	2,97	0,45	-1,19	0,0	9,0	614	0%
	Sales process supported with e-mail/Internet	TOT25	8	0,85	4,22	3,73	2,52	0,00	-1,15	0,0	8,0	614	0%
	Reliance on ICT	RELIAN2	3	0,87	2,37	1,89	0,75	0,35	-0,99	1,0	4,0	611	0%
	Reliance on ICT-supply process	RELIANSP				1,89	0,80	0,36	-0,95	1,0	4,0	602	2%
	Reliance on ICT-internal process	RELIANIN				1,87	0,89	0,47	-1,10	1,0	4,0	608	1%
	Reliance on ICT-sales process	RELIANSA				1,92	0,84	0,35	-1,01	1,0	4,0	603	2%
	Supply process supported with e-mail/Internet, weighed	TOT21W				10,64	7,64	0,34	-0,90	0,0	32,0	583	5%
	Internal process supported with e-mail/Internet, weighed	TOT23W				8,11	8,82	0,89	-0,46	0,0	36,0	589	4%
	Sales process supported with e-mail/Internet, weighed	TOT25W				8,77	7,61	0,65	-0,56	0,0	32,0	584	5%
	E-business adoption	EBUSADG3				27,76	21,60	0,50	-0,81	0,0	100,0	574	7%
Perceived opportunity characteristics	Perceived relative advantage	RELADV	4	0,86	2,81	3,88	0,98	-1,04	0,57	1,0	5,0	591	4%
	Perceived compatibility	COMP	5	0,82	2,89	3,03	0,98	-0,10	-0,76	1,0	5,0	594	3%
General firm characteristics	Percentage of employees with a university/higher vocational training	PERCHOPL		N.A.	N.A.	0,15	0,26	2,22	4,15	0,0	1,0	599	2%
	Sophistication of IT infrastructure	ITSCORE4		N.A.	N.A.	3,01	1,07	0,13	-0,71	1,0	5,0	581	5%
	Customer and competitor orientation	CUSTORIE	4	0,76	2,34	3,86	0,84	-0,98	0,88	1,0	5,0	593	3%
	Environment as source of ideas	ENVIRON	3	0,58	1,64	3,32	0,95	-0,43	-0,27	1,0	5,0	591	4%
	Entrepreneurial orientation	EO	7	0,88	4,10	2,58	1,01	0,10	-0,80	1,0	5,0	589	4%
Specific firm characteristics	Percentage of employees with an e-business-related training	PERCBIJS		N.A.	N.A.	0,11	0,22	2,79	7,67	0,0	1,0	473	23%
	Presence of innovation roles	INNROL	2	0,92	1,85	3,25	1,43	-0,32	-1,25	1,0	5,0	581	5%
	Perceived dedication of resources	DEDRES	2	0,94	1,88	3,22	1,37	-0,33	-1,16	1,0	5,0	589	4%
	Activated information network	ACTINFO		N.A.	N.A.	2,83	2,13	0,82	0,72	0,0	12,0	614	0%
	Perceived external pressure	EXPRESS		N.A.	N.A.	1,95	1,81	1,17	2,12	0,0	12,0	614	0%

a The eigenvalue of the first component in the Principal component analysis (see appendix 6.3)

7 Empirical Results

In the preceding chapters, I have discussed the construction of a theoretical model for e-business adoption (**chapter 4**), the methodological choices in this study (**chapter 5**), and the operationalisation of the theoretical constructs into observable variables (**chapter 6**). This chapter presents the results of the empirical investigation. The goal of this study is to answer the following research question:

1. ***What is e-business adoption?***
2. ***Which firm characteristics explain e-business adoption in SMEs?***
3. ***What are the differences in explaining e-business adoption from an innovation adoption perspective compared to an entrepreneurship perspective?***

In this chapter, I will first recapitulate the theoretical model and the expected relationships between the constructs in the model (**7.1**). The propositions as formulated in **chapter 4** can now be transformed into hypotheses or more concrete and operational statements of relationships. Next (in **7.2**), every hypothesised relationship in the model is investigated using the empirical observations from the survey and linear regression. In **7.3** the theoretical model is estimated in parts and as a whole using structural equation modelling. This technique makes it possible to test multiple relationships simultaneously.

The estimation in parts enables an interesting comparison of the approach to explaining e-business adoption from the innovation adoption perspective as

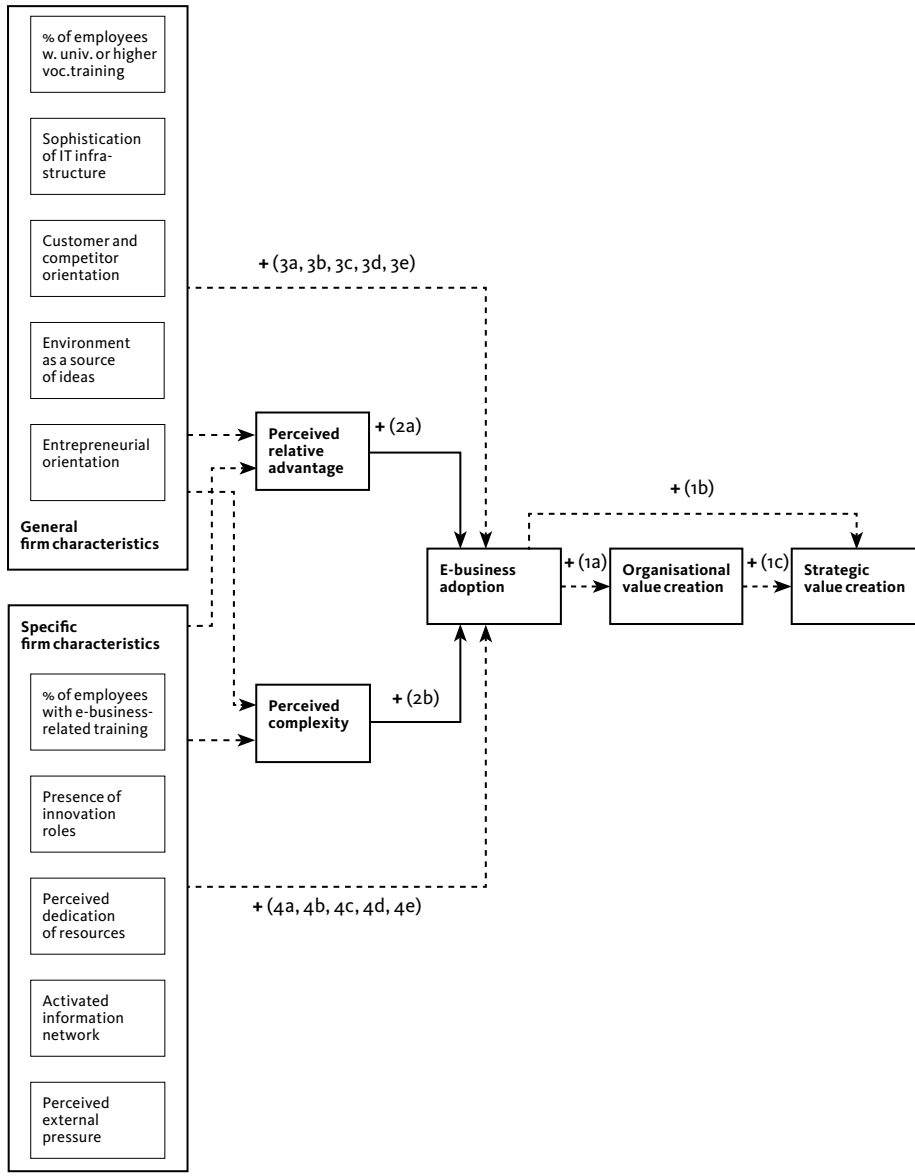
well as the entrepreneurship perspective. At the end of the chapter, the comparison of models is discussed. Finally (in **7.4**), empirical analysis provides evidence that e-business indeed has an entrepreneurial aspect.

7.1 The theoretical model revisited

In **chapter 4**, a theoretical model of e-business adoption has been developed. In that chapter, the selection of the various elements or constructs of the model has been discussed as well as the anticipated causal relationship of each construct to e-business adoption. This resulted in an overview of propositions. In **chapter 6** on operationalisation, each theoretical construct has been translated into a measurable variable. So, now the propositions can be reformulated into hypotheses indicating a causal relation between two variables. In **figure 7.1** I present an overview of the hypotheses for this study based on the propositions developed in **chapter 4**. The figure is based on **figure 4.4** representing the propositions. However, the proposition regarding the relation between perceived complexity and e-business adoption has been dropped, because the operationalisation failed to produce a reliable indicator (**6.3**).

In sum (from right to left in **figure 7.1**), e-business adoption is expected to lead to two types of value creation: organisational value creation and strategic value creation (***hypotheses 1a and 1b***). In addition, it is presumed that the adoption of e-business follows a 'reverse product cycle'; the application of new technologies first leads to improvements within the organisation, and then to the generation of new products and services (***hypothesis 1c***). From an innovation adoption perspective, I anticipate a positive relationship between the firm's perception of the opportunities that e-business adoption offers (perceived relative advantage and perceived compatibility) and e-business adoption (***hypotheses 2a and 2b***).

Figure 7.1 Overview of hypotheses



Next, from a review of entrepreneurship literature factors were identified as important in the opportunity recognition process. From this entrepreneurship perspective, I expect that firm attributes that relate to knowledge and experience, network contacts and the firm's strategic posture positively relate to e-business adoption (***hypotheses 3a to3e***, and ***4a to 4e***). In this respect, general firm characteristics represent firm attributes that *in general* enable opportunity recognition. Specific firm characteristics refer to firm attributes that facilitate the development of *e-business* opportunities. Finally, these general and specific firm characteristics are presumed to play a role in the formation of a perception of e-business adoption. The firm attributes provide a context in which the opportunities offered by ICTs are assessed. As such, I expect relationships between the characteristics of the firm and perceived opportunity characteristics. As I discussed before (**4.3**), propositions for the relations between the firm characteristics and perceived opportunity characteristics have not been formulated, as there is a lack of explicit research on these relationships. These relationships will however be empirically explored in this chapter.

7.2 Closer inspection of the hypotheses

In this section, I take a closer look at the hypotheses using the empirical data from the survey. Linear regression is used to investigate these relationships. Linear regression is the appropriate technique when it is presumed that one or more metric independent variables are related to a single metric dependent variable. **appendix 7.1** provides more information on (multiple) linear regression and its assumptions. In the various (multiple) regression analyses discussed in this section, 19 cases were identified as outliers[1]. An outlier analysis including the descriptive statistics for these cases on all variables can be found in **appendix 7.2**. These cases can be identified as distinctly different from the rest of the sample, mainly because some combinations of values on certain variables are extreme. Overlooking the various cases and their scores on the variables however, there is no evident pattern of characteristics. In the results presented in this section, the outliers have been removed. As the total number of outliers (19) is low compared to the sample size (614), removal of all outliers from the data set for further analysis is considered acceptable.

1 In the regression analysis (SPSS) cases were identified as outliers when their standardised residual was at least 3.

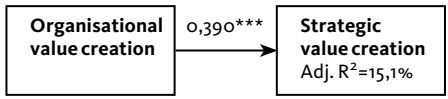
7.2.1 E-business adoption and value creation

In describing the construction of the theoretical model, I proposed a positive relation between e-business and two types of value creation: organisational and strategic value creation. E-mail and Internet are implemented and used to gain benefits for the firm, and so I argue that e-business adoption is inextricably connected to the creation of value. With the data collected, it is now possible to empirically investigate this proposed relationship. With e-business adoption economic value can be created in different ways. In this study, two types of value creation are distinguished (**4.2.1**):

- ***Organisational value creation,*** referring to value creation related to time, cost, and communication,
- ***Strategic value creation,*** referring to value creation related to products, markets, and services.

In **chapter 4**, I argued that in the case of e-business adoption the development of innovations follows a reverse product cycle. New ICTs are applied to business processes and organisational value, related to process innovation, is created. Strategic value creation, related to new products, services and markets, is expected to be a next step to organisational value creation. From the data collected in the survey, it seems that organisational value creation and strategic value creation are positively related (**6.1**). To investigate whether organisational value creation precedes strategic value creation, a linear regression is performed to assess whether this model fits the data. The result of the linear regression (**figure 7.2**) shows that organisational value creation explains a moderate 15,1% of the variance in strategic value creation. Further, the standardised regression coefficient of organisational value creation is positive ($\beta = 0{,}390$) and significant. These results support the theoretically expected positive causal relationship between organisational and strategic value creation (***hypothesis 1c***). A plot of the residuals against the predicted values of strategic value creation indicates that the relation between both types of value creation is linear. However, a normal probability plot of the residuals reveals that the distribution of the residuals is not completely normal. This indicates that the variance in strategic value creation is not the same for all values of organisational value creation. De Heus, Van der Leeden and Gazendam (1995) suggest that this does not lead to problems when the sample is large enough (n>100), which is the case in this regression (n=540).

Figure 7.2 Regression analysis: organisational -> strategic value creation



β significant at: *p<=0,05, **p<=0,01, ***p<=0,001 (one-tailed test)

To investigate the relationship between e-business adoption and the two different types of value creation, linear regression is performed. Linear regression of the relation between e-business adoption and organisational value creation indicates that 47,4% of the adjusted variance (R^2) in organisational value creation is explained by e-business adoption (**figure 7.3**). The β for e-business adoption is 0,689 and significant. Inspection of the normal probability plot of the residuals and the plot of residuals against the predicted values establishes that the error terms are normally distributed and display no pattern. The adoption of e-mail and Internet clearly facilitates a better efficiency and effectiveness in business processes.

Figure 7.3 Regression analysis: e-business adoption -> organisational value creation

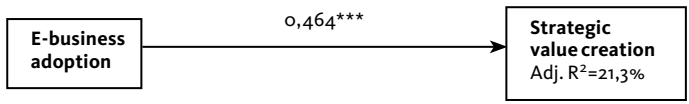
β significant at: *p<=0,05, **p<=0,01, ***p<=0,001 (one-tailed test)

Investigation of the relation between e-business adoption, organisational, and strategic value creation shows (**figure 7.4**) that two alternative explanations are possible for strategic value creation. In the first regression model, e-business adoption explains 21,3% of the adjusted variance in strategic value creation.
In the second regression model, e-business adoption and organisational value creation explain 22,1% of the adjusted variance in strategic value creation. A vis-

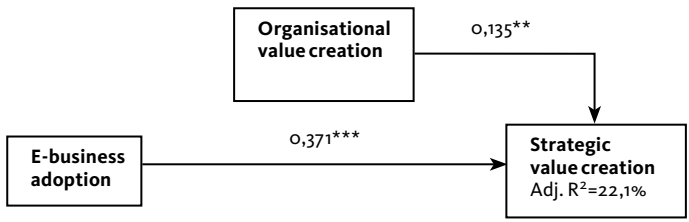
ual examination of the normal probability plot of the residuals using the second regression model reveals that the error terms are not normally distributed. As the sample size is large (n=501) no problems are expected (De Heus et al., 1995). Both models have about the same fit. So, the theoretical assumption that organisational value creation precedes strategic value creation is empirically supported (***hypothesis 1c***). However, organisational value creation is not necessarily a condition to create value strategically. Some firms manage to introduce new products and enter new markets by adopting e-mail and Internet, without process innovation first. Therefore, the theoretical assumption that e-business adoption leads to organisational and/or strategic value creation is supported (***hypotheses 1a and 1b***).

Figure 7.4 Two alternative regression models for strategic value creation

Regression model I



Regression model II



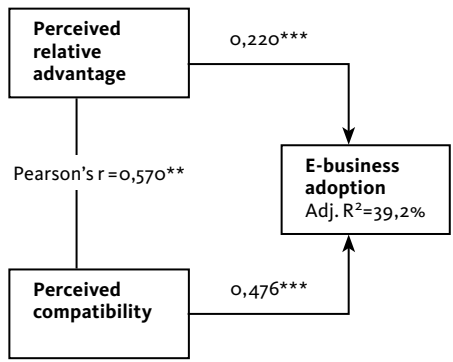
β significant at: *p<=0,05, **p<=0,01, ***p<=0,001 (one-tailed test)

7.2.2 Relation of perceived opportunity characteristics to e-business adoption

As I noted in the review of e-business literature, perceived innovation characteristics are frequently used to explain the adoption of e-business. In this research, I look at perceived characteristics of the *opportunity*. I argue that it is the opportunity offered by e-business that a firm assesses, and not the technological innovation (e-mail or the Internet). In this study, two perceived opportunity characteristics are distinguished: perceived relative advantage and perceived compatibility. Theoretically, I expect both opportunity characteristics to be positively related to e-business adoption.

To investigate both relationships empirically, I performed a linear regression. The result of the regression is presented in **figure 7.5**. Both perceived relative advantage and perceived compatibility are positively and significantly related to e-business adoption (***hypotheses 2a and 2b***). Together, the perceived opportunity characteristics explain 39,2% of the (adjusted) variance in e-business adoption. The standardised regression coefficient for perceived compatibility (β=0,476) is higher than the coefficient for perceived relative advantage (β=0,220). This is a remarkable result as in many studies perceived relative advantage appears as an important factor determining e-business adoption (section **2.2.2**). A check[2] on possible multicollinearity did not reveal any problems; the tolerance value for both perceived relative advantage and perceived compatibility is over 0,10 (both 0,675) and the VIF (variance inflation factor) is well below 10 (both 1,481) (Hair, Anderson, Tatham & Black, 1998).

Figure 7.5 Regression of perceived opportunity characteristics and e-business adoption

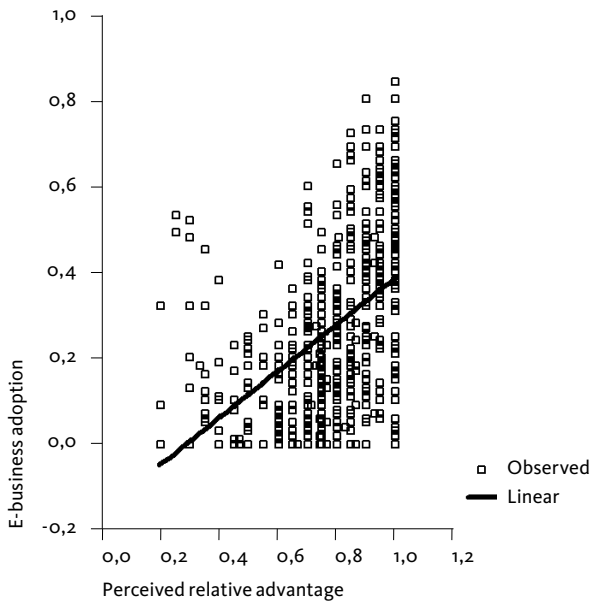


β significant at: *p<=0,05, **p<=0,01, ***p<=0,001 (one-tailed test)

È The check on multicollinearity is explained in appendix 7.1.

A closer look at the partial regression plot for the relation between perceived relative advantage and e-business adoption reveals that the relation is not quite linear. In addition, the plot shows that there are large differences in e-business adoption for larger values of perceived relative advantage. This quasi non-linear relationship causes the linear regression to underestimate the relationship between perceived relative advantage and e-business adoption. In **figure 7.6** the scatterplot shows that firms that perceive a low relative advantage for e-business (below approximately 0,4 on a scale from 0 to 1), adopt e-business nevertheless. This suggests that considerations other than the perceived relative advantage of e-business opportunities determine adoption. Analysis of the complete theoretical model is expected to indicate which other variables influence the adoption of e-business.

Figure 7.6 The relation between perceived relative advantage and e-business adoption[a]



a Scores for e-business adoption and perceived relative advantage have been standardised on a 0 to 1 scale to enhance readability

7.2.3 Relation of general firm characteristics to e-business adoption

General firm characteristics represent attributes of a firm that in general enable the discovery of business opportunities. These firm attributes pertain to general knowledge and experience, network contacts and the firm's strategic posture. To investigate the hypothesised relationships of general firm characteristics to e-business adoption, a multiple linear regression is performed. The result of the regression is shown in **table 7.1**.

Table 7.1 Regression: general firm characteristics → e-business adoption

Firm characteristics	General firm characteristics	Standardised coefficient beta (β)	E-business adoption
Knowledge and experience	% of employees with a university or higher vocational training	0,091**	Adjusted R^2 = 41,9%
	Sophistication of IT infrastructure	0,413***	
Network contacts	Customer and competitor orientation	0,051	
	Environment as a source of ideas	0,066*	
Strategic posture	Entrepreneurial orientation	0,309***	

*p<=0,05, **p<=0,01, ***p<=0,001 (one-tailed test)

An analysis of tolerance and VIF values did not reveal any multicollinearity problems. An examination of a plot of the residuals against the predicted dependent variable does not show any pattern of increasing or decreasing values. The normal probability plot shows a diagonal line, which does not indicate any multivariate non-normality. Together the five general firm characteristics explain 41,9% of the adjusted variance in e-business adoption. As can be seen from the illustration, the regression coefficients of all general firm characteristics are positive and therefore in accordance with the directions of the hypothesised causal relationships with e-business adoption (***hypotheses 3a, 3b, 3c, 3d, and 3e***). The impact of the sophistication of IT infrastructure and the impact of the entrepreneurial orientation on e-business adoption is significant and relatively strong. The effect of the level of formal education and the firm's capability to use the environment as a source of ideas, on e-business adoption is also significant, but rather weak. The firm's orientation towards customers and competitors does not have a significant effect on e-business adoption. A further inspection of the

bivariate relationships of the aforementioned three general firm characteristics and e-business adoption on the basis of partial regression plots establishes that these three variables only have a very weak linear relationship to e-business adoption. Transformation of the variables did not improve the linearity of the relation to e-business adoption.

7.2.4 Relation of specific firm characteristics to e-business adoption

Specific firm characteristics facilitate the development of e-business opportunities and pertain to e-business-related knowledge and experience, and network contacts. To establish the effect of the specific firm characteristics on e-business adoption, multiple linear regression is performed. The result of the regression is presented in **table 7.2**.

An inspection of tolerance and VIF values did not show any problems concerning multicollinearity. An examination of a plot of the residuals against the predicted value for e-business adoption does not show any pattern of increasing or decreasing values. The normal probability plot shows a diagonal line, which does not indicate any multivariate non-normality. The five specific firm characteristics explain 48,0% of the adjusted variance in e-business adoption. The regression coefficients of all specific firm characteristics are positive and significant. So, the data of the survey provide empirical support for all hypothesised causal relationships of specific firm characteristics with e-business adoption (***hypotheses 4a, 4b, 4c, 4d, and 4e***).

Table 7.2 Regression: Specific firm characteristics → e-business adoption

Firm characteristics	General firm characteristics	Standardised coefficient beta(β)	E-business adoption
Knowledge and experience	% of employees with an e-business-related training	0,092**	Adjusted R^2 = 48,0%
	Presence of innovation roles	0,231***	
	Perceived dedication of resources	0,285***	
Network contacts	Activated information network	0,227***	
	Perceived external pressure	0,097*	

*p<=0,05, **p<=0,01, ***p<=0,001 (one-tailed test)

7.2.5 Relation of general firm characteristics to perceived opportunity characteristics

To explore the relationships between the specified general firm characteristics and perceived opportunity characteristics, two multiple linear regressions are performed: one for perceived relative advantage and one for perceived compatibility. The results of the regressions are shown in **table 7.3**. An analysis of tolerance and VIF values did not reveal any multicollinearity problems in both regressions.

Table 7.3 Regression: general firm characteristics → perceived opportunity characteristics

Firm characteristics	General firm characteristics	Standardised coefficient beta (β)	Perceived relative advantage	Standardised coefficient beta (β)	Perceived compatibility
Knowledge and experience	% of employees with a university or higher vocational training	0,001		0,035	
	Sophistication of IT infrastructure	0,183***		0,196***	
Network contacts	Customer and competitor orientation	0,300***	Adjusted R^2 = 21,9%	0,124**	Adjusted R^2 = 26,9%
	Environment as a source of ideas	0,105**		0,057	
Strategic posture	Entrepreneurial orientation	0,062		0,322***	

*p<=0,05, **p<=0,01, ***p<=0,001 (one-tailed test)

For perceived relative advantage, an examination of a plot of the standardised residuals against the standardised predicted value for perceived relative advantage shows no evident pattern. The normal probability plot is not a completely straight diagonal line, which indicates non-normality in the distribution of the error terms. Considering that the sample size is larger than 100, no problems are expected (De Heus et al., 1995). Together the five general firm characteristics explain 21,9% of the adjusted variance in perceived relative advantage. The regression coefficients of all general firm characteristics are positive and indicate a positive relationship to perceived relative advantage. The impact of the firm's orientation towards customers and competitors and the sophistication of IT infrastructure are both significant and relatively strong. The effect of the

firm's capability to use the environment as a source of ideas is significant, but weak. The effect of the firm's entrepreneurial orientation and the effect of the level of formal education on perceived relative advantage are not significant.

The output for perceived compatibility shows no signs of non-normality of the distribution of the residuals, or a pattern in the residuals. Together the five general firm characteristics explain 26,9% of the adjusted variance in perceived compatibility. The regression coefficients of all general firm characteristics are positive and indicate a positive relationship to perceived compatibility. The impact of the firm's entrepreneurial orientation, the firm's orientation towards customers and competitors and the sophistication of IT infrastructure on the perception of compatibility are all significant and relatively strong. The effect of the firm's capability to use the environment as a source of ideas, and the level of formal education on perceived compatibility are not significant. The partial regression plots for the relations between these firm characteristics and perceived compatibility show a very weak linear relationship.

7.2.6 Relation of specific firm characteristics to perceived opportunity characteristics

To explore the relationships between the specified specific firm characteristics and perceived opportunity characteristics, two multiple linear regressions are performed: one for perceived relative advantage and one for perceived compatibility. The results of the regressions are in **table 7.4**. An analysis of tolerance and VIF values did not reveal any multicollinearity problems in both regressions.

Table 7.4 Regression: specific firm characteristics → perceived opportunity characteristics

Firm characteristics	Specific firm characteristics	Standardised coefficient beta (β)	Perceived relative advantage	Standardised coefficient beta (β)	Perceived compatibility
Knowledge and experience	% of employees with an e-business-related training	0,039	Adjusted R^2 = 28,2%	0,111**	Adjusted R^2 = 51,0%
	Presence of innovation roles	0,223***		0,254***	
Network contacts	Perceived dedication of resources	0,310***		0,436***	
	Activated information network	0,047		0,035	
Strategic posture	Perceived external pressure	0,013		0,054	

*p<=0,05, **p<=0,01, ***p<=0,001 (one-tailed test)

For perceived relative advantage, an examination of a plot of the standardised residuals against the standardised predicted value for perceived relative advantage does not show an evident pattern of values. The normal probability plot is not a completely straight diagonal line, which indicates non-normality in the distribution of the error terms. Regarding the large sample size, no problems are expected (De Heus et al., 1995). Together the five specific firm characteristics explain 28,2% of the adjusted variance in perceived relative advantage. Two specific firm characteristics stand out as explanatory variables. Perceived presence of innovation roles and perceived dedication of resources are both positively and significantly related to perceived relative advantage. The other three firm characteristics have a positive relationship with perceived relative advantage, however insignificant.

The output for perceived compatibility indicates a normal distribution of the residuals, and no evident pattern in the residuals. Together the five specific firm characteristics explain 51,0% of the adjusted variance in perceived compatibility. The regression coefficients of all specific firm characteristics are positive and indicate a positive relationship to perceived compatibility. Again, the perceived presence of innovation roles and the perceived dedication of resources explain most of the variance in perceived compatibility. Also, the percentage of people in the firm with an e-business related training has a positive and significant, yet moderate impact on perceived compatibility. The other two variables, activated information network and perceived external pressure are positively, yet insignificantly, related to perceived compatibility.

7.2.7 Conclusions

The results of the various multiple regression analyses in the previous sections show that the existence and direction of the relationships agree with the hypothesised relationships. All but two relationships of the 15 hypothesised were found to be significant as well. This means that knowledge and experience, network contacts and strategic posture have been found positively related to e-business adoption. E-business adoption is positively related to organisational and strategic value creation. Structural equation modelling in the next section will decide whether the hypotheses will hold when estimated simultaneously. The relation between customer and competitor orientation and e-business adoption, as well

as the relation between using the environment as a source of ideas and e-business adoption were found to be insignificant. Therefore, these two relations will be left out of the model in further analysis.

Exploration of the relations between the general and specific firm characteristics, and the perceived opportunity characteristics (in **7.2.5** and **7.2.6**) established that all relations are positive in direction. Perceived relative advantage is particularly influenced by a customer and competitor orientation, the sophistication of IT infrastructure, the perceived dedication of resources, and the presence of innovation roles. Perceived compatibility is influenced in particular by an entrepreneurial orientation, the sophistication of IT infrastructure, perceived dedication of resources, and the presence of innovation roles. Ergo, a positive perception of e-business opportunities is mainly determined by knowledge and experience with IT, the perceived availability of time and money, and the presence of people that are enthusiastic about e-business. In addition, a focus on the market contributes to seeing e-business adoption as beneficial to the firm. Further, a firm's experience with entrepreneurship apparently contributes to a sense of compatibility. Overall, it seems that the formation of a perception of e-business adoption is largely an internal affair. In the next section, the complete model will be estimated. By looking at all the relationships in the model simultaneously, we will learn more about the influence of firm characteristics on the perceptions of e-business adoption. The results of the empirical analyses will be discussed in their entirety at the end of this chapter.

7.3 Estimating three models that explain e-business adoption

To examine the complete theoretical model and all the dependent relationships in it simultaneously, structural equation modelling (SEM) is the appropriate technique (more details on this method of analysis are given in **appendix 7.3**). The heart of structural equation modelling is the structural model. This model specifies causal relationships between the independent (explanatory) and the dependent (explained) variables. In the estimation procedure, the covariance matrix of the input (sample) data is compared with a covariance matrix

predicted by the model. The closer the similarity is between both matrices, the better the theoretical model fits the empirical data. Since structural equation modelling is a purely straight on statistical procedure, any relationship that is allowed between variables will be estimated. Therefore, it is essential to base a model on theory, and restrict the number of relationships between the variables. In the case of specified causal relationships, structural equation modelling serves a purpose in confirming multiple hypotheses. As discussed under internal validity (**5.6**), to establish causal relationships, four criteria need to be met (Swanborn, 1987; Hair et al., 1998):

- Sufficient association between the two variables,
- Temporal antecedence of the cause versus the effect,
- A theoretical basis for the relationship, and
- Lack of alternative causal variables.

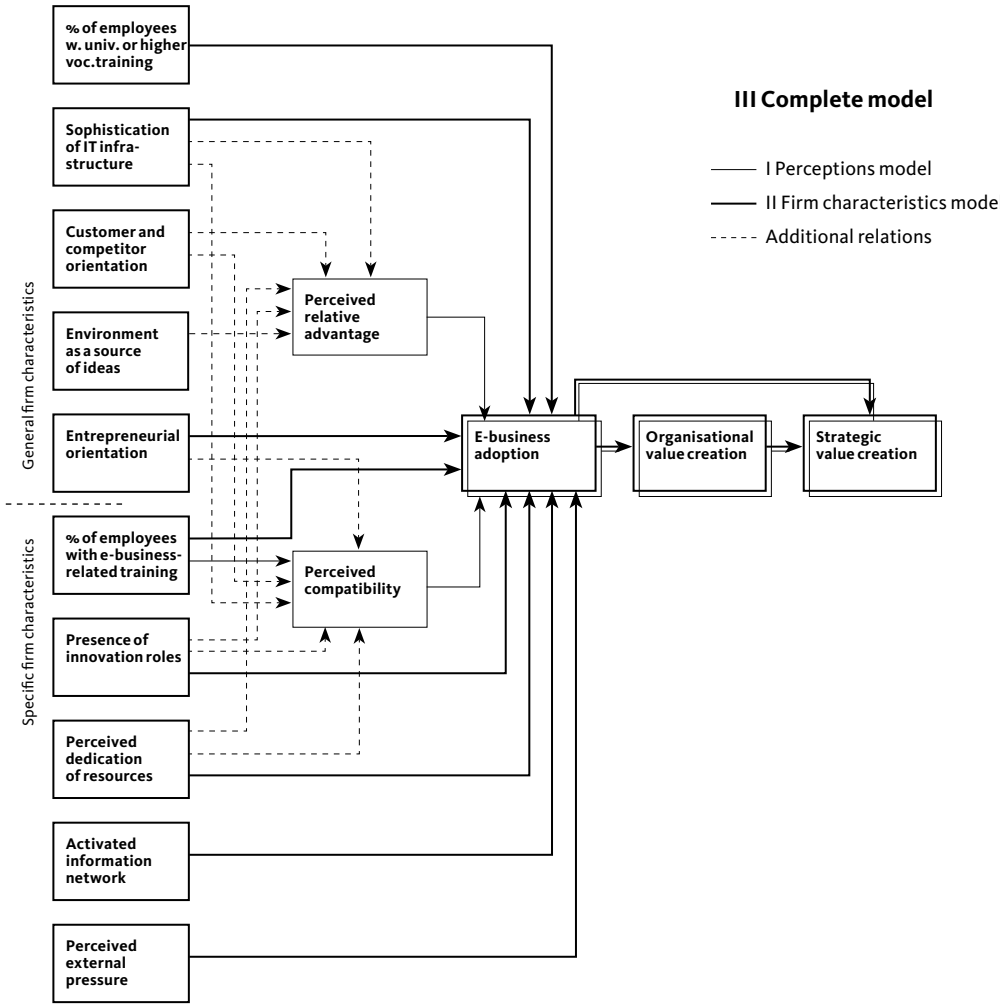
The regression analyses in the previous section have provided information on the associations between the variables. The insignificant relations have been identified and are removed from the model. The temporal antecedence of the cause versus the effect can only be argued theoretically, because the data were collected at one point in time. Therefore, a theory-based approach to SEM is a necessity, as causal relationships need to be explicitly stated and grounded. To check for the influence of possible alternative causal variables, the class of firm size will be used as a control variable. This will be elaborated in the next sections.

Specifying a theoretical model is the first stage in the SEM-process as described by Hair et al. (1998) (see **appendix 7.3**). The theoretical model that has been proposed in this study is depicted in **figure 7.1**. In fact, this model consists of two, partly overlapping, models. Together, they form the complete model. **Figure 7.7** shows the coherence of the three structural models[3]. In this section, the three models for explaining e-business adoption will be estimated and compared:

I The perceptions model
II The firm characteristics model
III The complete model

3 The additional relations in Figure 7.7 refer to the relations between the firm characteristics and the two perceived opportunity characteristics. These relations occur only in the complete model (III) and do not exist in model I and II separately.

Figure 7.7 Framework of the three structural models



The first model, ***the perceptions model,*** explains e-business adoption and consecutive value creation using perceived opportunity characteristics as independent variables. This model represents a tradition in innovation adoption literature to explain innovation adoption using perceived innovation characteristics as explanatory variables. This approach has been found in many studies explaining e-business adoption. In this study, I argued that it is not the innovation itself that is being evaluated by the firm, but the opportunities that ICT offers for e-business. Hence, perceived *opportunity* characteristics are used as explanatory variables. In this model, only perceptions are used as explanatory variables. Consequently, there is *no* reference to the adopter's context in which the e-business opportunity is assessed.

The second model, ***the firm characteristics model,*** explains e-business adoption and value creation directly using a set of firm characteristics as explanatory variables. In the conclusion of the e-business adoption literature review, I argued that to really understand the adopter's perception of e-business adoption, it is essential to investigate the adopter's context. The firm's knowledge, experience, network contacts and strategic posture influence its perception of e-business opportunities. Perceptions are in fact a mixture of firm characteristics and opportunity characteristics. By eliminating the perceptions from the model, and using only firm characteristics as explanatory variables, the model addresses directly the influence of these variables on e-business adoption and value creation. In the perceptions model, this information remains concealed.

The third ***complete model*** combines the perceptions and firm characteristics model into the theoretical model as proposed. The model reflects the theory that firm characteristics influence perceived opportunity characteristics, and have a direct influence on e-business adoption as well.

The modelling strategy in this study is to estimate and compare the perceptions and firm characteristics models. By contrasting two different approaches in explaining e-business adoption, we gain insight into the difference in fit and explanatory power of the two models. The estimation of the complete model, in which firm characteristics as well as perceived opportunity characteristics are included, will provide us with information on the relation between firm

characteristics, perceived opportunity characteristics and e-business adoption and value creation. In this way, we gain insight into the added value of including direct influences (from firm characteristics) as well as perceptions into an explanatory model for e-business adoption.

The next step in SEM is to translate the specified theoretical model and the proposed causal relationships into a path diagram. In effect, **figure 7.7** shows the path diagram for the complete model (and the two partial models). The relations between the constructs that have been identified as insignificant in **7.2** are left out of the model. All the causal relations outlined in the path diagram have a theoretical underpinning (hypotheses), or have been explored in **7.2** (the relations of the perceived opportunity characteristics to e-business adoption). Multiple linear regressions have shown that all relations can be considered linear. The reliability of the constructs has been discussed in **chapter 6**. To enhance readability the correlations between the constructs, and the unobserved error terms of the explained constructs have been left out of the figure. In the model, all constructs have been modelled as directly measured variables. In effect, each theoretical concept is defined by its empirical indicator. This choice will be discussed in the limitations section in **chapter 8**.

Next, the path diagram is translated into a series of structural equations. Each construct to be explained is a dependent variable in a separate equation. A dependent variable is predicted by independent (explanatory) variables or by other dependent variables. For each hypothesised effect, a structural coefficient (β) is estimated. An error term (ϵ) is included for each equation to represent the sum of the effects due to specification error and random measurement error. The error term represents the variance unexplained by the observed explanatory constructs and other explained constructs. In **appendix 7.4** an overview is presented of the structural equations that belong to models I, II en III.

7.3.1 Missing values, sample size, method of estimation

Before the models can be estimated, the input data need to be analysed. The first issue of concern is the impact of missing data. In order to identify possible patterns in missing data and assess the extent of missing data, a missing value analysis was performed (see **appendix 7.5**). The analysis shows that the variable

e-business related training (PERCBIJS) is the only variable with a substantial number of missing values (23%). The percentage of missing values for the other variables varies between 0% and 9%. There is no evident pattern of missing values.

To deal with missing data, three options are available: listwise deletion of missing values (only complete cases are used), pairwise deletion of missing values (all available information is used), and imputation methods (missing values are estimated based on valid values of other variables and/or cases in the sample). For this sample, listwise deletion would reduce the number of cases to 353 (**appendix 7.5**). Also, listwise deletion inflates the mean values of most of the variables and thus leads to bias. Pairwise deletion of missing values is therefore a better option for this sample, leaving 595 cases. However, various variables have a univariate non-normal distribution, displaying skewness and kurtosis >|1| (**appendix 7.5**). In addition, multivariate non-normality was found in the multiple regression analysis (**7.2**). The most common estimation procedure, maximum likelihood estimation (ML), is known to be sensitive to non-normality (Hair et al., 1998). Generally weighted least squares (WLS) is a good alternative estimation method, especially as the observed variables are a mix of continuous and ordinal data (Jöreskog & Sörbom, 1993). WLS is less sensitive to non-normal data, but requires an asymptotic covariance matrix to weigh the sample's variances and covariances, or correlations being analysed. The calculation of an asymptotic covariance matrix is only possible when listwise deletion or imputation of missing values is applied. Hence, the expectation maximisation[4] (EM) method is used in SPSS to impute missing values on all variables. To ensure that the values imputed by the EM method are not biased, the EM means and standard deviations were compared to means in case of listwise and pairwise deletion (**appendix 7.5**). The statistics of the sample using EM imputation are similar to those using pairwise deletion, and therefore acceptable for further analysis.

The recommended sample size for SEM is 200 (Hair et al., 1998). A model's complexity, possible misspecification and variables that exhibit non-normal characteristics increase the sample size. The model in this research is rather complex, and some variables in the model have non-normal distributions. As a general rule of thumb, the sample size should have a ratio of 15 respondents for each

4 In the EM method, the expectation maximisation algorithm is used to produce maximum likelihood point estimates of means, variances, and covariances (Von Hippel, 2004).

estimated parameter. Also, the model (or part of it) has not been tested before and although all the variables and relations are carefully based on theory, there is a risk of omitting relevant other variables and relations. Finally, the estimation method (WLS) requires a large sample size. The sample size of 595 seems adequate to meet these requirements.

7.3.2 Choice of input matrix

When the observed variables are a mixture of ordinal and continuous variables, the use of ordinary product-moment (Pearson) correlations is not recommended (Jöreskog , 2004; Jöreskog & Sörbom, 1993). If both variables are ordinal, the polychoric correlation coefficient is appropriate; if one variable is continuous and the other ordinal, a polyserial correlation is used (Jöreskog & Sörbom, 1993). These correlations are not computed from actual scores, but are rather theoretical correlations of the underlying unobserved continuous variable of which the ordinal variable may be regarded as a crude measurement (Jöreskog, 2004). **Table 7.6** provides an overview of the appropriate correlations between the variables. To calculate the correlations, bivariate normality is assumed. PRELIS[5] output indicates that only 3 out of 39 bivariate polyserial or polychoric correlations have an RMSEA[6] of more than 0,1 that indicates non-normality (Jöreskog, 2004). Overall then, the polychoric or polyserial correlations are reliable considering this small number of non-normal relations. From **table 7.5** there is only one correlation that could indicate a multicollinearity problem. The correlation between dedication of resources (DEDRES) and the presence of innovation roles (INNROL) is 0,765. However, the correlation coefficient is still below the limits proposed by Hair et al. (1998) of 0,90 and 0,80. Moreover, in the multiple regression analysis of e-business adoption and specific firm characteristics, there were no signs of multicollinearity for DEDRES and INNROL, judged by their tolerance and VIF values (**7.2.4**).

5 PRELIS is a preprocessor for LISREL. PRELIS enables data screening and data summarisation by analysing the variables jointly (as opposed to one variable at a time).

6 Polychoric correlations were found to be very robust to violations of underlying bivariate normality whereas the chi-square measure is not (Jöreskog, 2004). Jöreskog therefore developed a Root Mean Square Error of Approximation (RMSEA) measure as an alternative to the chi-square measure. Based on simulation studies Jöreskog found that there are no serious effects of non-normality unless RMSEA is larger than 0,1.

Table 7.5 Table of polychoric, polyserial and Pearson product moment correlations between variables (n=595)

	KWP	VCO2	VCSTRAT2	EBUSADG3	RELADV	COMP	PERCHOPL	ITSCORE4	CUSTORIE	ENVIRON	EO	INNROL	DEDRES	PERCBIJS	ACTINFO	EXPRESS
KWP	1.000															
VCO2	0.250	1.000														
VCSTRAT2	0.100	0.472	1.000													
EBUSADG3	0.408	0.628	0.468	1.000												
RELADV	0.170	0.382	0.291	0.471	1.000											
COMP	0.184	0.522	0.514	0.577	0.566	1.000										
PERCHOPL	-0.211	0.075	0.031	0.077	-0.026	0.032	1.000									
ITSCOR4B	0.536	0.396	0.260	0.551	0.294	0.347	-0.015	1.000								
CUSTORIE	0.265	0.256	0.244	0.264	0.395	0.314	-0.089	0.199	1.000							
ENVIRON	0.159	0.222	0.163	0.287	0.292	0.276	-0.008	0.237	0.442	1.000						
EO	0.284	0.386	0.397	0.481	0.293	0.463	0.030	0.354	0.423	0.377	1.000					
INNROL	0.349	0.475	0.377	0.571	0.487	0.638	-0.040	0.426	0.388	0.317	0.454	1.000				
DEDRES	0.367	0.514	0.402	0.586	0.509	0.677	-0.052	0.452	0.392	0.299	0.455	0.765	1.000			
PERCBIJS	-0.180	0.203	0.175	0.185	0.116	0.200	0.208	0.058	0.034	0.081	0.137	0.158	0.130	1.000		
ACTINFO	0.190	0.418	0.394	0.503	0.283	0.373	-0.022	0.350	0.135	0.216	0.280	0.412	0.420	0.176	1.000	
EXPRESS	0.159	0.408	0.336	0.410	0.218	0.313	-0.066	0.277	0.123	0.158	0.180	0.336	0.326	0.118	0.542	1.000

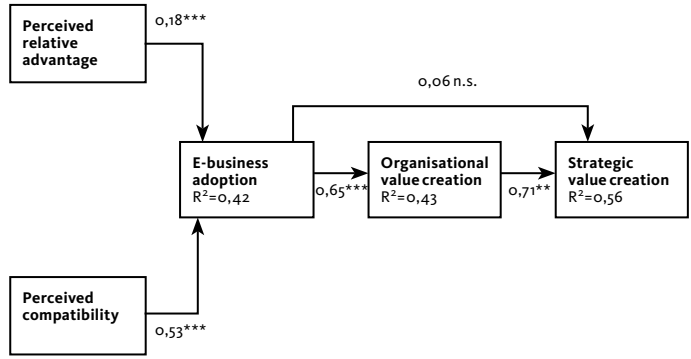
KWP= Class of firm size
VCSTRAT2 = Strategic value creation
VCO2= Organisational value creation
EBUSADG3= E-business adoption
RELADV= Perceived relative advantage
COMP= Perceived compatibility
PERCHOPL= % of employees with a university or higher vocational training
ITSCORE4= Sophistication of IT infrastructure
CUSTORIE= Customer and competitor orientation
ENVIRON= Environment as a source of ideas
EO= Entrepreneurial orientation
PERCBIJS= % of employees with an e-business-related training
INNROL= Presence of innovation roles
DEDRES= Perceived dedication of resources
ACTINFO= Activated information network
EXPRESS= Perceived external pressure

7.3.3 Estimation of model I: the perceptions model

In order to estimate the perceptions model, I will use the input matrix, as described in **7.3.2**, in combination with its asymptotic covariance matrix. The estimation method used is WLS.. Both matrices were calculated using PRELIS 2.30. The sample size is 595, as 19 outliers have been removed previously (as dis-

cussed in **7.2**). There are no missing values on any variable as missing values have been imputed using the EM method. Next, the model is estimated using LISREL 8.30 and the WLS method of estimation. The estimated model is in **figure 7.8**.

Figure 7.8 Estimated Model I: the perceptions model[a]



a Causal coefficients are standardised beta coefficients significant at: *p<=0,05, **p<=0,01, ***p<=0,001 (one-tailed test), n.s.=not significant

In order to evaluate the estimated model a number of goodness-of-fit measures has been selected. The selection is explained in detail in **appendix 7.6**. A first indication of goodness-of-fit is the number of degrees of freedom. The number of degrees of freedom is larger than zero, which means that the model has been identified. To assess the overall fit of the model to the data, four measures are used: NCP, AGFI, RMR, RMSEA, and ECVI. The estimated non-centrality parameter (NCP) is an alternative to the Chi-square statistic and less affected by sample size (Hair et al., 1998). The NCP is 19,31. The adjusted goodness of fit measure (AGFI) is 0,98, which indicates that the model fits the data well. Another indication of a good model fit is the low value of RMR (0,094), which measures the square root of the average of the fitted residuals. The root mean square residual of approximation (RMSEA=0,09) is just over the recommended value of 0,05-0,08 (Hair et al., 1998). The RMSEA indicates the goodness-of-fit that could be

expected if the model were estimated in the population, not just the sample drawn from the population. The value of 0,09 suggests that reasonable errors of approximation may occur in the population (Jöreskog & Sörbom, 1993). Finally, the expected cross validation index (ECVI) is low (0,077). ECVI is an approximation of the goodness-of-fit for the estimated model using another sample of the same size, taking into account the number of parameters (Hair et al., 1998).

A closer look at the solution reveals no 'offending' estimates; LISREL output does not show any negative or non-significant error variances, extremely large standardised coefficients, or very large standard errors associated with an estimated coefficient (Hair et al., 1998). Further, the residuals, standardised residuals and modification indices are inspected to assess the fit of the estimated model in detail and locate possible misspecification in the structural model (Jöreskog & Sörbom, 1993). The stem leaf plot of the fitted residuals is symmetrical around 0, which characterises a good model (Hair et al., 1998). Modification indices larger than 3,84 suggest adding non-estimated relationships to the model (Hair et al., 1998). In this estimation, there are four conspicuous modification indices over 3,84. First, relations are suggested from organisational value creation to e-business adoption (M.I =10,84), and from strategic value creation to e-business adoption (M.I=12,83). This reciprocity between value creation and e-business adoption however is impossible to interpret theoretically. For both types of value creation, the question specifically inquired about the value created *as a result of e-business*. In both cases, the temporal antecedence is beyond question; value creation follows e-business adoption. Consequently, these modification indices are ignored.

Second, modification indices suggest relations from perceived compatibility to organisational value creation (M.I=14,77), and from perceived compatibility to strategic value creation (M.I=18,59). Seemingly, perceived compatibility also has a direct effect on value creation, and not only indirectly via e-business adoption. Again, these relations are impossible to interpret theoretically. Value is created only when e-business is actually used. It is hard to imagine that value is created by a perception alone; attitude does not equal practice. Again, the modification indices do not indicate any model misspecification, and so they are ignored.

The signs of the estimated coefficients in the solution are all positive as was specified in the theoretical model. To assess significance one-tailed tests are used, as the direction of the relations is pre-specified. Four out of five of the estimated coefficients are significant. This means that confirmation has been found for ***hypotheses 1a*** (e-business adoption → organisational value creation), ***1c*** (organisational → strategic value creation), ***2a*** (perceived relative advantage → e-business adoption), and ***2b*** (perceived compatibility → e-business adoption). These results are in line with the results of the linear regression, except for the hypothesised relation between e-business adoption and strategic value creation (***hypothesis 1b***). This relation was found to be significant in regression analysis, but insignificant in the estimated solution (β=0,06, t-value=0,29). Apparently, the perceptions model cannot explain a direct relation from e-business adoption to strategic value creation.

The squared multiple correlation (R^2) is a measure of the strength of the linear relationship. R^2 represents the proportion explained variance in the dependent variables. A small R^2 indicates a weak relationship and suggests the model is not effective (Jöreskog & Sörbom, 1993). The perceptions model explains 42% of the variance in e-business adoption, 43% of the variance in organisational value creation, and 56% of the variance in strategic value creation. So, these values indicate an effective model. In order to further assess the effectiveness of the perceptions model, I compared the variance explained to comparable[7] studies from **chapter 2**. In these studies, e-business adoption is usually explained with perceived innovation characteristics as independent variables like perceived relative advantage, perceived compatibility and complexity. **table 7.6** presents the comparison. The overview shows that the results of the perceptions model are in line with similar explanations of e-business adoption.

To make causal interpretations it is important to ensure that no other variables explain e-business adoption and value creation than the variables included in the model. To get an indication of possible effects on e-business adoption and value creation from variables that lie outside the model, I re-estimate the model including class of (firm) size as an independent variable. In the literature review (**2.3.2**), I concluded that organisational size seems to be a convenient alternative for measuring the effect of other internal variables or organisational structure

7 Many studies included in the review in chapter 2 explain e-business adoption using discriminant analysis, or did not report on the total variance explained. Hence, their results could not be compared to this study.

on innovativeness. So, including size[8] into the model provides an insight into variance unexplained by the perceived opportunity characteristics. The results of the estimation indicate that the overall model fit of the model including class of size (model IK) is comparable to the original perceptions model (model I) (**appendix 7.7**). Both models have a good fit. More important however is that the proportion explained variance (R^2) in e-business adoption changes from 42% in the original perceptions model to 56% in the model including class of size. The variance explained in organisational value creation is about the same using model IK (changes from 43% to 45%). The variance explained in strategic value creation decreases from 56% using the original model to 49% using the model including class of size. Ergo, the model including class of firm size does a better job in explaining e-business adoption than does the original perceptions model, and performs less in explaining strategic value creation.

Table 7.6 Comparison of variance explained

Author	Year	Level of analysis	Measure of adoption	Overall variance explained (R^2)	Comment
Model I: the perceptions model	2004	firm	E-business adoption	42%	
Agarwal & Prasad	1997	individual	Current use of www (intention to use www in future)	48% (46%)	adjusted R^2
Gefen & Straub	1997	individual	E-mail use	34%	
Cheung, Chang & Lai	2000	individual	Internet/www usage	36%	
Lederer, Maupin, Sena & Zhuang	2000	individual	Website	58%	
Chang & Cheung	2001	individual	Intention to use Internet/www	36%	
Eder & Igbaria	2001	firm	Intranet diffusion (infusion)	21,3% (69%)	
Kendall, Tung, Chua, Hong, Ng & Tan	2001	firm	E-commerce adoption	41%	
Raymond	2001	firm	Strategic website implementation	31%	
Cheng, Cheung & Chang	2002	individual	Internet & www usage in manufacturing (services)	32,9% (49,5%)	

8 The respondents are equally divided over the three classes of firm size. See table 5.6 in chapter 5.

The regression coefficients for perceived relative advantage and perceived compatibility hardly change (the solution is in **appendix 7.8**). However, the regression coefficient for class of size is 0,36 (significant at the 0,001 level), and so it is an influential explanatory variable. Apparently, there are other explanatory variables related to the firm that are not included in the model.
The perceptions model explains e-business adoption and consecutive value creation by using perceived opportunity characteristics as explanatory variables. This approach is used in many studies aimed at explaining e-business adoption (**chapter 2**). The logic behind this approach is that a positive evaluation of the opportunities offered by ICTs is followed by the adoption of e-business. For example, perceiving the use of the Internet as beneficial to the company instigates a firm to actually adopt the Internet. However, a positive perception does not automatically leads to adopting e-business. First, this is reflected in the low value of the regression coefficient for perceived relative advantage. Second, it comes to the fore in the results of the linear regression of perceived relative advantage and e-business adoption. A high level of perceived relative advantage does not in any case relate to a high level of e-business adoption (as illustrated in **figure 7.6**).

The impact of perceived compatibility is more important on e-business adoption than the influence of perceived relative advantage (**figure 7.8**). It relates to the degree that the firm believes that e-business is congruent with values and existing practices within the firm and its value chain. For example, the perception that the firm's products and services are suited for e-business stimulates its adoption. Compatibility extends beyond the company itself, and includes compatibility of e-business to the firm's customers and suppliers. Further, the estimated perceptions model proves that improving efficiency and effectiveness of business processes (organisational value creation) is an evident result of e-business adoption. Strategic benefits, related to new products and services, and new markets, follow organisational value creation.

In summary, the perceptions model is effective in explaining e-business adoption and value creation considering the good model fit on the data and the proportions explained variance in the dependent variables. In addition, the model is parsimonious as only two explanatory variables are used. Yet, the proportion

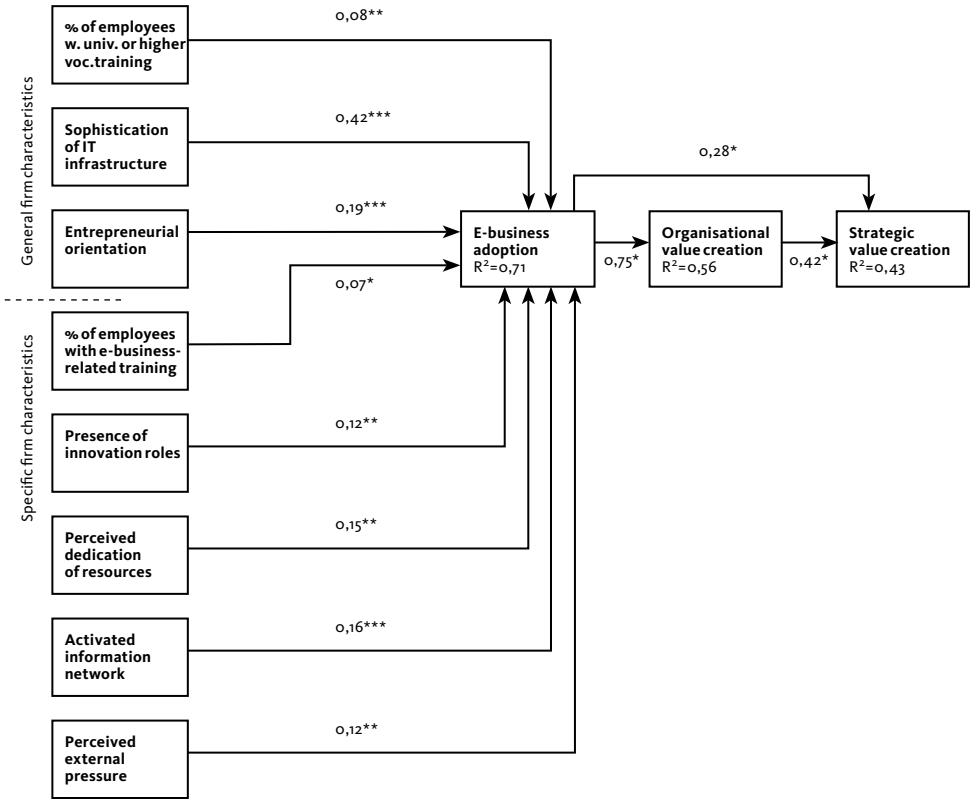
explained variance of 42% in e-business adoption also tells us that the remaining 58% in e-business adoption remains unexplained. Also, the fact that class of firm size changes the explained variance in e-business adoption from 42% to 56% indicates that the model is incomplete. Moreover, the perceptions model does not provide any insight into the influence of the adopter's context, especially the impact of previous knowledge and experience, network contacts and strategic posture. It remains unclear how these firm characteristics contribute to a perception of e-business adoption and value creation.

7.3.4 Estimation of model II: the firm characteristics model

The firm characteristics model is estimated following the same procedure as the perceptions model. The input matrix, as described in **7.3.2**, is used in combination with its asymptotic covariance matrix. The method of estimation is WLS. The estimated model is in **figure 7.9**.

To evaluate the model fit, the same goodness-of-fit measures are used as with Model I. The model is identified with 16 degrees of freedom. The overall fit of the model is good with an adjusted goodness of fit measure (AGFI) of 0,99. The NCP is a low 6,60. The square root of the average of the fitted residuals (RMR) is low (0,047). The root mean square residual of approximation (RMSEA=0,027) is well below the recommended value of 0,05 (Hair et al., 1998). This value indicates a close fit if the model were estimated in the population (Jöreskog & Sörbom, 1993). Finally, the expected cross validation index (ECVI) is low (0,21). To evaluate the detailed model fit, the estimated solution is inspected. A closer look at the solution reveals no 'offending' estimates. Inspection of the stem leaf plot of the fitted residuals indicates a good model fit.

Figure 7.9 Estimated Model II: the firm characteristics model[a]



a Causal coefficients are standardised beta coefficients significant at: *p<=0,05, **p<=0,01, ***p<=0,001 (one-tailed test)

In the LISREL output, three interesting modification indices are given with a value over 3,84. Again, a relation is suggested from strategic value creation to e-business adoption (M.I=12,77). As I pointed out in discussing the evaluation of the perceptions model, this relation is impossible to interpret considering the actual question and the 'fixed' order of e-business adoption and value creation.

The other two modification indices point at direct relations from entrepreneurial orientation and the activated information network to strategic value creation (M.I=9,38 and 5,75 respectively). This may be explained by a shortcoming in the measurement of e-business adoption. The operationalisation of e-business adoption in this study is based upon the idea that e-business is the support of business processes with ICTs. Hence, e-business adoption is measured by 'counting' the number of business activities supported by e-mail and Internet, weighing the outcome with the intensity of use. However, new products and services based on e-mail and Internet create strategic value. The measurement instrument for e-business adoption focuses on business processes, and does not specifically address products or services based on the Internet or e-mail. Specifically innovative companies have a relatively high entrepreneurial orientation and large activated information network. This is illustrated by the fact that, in this study, these companies score significantly higher on the introduction of new products and services than companies that do not[9].
True product innovations based on e-mail or Internet, do not reveal themselves in the level of e-business adoption as measured in this study. For example, the Dutch company of Bibit **(www.bibit.com)** provides complex electronic payment services. They create strategic value by offering a unique product based on Internet technology. However, their score on e-business adoption in this study would not entirely express the extent to which their company is based on the Internet. Hence, the suggested relations from entrepreneurial orientation and activated information network to strategic value creation indicate this deficit in the measurement of e-business adoption, and not a misspecification of the model. Including the direct relations from entrepreneurial orientation and activated information network to strategic value creation in the model, resulted in insignificant relations in the solution. Therefore, the suggestion to add both relations is ignored.

The signs of the estimated coefficients in the solution are all positive as was specified in the theoretical model. All estimated coefficients are significant[10].

9 An independent samples T-test showed that respondents indicating new products and services as strategic value created, score significantly higher on entrepreneurial orientation and activated information network compared to companies that did not create this type of strategic value.

10 One of the items for sophistication of IT infrastructure refers to an external connection (Table 6.11). To rule out possible contamination between this item and e-business adoption, the model was re-estimated without the 48 cases scoring on this item. There was hardly any change in model fit or regression coefficients, so contamination is not substantiated.

Consequently, ***hypotheses 1a, 1b, 1c, 3a, 3b, 3e, 4a, 4b, 4c, 4d, and 4e*** are confirmed. Most notable is the significant and relatively strong relation between the sophistication of IT infrastructure and e-business adoption. The results are completely in line with the results of the linear regressions.

Inspection of the coefficients of determination (R^2) indicates that the firm characteristics model is effective in explaining e-business adoption and value creation. The firm characteristics model explains 71% of the variance in e-business adoption, 56% of the variance in organisational value creation, and 43% of the variance in strategic value creation.

In order to check whether the proposed model represents all influential firm characteristics, the class of firm size is added to the model as explanatory variable. The result of the estimation indicates that the overall model fit of the model including class of size (model IIK) is comparable to the original firm characteristics model (model II) (the results are presented in **appendix 7.7**). Both models have a good fit on the data. Also, the proportion explained variance (R^2) in e-business adoption is about the same: 71% for the original firm characteristics model (model II), and 72% for the model including class of size (model IIK). Also, there is hardly any difference in variance explained in organisational and strategic value creation using the model including firm size. The estimated coefficients decrease only slightly in the model due to the introduction of the class of size in the model (the solution is in **appendix 7.9**). The estimated regression coefficient for class of size is 0,12 and significant. Hence, including the class of size does not change the model, and so there is no indication that relevant firm characteristics have been overlooked.

The firm characteristics model, e-business adoption and value creation are explained by a selection of firm characteristics that stimulate the recognition of business opportunities. The logic behind this approach is that e-business is not a well-defined innovation with known features. E-business is the application of ICTs to support business processes in a way that creates value for the company. So, e-business adoption is more about finding profitable ways to deploy technological innovations like the Internet, than about accepting or rejecting a technological innovation. From an entrepreneurship perspective, the explana-

tion of e-business adoption focuses on how capable a firm is in discovering and developing business opportunities based on ICTs that create value. The selected firm characteristics facilitating this opportunity recognition process, relate to a firm's relevant knowledge and experience, network contacts and strategic posture.

The results of the estimated firm characteristics model first of all demonstrate that the explanation of e-business adoption and value creation is multi-dimensional. All estimated relations were found to be significant indicating a coherent framework of explanatory variables. Evidently, the sophistication of IT infrastructure is a powerful and dominant explanatory variable to e-business adoption[11]. The accumulated knowledge and experience with the implementation and use of information technology forms a basis for acquiring related new knowledge like knowledge of e-mail and Internet. This knowledge base is a necessary precondition for recognising and developing e-business opportunities. An entrepreneurial strategic posture supports the process of acting upon these business opportunities. Entrepreneurial orientation reflects a firm's degree of entrepreneurship and its willingness to innovate, take risks, and act pro-actively on opportunities in general. The results indicate that this is the case for e-business opportunities as well.

Network contacts prove to be influential as well. A firm uses its network to find information about e-business opportunities and reduce uncertainty about the consequences of adopting e-business, its appropriateness, and complexity. Pro-actively tapping outside social contacts for specific information related to e-business aids in the evaluation of e-business opportunities. Motivation and support that the firm perceives from external parties, further facilitates a positive evaluation of the opportunities. Apparently, perceived external pressure makes the opportunities for e-business seem more attractive.

11 The dominance of IT sophistication may give the impression that the other variables are superfluous. This is not the case. In a re-estimation of the firm characteristics model with solely IT sophistication as the explanatory variable, the variance explained in e-business adoption drops to 31%, to 42% in organisational value creation and to 27% in strategic value creation (compared to 71%, 56%, and 43% respectively in the complete firm characteristics model).

The expected availability of time and money for e-business is a reflection of the firm's commitment to stimulate the development of e-business opportunities. The perceived dedication of resources motivates people to think about possible application of ICTs for e-business. Another form of commitment or readiness for e-business adoption is the presence of individuals in the company that take on certain innovation roles. Organisations need individuals that are capable and motivated to recognise opportunities for e-business and make them real. The 'gatekeeper' is enthusiastic about e-business and acquires new knowledge and brings it into the organisation. The 'champion' translates these innovative ideas into concrete propositions for e-business, and pushes their realisation. The results indicate that the presence of these innovation roles stimulates e-business adoption and consecutive value creation.
Least influential on e-business adoption are the level of formal education and the level of e-business related training. The limited impact of the level of formal education is most likely due to its operationalisation. As an indicator I choose the percentage of employees with a university or higher vocational training. However, in most small companies this percentage is low and hardly differentiates one company from another (see **table 6.10** in **chapter 6**). In most companies the percentage of employees that took an e-business related training is low as well and shows a similar problem in differentiating firms (see **table 6.12** in **chapter 6**).

The estimated firm characteristics model clearly proves the relation between e-business adoption, and organisational and strategic value creation. This confirms the hypotheses that e-business adoption improves the efficiency and effectiveness of business processes as well as provides firms with strategic benefits like new products, markets and services. The results also indicate that e-business innovation follows a 'reverse product cycle' as Barras (1986) found for the introduction of information technologies in the services industry (discussed in **4.2.1**). He argued that the application of new technologies starts with process improvements to increase efficiency of delivery of existing services, moves to process innovations, which improve service quality, and then leads to product innovations through the generation of new types of services. The results confirm that strategic value creation succeeds organisational value creation in the case of e-business adoption.

In summary, the firm characteristics model is effective in explaining e-business adoption and value creation regarding the good model fit on the data and the variance explained in the dependent variables. Especially, the proportion explained variance in e-business adoption (71%) is high. Although the model is less parsimonious than the perceptions model, it gives a lot of information on firm characteristics that matter in the adoption of e-business and the creation of value. Prior knowledge and experience with IT, the use of specific network contacts and a pro-active strategic posture all contribute to e-business adoption.

7.3.5 Estimation of model III: the complete model

The third model to be estimated is the complete model, in which the perceptions model (model I) and the firm characteristics model (model II) are integrated. Again the input matrix, as described in **7.3.2** is used in combination with its asymptotic covariance matrix. The estimation method used is WLS.

The estimated model shows an acceptable fit (**appendix 7.10**). However, closer inspection of the estimated solution reveals several extreme, 'offending' estimates. Four of the 24 estimated regression coefficients are well over 1 (ranging from |4,73| to 11,98). These coefficients concern the relationships between perceived presence of innovation roles, perceived dedication of resources, and the two perceived opportunity characteristics: perceived relative advantage and compatibility. Moreover, the relation between perceived innovation roles and both opportunity characteristics is negative, which is contrary to the hypothesised directions as well as the directions found in the linear regressions (**table 7.5**). Further, the error variance in perceived compatibility is –0,01 and insignificant (t-value = -0,04). All these results indicate an invalid solution.

The most likely explanation for these results seems to be that the measurements of perceived innovation roles and perceived dedication of resources overlap with perceived relative advantage and perceived compatibility. The presence of innovation roles may correspond with two items for perceived compatibility: 'in our company there is a lot of interest in electronic business' and 'we have enough knowledge available in the company for electronic business'. This contamination thus results in regression coefficients larger than 1. The over-

lap between the other constructs however is hard to explain. In the questionnaire, the questions for innovation roles and dedication of resources are placed below the questions for relative advantage and compatibility. A possible pattern in the responses could account for the contamination. However, inspecting the responses, there does not appear to be a clear response pattern.

The broad character of both perceived relative advantage and perceived compatibility constructs may also play a part. Tornatzky and Klein (1982) discuss the 'garbage can' quality of perceived relative advantage in which a variety of advantages can be tossed, and the multiple interpretations of compatibility. In addition, questions are raised in literature about the independence of the two concepts (Moore & Benbasat, 1991; Tornatzky & Klein, 1982). Ergo, when perceived characteristics are used as dependent variables there is a reasonable risk that the constructs overlap with independent variables. Illustrative is the fact that when a model is estimated consisting of the firm characteristics as the independent variables, and perceived relative advantage and perceived compatibility as the dependent variables, the estimation fails to converge into a solution (the procedure stopped after 410 iterations).

7.3.6 Conclusions

The estimated perceptions and firm characteristics models enable an interesting comparison of approaches to the explanation of e-business adoption and value creation. The perceptions model is based on a much-used approach in explaining innovation adoption. The relative advantage and the compatibility of the e-business opportunity as perceived by the firm effectively explain e-business adoption and value creation. The model is parsimonious, yet provides little information on which firm characteristics really matter in forming a perception of e-business. In comparison to the perceptions model, the firm characteristics model gives more information on firm characteristics that are behind the firm's perception of relative advantage and compatibility. Although in this study the exact relation from the firm characteristics to the perceived opportunity characteristics cannot be uncovered, we get a good picture of which firm characteristics matter in e-business adoption and value creation.

Looking at the goodness-of-fit measures (**table 7.7**), it is evident that both models have a good fit. However, on several measures the firm characteristics model

performs better. The firm characteristics model is less parsimonious than the perceptions model, which results in a slightly higher ECVI value. Usually the model with the lowest ECVI is favoured, however, in this case the firm characteristics model is more informative than the perceptions model. Model II has a larger number of degrees of freedom, which indicates that there is more information in the data matrix than the number of parameters to be estimated.
The overall model fit of the firm characteristics model is better than the perceptions model; the NCP, RMR and RMSEA are lower, and the AGFI is higher for the firm characteristics model in comparison to the perceptions model.
Moreover, comparing the proportion explained variance in e-business adoption in both models, the firm characteristics model clearly outperforms the perceptions model. The perceptions model explains 42% in e-business adoption compared to 71% in the firm characteristics model. So, I prefer to use the firm characteristics model to explain e-business adoption and value creation.

Table 7.7 Evaluation of model I and II

	Goodness-of-fit measures:	Model I: the perceptions model	Model II: the firm characteristics model
1	Degrees of freedom ≥0	4	16
2	Overall model fit		
	Estimated Non Centrality Parameter	NCP = 19,31	NCP = 6,60
	Adjusted Goodness-of-Fit >0,90	AGFI = 0,98	AGFI = 0,99
	Root Mean Square Residual	RMR = 0,094	RMR = 0,047
	Root Mean Square Residual of Approximation <=0,05-0,08	RMSEA = 0,090 confidence interval: 0,057 - 0,13 RMSEA < 0,05 (p = 0,025)	RMSEA = 0,027 confidence interval: 0,0 - 0,050 RMSEA < 0,05 (p = 0,95)
	Expected Cross Validation Index	ECVImodel = 0,077	ECVImodel = 0,21
3	Offending estimates	no	no
4	Detailed model fit		
	Inspection of residuals	stem leaf plot symmetrical around 0	stem leaf plot symmetrical around 0
	Modification indices	no misspecification indicated	no misspecification indicated
5	Examination of the solution		
	Signs of coefficients	as hypothesised	as hypothesised
	Significance of coefficients	4 of 5 estimates significant	11 of 11 estimates significant
	Squared multiple correlations (R2)	R^2 (Organisational value creation) = 0,43 R^2 (Strategic value creation) = 0,56 R^2 (E-business adoption) = 0,42	R^2 (Organisational value creation) = 0,56 R^2 (Strategic value creation) = 0,43 R^2 (E-business adoption) = 0,71

Together, the perceptions and firm characteristics model make up the complete model (**Figure 7.7**). The linear regressions on firm characteristics and perceived opportunity characteristics suggest that the selected firm characteristics have a positive effect on the perceptions (**7.2.5** and **7.2.6**). However, the results of the estimation of the complete model indicate contamination between some firm characteristics and perceived opportunity characteristics. Therefore, the unreliable result of the estimation of the complete model makes it impossible to get insight into the relations between firm characteristics, perceived opportunity characteristics and e-business adoption and value creation. Therefore, this study cannot conclude on the relations between firm characteristics and perceived opportunity characteristics.

Summarising the results of the structural equation modelling, 13 out of the 15 hypothesised relationships can be confirmed. In **table 7.8** the results are presented. The perceptions model confirms the positive relationship between the perceived opportunity characteristics and e-business adoption (***hypotheses 2a and 2b***). The firm characteristics model, which I prefer to explain e-business adoption, confirms the other hypotheses, except for the relation between customer and competitor orientation and e-business adoption (***3c***), and using the environment as a source of ideas and e-business adoption (***3d***).

Table 7.8 Overview of hypotheses

	Relationship (variable names)	Nature	Status
1a	E-business adoption → organisational value creation	+	confirmed
1b	E-business adoption → strategic value creation	+	confirmed
1c	Organisational value creation → strategic value creation	+	confirmed
2a	Perceived relative advantage → e-business adoption.	+	confirmed
2b	Perceived compatibility → e-business adoption	+	confirmed
3a	% of employees with a university or higher vocational training → e-business adoption	+	confirmed
3b	Sophistication of IT infrastructure → e-business adoption	+	confirmed
3c	Customer and competitor orientation → e-business adoption	+	not confirmed
3d	Environment as a source of ideas → e-business adoption	+	not confirmed
3e	Entrepreneurial orientation → e-business adoption	+	confirmed
4a	% of employees with an e-business-related training → e-business adoption	+	confirmed
4d	Activated information network → e-business adoption	+	confirmed
4e	Perceived external pressure → e-business adoption	+	confirmed

7.4 The entrepreneurial aspect of e-business adoption

At the end of the innovation adoption literature review (**chapter 2**), I contended that e-business has an entrepreneurial aspect. The recognition of opportunities to deploy ICTs to create value for the company is at the heart of e-business adoption. Therefore, literature on entrepreneurship and opportunity recognition has been explored to find out how an entrepreneurship perspective may contribute to the explanation of e-business adoption (**chapter 3**). I concluded that the entrepreneurship perspective focuses on how the adoption of ICTs creates value; it puts innovation adoption in a purposeful perspective. Electronic business is about adopting ICTs for the sake of doing business. Entrepreneurship literature, and in particular the body of knowledge on opportunity recognition, has been used to select firm characteristics that facilitate the recognition of business opportunities for e-business. Knowledge and experience, and network contacts were found to be important. However, in the few opportunity recognition studies on firm level, the firm's strategic orientation stood out as being important to explain the discovery and exploitation of opportunities.

In this study, e-business adoption is considered truly entrepreneurial when its adoption results in new ways of working (strategic value) as opposed to the optimisation of existing ways of working (organisational value creation) (as discussed in **3.2**). In the comparison of models, I concluded that the firm characteristics model offers more information on influential firm characteristics than the perceptions model. But is it informative enough to distinguish firms that create strategic value from firms that do not?

To answer this question an independent samples t-test is performed. The sample is divided into two groups: the 'entrepreneurial' group, and the 'optimising' group. The 'entrepreneurial' group consists of firms that introduced new products, services or entered new markets as a result of e-business adoption (strategic value creation). The 'optimising' group is composed of firms that 'only' created value by improving the efficiency or effectiveness of their business processes (organisational value creation). The results are presented in **table 7.9**.

Table 7.9 Comparison of 'optimising' and 'entrepreneurial' firms

Firm characteristic	Entrepreneurial group[a] n=225		Optimising group n=370		T-test for equality of means[b]		
	Mean	Std.dev	Mean	Std.dev	t	df	Sig. (2-tailed)
Activated information network	3,578	2,093	2,276	1,930	7,729	593	0,000
Perceived dedication of resources[c]	3,709	1,204	2,910	1,321	7,562	507	0,000
Entrepreneurial orientation	2,941	0,970	2,354	0,929	7,351	593	0,000
Perceived external pressure	2,529	1,827	1,524	1,661	6,885	593	0,000
Presence of innovation roles	3,700	1,260	2,976	1,391	6,372	593	0,000
Customer and competitor orientation	4,059	0,711	3,741	0,855	4,898	538	0,000
Sophistication of IT infrastructure[c]	3,186	1,072	2,883	0,994	3,397	446	0,001
% of employees with an e-business-related training[c]	0,131	0,200	0,085	0,176	2,800	427	0,005
Environment as a source of ideas	3,433	0,871	3,235	0,961	2,523	593	0,012
% of employees with a university or higher vocational training	0,160	0,244	0,150	0,265	0,459	593	0,647

a The 'optimising' group reported no strategic value creation, the 'entrepreneurial' group did report some form of strategic value creation

b A significant t-test indicates that group means are significantly different; where variances are not equal the corrected t-test is presented

c Equal variances are not assumed according to the Levene's test ($p<0,05$), therefore the corrected t-test is presented

In the results of the firm characteristics model, IT sophistication emerged as the most important determinant of e-business adoption. Interestingly, the sophistication of IT infrastructure differentiates both groups, however, much less evident than other independent variables (considering the t-value). The 'entrepreneurial' group scores significantly higher than the 'optimising' group of firms, on activated information network, perceived dedication of resources, entrepreneurial orientation, perceived external pressure, and perceived presence of innovation roles (all significant $p<0,001$, in sequence of decreasing t-values).

In particular, the number of network contacts that were activated to find information on electronic business most differentiates firms that created strategic value from firms that only created organisational value. In other words, the 'entrepreneurial' firms use their network more intensively than 'optimising' firms. Next, in 'entrepreneurial' firms the perception that money and time are available for e-business is significantly higher than in 'optimising' firms. Slack resources positively influence adoption and the creation of strategic value. Entrepreneurial orientation clearly distinguishes the enterprising from the optimising firms. This finding in particular indicates that strategic value creation relates to entrepreneurship, as entrepreneurial orientation is a widely used and accepted indicator of entrepreneurial behaviour. This points out that there is indeed an entrepreneurial aspect to e-business adoption.

8 Conclusions and implications of the study

In the introductory chapter of this study, it was illustrated that e-business is often associated with appealing examples like Dell, Amazon, or Cisco. These companies are completely interwoven with ICT, and their business *is* e-business. However, there are also exciting examples of small and medium sized enterprises (SMEs) in traditional industries that manage to change their existing ways of working and create new business by adopting ICTs. To them, adopting e-business means using ICTs to effectively support their daily business. In addition, there is confusion about what the term e-business stands for. Is it about having a website, selling online, or does it refer the use of ICTs in business? This study is aimed at explaining e-business adoption in SMEs. Consequently, the investigation needs to start with conceptualising e-business adoption and making it measurable. Therefore, the first research question is formulated as:

1 ***What is e-business adoption?***

Statistics show that by now many SMEs have computers and Internet access. However, in general SMEs lag behind larger companies in benefiting from the integration of ICTs into their daily business. SMEs play a significant role in our economy, and so stimulating e-business adoption could promote their com-

petitiveness and contribution to economic growth. However, there is a lack of insight in what is holding SMEs back in adopting e-business. Is it a lack of awareness of the possibilities of ICTs, a lack of knowledge and skills, or perhaps a lack of resources? Therefore, this investigation aims to identify firm characteristics that explain e-business adoption. So, the second research question is:

2 ***Which firm characteristics explain e-business adoption in SMEs?***

In the literature, most studies explain e-business adoption from an innovation adoption perspective. In this view, the adopter's perception of e-business is used to explain its adoption. However, e-business is not just the adoption of 'of the shelf' technologies with stable, pre-determined features. On the contrary, e-business is an innovation that is largely shaped by the adopting firm. It is the adopting firm that decides *how* to apply ICTs. Moreover, e-business adoption is about finding ways to capitalise on ICTs, and create new value. Entrepreneurship theory proves to be helpful in understanding the entrepreneurial element in e-business adoption. In an entrepreneurship perspective, e-business adoption is about recognising business opportunities to apply ICTs in ways that improve existing business, or create new business for the company. In this perspective, e-business adoption can be explained from the firm's ability to recognise opportunities to create value by adopting ICTs. This study offers the opportunity to investigate the differences between the two theoretical approaches to explaining e-business adoption, and so the third research question is:

3 ***What are the differences in explaining e-business adoption from an innovation adoption perspective compared to an entrepreneurship perspective?***

In this chapter, I will deal with each research question and report on the most important theoretical and empirical findings. In **8.1**, the findings are presented with respect to the conceptualisation and measurement of e-business adoption. Section **8.2** deals with the identification of firm characteristics that explain e-business adoption. In **8.3** refers to the third research question, and reflects on the consequences of using two different perspectives. Subsequently, practical implications are discussed for SMEs, policy makers, and SME-consultants based on the findings of this research (**8.4**). In **8.5**, the limitations of this research are considered. Finally, suggestions for future research are presented (**8.6**).

8.1 What is e-business adoption?

Theoretical findings

First, 45 studies on e-business adoption were reviewed to investigate the conceptualisation and measurement of e-business adoption. From this review, I inferred that ***e-business adoption is about the support of business processes with icts resulting in value creation*** (**section 2.4**). In this body of knowledge, the conceptualisation and measurement of e-business adoption is hardly worked out or even discussed. I did find some consistency in the way e-business adoption is characterised. In most studies reviewed, a combination of aspects or features of e-business adoption is used to typify this apparently complex and multidimensional phenomenon. More general literature on innovation adoption and information systems suggests using a multidimensional measure for innovation adoption that reflects a degree of adoption or extent of use of an innovation within the organisation. Apparently, it is important to conceptualise e-business adoption as the extent to which a firm uses ICTs to support its business activities. However, none of the e-business adoption studies reviewed offered a comprehensive way of measuring this concept. In addition, many studies on e-business adoption look at what benefits are gained or what value is created by using these ICTs. This indicates that the conception of e-business adoption goes beyond the observation of implemented ICTs like e-mail or the Internet. Seemingly, e-business adoption is connected to value creation, yet the literature reviewed does not indicate how to conceptualise or systematically measure this idea.

After reviewing entrepreneurship literature, I observed that knowledge on entrepreneurship provides a useful starting-point for the conceptualisation of e-business adoption. I concluded that ***e-business adoption can be conceptualised as an opportunity because the application of icts offers the possibility to create new business value*** (**3.6**). In entrepreneurship literature, innovation is explicitly linked together with value creation by the opportunity concept. An opportunity is a situation in which the exploitation of innovation creates new economic value. So, in an entrepreneurship perspective e-business adoption is linked to the creation of value.

Both theoretical perspectives have contributed to a conceptualisation of e-business adoption that was successfully operationalised and measured. The suggestions from the innovation adoption literature helped to effectively operationalise e-business adoption as the extent to which a firm uses ICTs to support its business activities. To express the entrepreneurship perspective, e-business adoption is linked to value creation in the theoretical model. This reflects the idea that innovation adoption is not a goal in itself, but serves the purpose of creating value. Next, the summarised empirical findings on both e-business adoption and value creation are reported.

Empirical findings

To operationalise e-business adoption, two empirical variables were used: business process support and intensity of use. In this study, *business process support* indicates which business activities are supported by e-mail or the Internet for three different business processes: the supply, the internal and the sales process. The empirical findings on business process support show that:

- ***The supply process is most supported by either e-mail or the Internet, followed by the sales and the internal processes*** (**6.2**). For the supply process 8 business activities were identified. The respondents indicated that on average 5,1 of these business activities are supported in their firm by either e-mail or the Internet. For the sales process on average 3,7 out of the given 8 business activities are supported by either e-mail or the Internet. For the internal process 9 business activities were identified. Respondents indicated that e-mail and/or the Internet support on average 3,2 activities in their firm.
- ***The passive use of the Internet predominates in Dutch SMEs*** (**6.2**). The Internet is used in particular as a source of information on suppliers (80%) or on customers and competitors (71%), and for electronic banking (63%). More active use is found less frequently like using the Internet to provide information about its products or services (63%), recruit new personnel (38%), or order products and services (36%).

The extent to which firms support their business processes by e-mail or Internet does not reflect how often or intensively these technologies are used. To measure this *intensity of use*, I assessed to what extent the three business processes rely on the use of e-mail and the Internet, as suggested by Lassila and Brancheau (1999).

From the empirical findings I conclude that firms differ in their dependence on ICT for different business processes: 24% of the respondents indicated serious hindrance to the supply process when e-mail or the Internet would be out of order. Regarding the sales and internal processes, 27% and 28% of the respondents respectively indicated serious inconvenience for the continuation of business. So, although the supply process is the most supported business process, only a fourth of the firms indicated that their supply process heavily relies on e-mail and the Internet. More importantly, this demonstrates that ***business process support and intensity of use are two different dimensions of e-business adoption*** (**6.2**). In effect, business process support looks at the *width* of e-business adoption, and reliance on ICT looks at the *depth* of e-business adoption (Gatignon & Robertson, 1985). The results of the survey show that for most firms the width and depth of e-business adoption is limited. In further analysis the 'score' on e-business adoption for each firm is calculated by weighing business process support with the intensity of use to reflect the extent of ICT use.

Considering these empirical findings I conclude that the operationalisation of e-business adoption adequately reflects an extent of use as was suggested in innovation adoption literature. It gives detailed information on the diverse use of e-mail and the Internet in a total of 25 business activities. As a consequence, the operationalisation of e-business adoption as was used in this study facilitates the assessment of variance in e-business adoption. Not only by observing differences in business process support among SMEs, but also by identifying firms that really depend upon e-mail and the Internet doing their daily business.

To operationalise value creation, two different types of economic value creation were distinguished. Firstly, e-business adoption can improve the efficiency and effectiveness of the existing organisation; in this study this is labelled as *organisational value creation*. Secondly, e-business adoption can offer the possibility to introduce new products or services, or enter new markets; this is labelled as *strategic value creation*. The empirical findings on value creation show that:

– ***E-business adoption is inextricably linked to the creation of economic value*** (**6.1**). The findings confirm the presumption that e-business adoption leads to efficiency and effectiveness improvements (organisational value creation) and/

or to the introduction of new products or services, or new markets (strategic value creation).

- ***Organisational value creation and strategic value creation are two distinct dimensions of value creation*** (**6.1**). Principal component analysis confirmed the two components of value creation.
- ***E-business adoption more often leads to organisational value creation than to strategic value creation*** (**6.1**). In the survey, 82% of the respondents indicated that e-business adoption resulted in saving time and money, improved communication, customer service or an improved company image (organisational value creation). Only in a minority of firms (38%) e-business adoption led to entering a new market, opening up a new market channel, the introduction of a new service or product, or a higher turnover associated with these changes (strategic value creation). In these instances only, the type of value creation is entrepreneurial because economic value is created from new ways of working that have an impact on the market.
- ***The adoption of e-business follows a 'reverse product cycle'*** (**7.2.1**). Barras (1986) found that the application of new information technologies in the service industry first leads to the improvement of the efficiency and quality of existing services (process innovation), and then to the generation of new types of services (product innovation). Analogously, in this study most firms indicated that e-business adoption led to organisational value creation (efficiency and effectiveness improvements); in some of these firms, this was followed by strategic value creation (introducing new products and services, or entering new markets). Organisational value creation appears to form a condition to create strategic value from e-business adoption.

From these empirical findings, I conclude that it proves possible to use suggestions from both the innovation adoption and the entrepreneurship literature to operationalise e-business adoption. Moreover, the entrepreneurship perspective offers a valuable addition to measuring e-business adoption as the extent of ICT use in supporting business processes. The empirical data show that linking e-business adoption to value creation offers much more insight into what the ICTs are used for and how e-business adoption creates value for the company.

8.2 Which firm characteristics explain e-business adoption?

Theoretical findings

To answer the second research question, first e-business adoption literature was investigated. From this review, I concluded that ***most studies make use of the adopter's perceptions of e-business (perceived innovation characteristics) to explain its adoption*** (**2.4**). The adopter's perception of e-business adoption in my view is only part of the explanation, as it does not explain *why* the adopter perceives e-business positively or negatively. Presuming that a firm evaluates the consequences of adopting e-business in its own context, research into the role of firm attributes in e-business adoption seems relevant. In the e-business literature, some studies use adopter characteristics like IT knowledge and use, size, or organisational support to explain e-business adoption. In order to look for coherence in these firm attributes, literature on organisational innovativeness was consulted. In the end, I concluded that the following firm factors influence e-business adoption: the firm's relevant knowledge and experience, network influence, a favourable attitude towards change, and an appropriate internal structure.

Literature on entrepreneurship focuses on the discovery, development and exploitation of business opportunities to create new business. So, from an entrepreneurship perspective, e-business adoption is about recognising how the application of ICTs can create business value. This presumption implies that in order to explain e-business adoption we need to investigate ***which firm characteristics enable a firm to recognise business opportunities based on icts*** (**3.6**). Now, most research is focussed on explaining opportunity recognition on the individual level. Only a few empirical studies were found that explain opportunity recognition on firm level. By comparing the individual level knowledge to the firm level results, the importance of three main firm factors could be presumed: knowledge and experience, network contacts, and strategic posture.

The findings from both theoretical views, innovation adoption and entrepreneurship, point in the same direction and corroborate the importance of knowledge and experience, network contacts, and strategic posture. In this

study, the internal organisational structure is not included in the explanation, mainly because organisational structure is a non-behavioural attribute, and as such does not make a firm entrepreneurial (Covin & Slevin, 1991). In addition, Miller and Friesen (1982) found that the strategy followed by the firm matters much more to innovativeness than its structure. The firm's strategic posture is explicitly included in the model, so it seems justifiable to omit the organisational structure. Further, the strategic posture construct is a wider concept than a favourable attitude towards change, because entrepreneurial behaviour not only relates to innovativeness, but also to risk-taking and pro-activeness.

The findings from the two theoretical perspectives were used to develop a theoretical model explaining e-business adoption. The theoretical constructs were operationalised into empirical variables. In the complete theoretical model, 15 hypothesised relations were specified, proposing that (**7.1**):

- ***E-business adoption relates positively to organisational and strategic value creation.***
- ***Perceived relative advantage and perceived compatibility relate positively to e-business adoption.*** In this study, the term perceived *opportunity* characteristics is used instead of perceived innovation characteristics. This is based on the premise that it is not the innovation itself that is being assessed, but rather the opportunity to create value that the innovation (e-mail or Internet) offers.
- ***General firm characteristics relate positively to e-business adoption.*** These firm attributes facilitate the recognition of universal business opportunities: the level of formal education, the sophistication of IT infrastructure, customer and competitor orientation, using the environment as a source of ideas, and entrepreneurial orientation.
- ***Specific firm characteristics relate positively to e-business adoption.*** These firm attributes facilitate the recognition of opportunities for *e-business* explicitly: e-business related training, perceived presence of innovation roles, perceived dedication of resources, activated information network, and external pressure.
- ***General and specific firm characteristics relate to perceived relative advantage and compatibility.*** These relations will be explored as a lack of literature on the background or origin of perceived innovation characteristics hindered the formulation of explicit hypotheses.

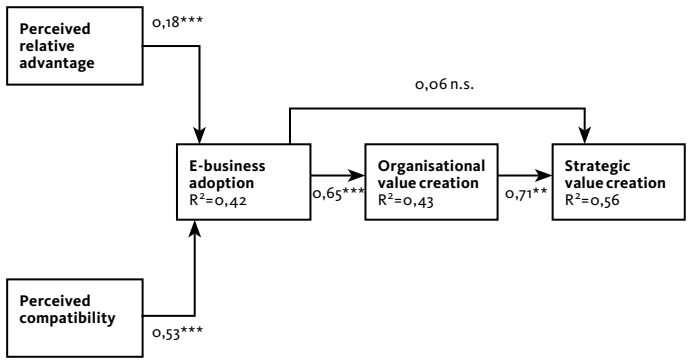
Empirical findings

The complete proposed theoretical model in effect consists of two, partly overlapping, models. These two models each represent a different theoretical perspective on e-business adoption. In the *perceptions model,* perceived opportunity characteristics are proposed to explain e-business adoption and value creation. In the *firm characteristics model*, general and specific firm characteristics were put forward to explain e-business adoption and value creation. So, in effect three models have been tested using structural equation modelling: I The perceptions model, II The firm characteristics model, and III The complete model. Overall, 13 of the 15 hypotheses could be confirmed. Next, I will report the empirical findings on each of the individual models in detail.

I The perceptions model

This model represents a tradition in innovation adoption literature using perceived innovation characteristics to explain adoption. This approach is also common in many e-business adoption studies. ***In the perceptions model, perceived opportunity characteristics explain e-business adoption and value creation*** (**7.3.3**). The estimated model is presented once again in **figure 8.1**.

Figure 8.1 The perceptions model[a] (n=595)



a Causal coefficients are standardised beta coefficients significant at: *p<=0,05, **p<=0,01, ***p<=0,001 (one-tailed test), n.s.=not significant

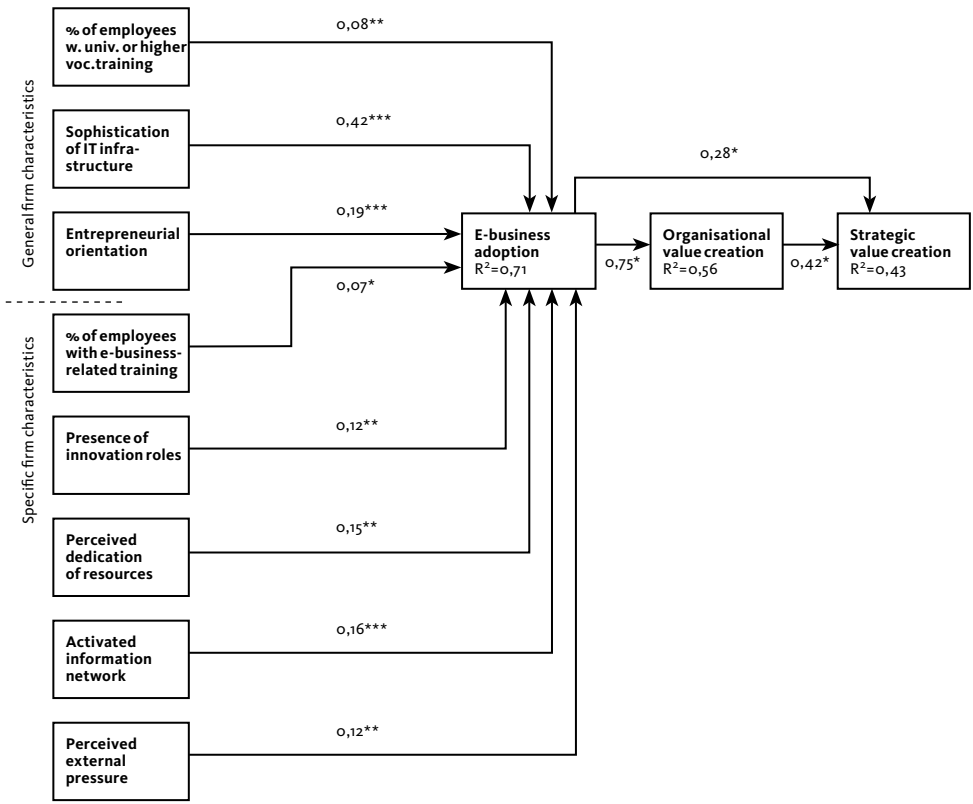
The main empirical results on the perceptions model are (**7.3.3**):

- ***The model is effective in explaining e-business adoption and value creation.*** The model explains 42% of the variance in e-business adoption, 43% of the variance in organisational value creation and 56% in strategic value creation. The result for e-business adoption is in line with similar studies from the e-business adoption literature review (with an average explained variance of ± 40%).
- ***The model is parsimonious.*** Only two explanatory variables, perceived relative advantage and perceived compatibility, explain 42% of the variance in e-business adoption.
- ***E-business adoption has a strong and positive relation to organisational value creation.*** E-business adoption leads to improvements in efficiency and effectiveness (β=0,65). This organisational value creation is then related to strategic value creation (β=0,71).
- ***Perceived compatibility has a strong positive relation to e-business adoption.*** Both perceived opportunity characteristics relate positively to adoption. However, perceived compatibility has a far stronger relation to adoption (β=0,53) than perceived relative advantage (β=0,18). Ergo, when a firm believes that e-business fits well with values and existing practices within the firm and its value chain, e-business adoption may be expected.
- ***The perceptions model appears to be incomplete.*** The addition of class of size as a third explanatory variable resulted in an increase in the explained variance in e-business adoption (from 42% to 56%), indicating that the model is incomplete.

II The firm characteristics model

In the firm characteristics model, e-business adoption and value creation are explained using a selection of firm characteristics that were hypothesised to stimulate the recognition of business opportunities for ICTs (**7.3.4**). The firm characteristics model represents an entrepreneurship perspective on e-business adoption. The explanation is based on the presumption that e-business adoption is about the discovery and development of business opportunities based on the use of e-mail and the Internet, in order to create value. The estimated model is presented once more in **figure 8.2**.

Figure 8.2 The firm characteristics model explaining e-business adoption[a] (n=595)



a Causal coefficients are standardised beta coefficients significant at:
*p<=0,05, **p<=0,01, ***p<=0,001 (one-tailed test)

The main empirical results on the firm characteristics model are (**7.3.4**):

– ***The model is effective in explaining e-business adoption and value creation.*** The variance explained in e-business adoption is a high 71%. The variance explained in organisational and strategic value creation is 56% and 43% respectively.

- ***E-business adoption is positively related to organisational and strategic value creation.*** E-business adoption leads to improvements in efficiency and effectiveness (β=0,75). Adoption also leads directly to strategic value creation (β=0,28) and indirectly, through organisational value creation (β=0,42).
- ***The explanation of e-business adoption is multifaceted.*** Almost all estimated (and expected) relations[1] between the firm characteristics, e-business adoption and value creation are significant which indicates a coherent explanatory framework.
- ***The sophistication of IT infrastructure dominates among the explanatory variables.*** The variable has a strong and positive relation to e-business adoption (β=0,42). It represents the accumulated knowledge and experience with the implementation and use of IT in the company. This knowledge base is a necessary precondition for recognising and developing e-business opportunities.
  An entrepreneurial orientation, which reflects a firm's entrepreneurial strategic posture, supports the process of acting upon these business opportunities (β=0,19). The network is used to actively find specific information related to e-business and aids in the evaluation of e-business opportunities (β=0,16). Motivation and support that the firm perceives from external actors further facilitate a positive evaluation of the opportunities (β=0,12).
  The role of perceived dedication of resources (β=0,15) and perceived presence of innovation roles (β=0,12) in adopting e-business indicates the firm's commitment to stimulate the development of e-business opportunities. The perceived availability of time and money motivates people to think about possible applications of ICTs for e-business; the presence of individuals capable and motivated to recognise opportunities for e-business and act upon them stimulates e-business adoption and consecutive value creation. Both variables dealing with formal education and e-business training have little effect, most probably due to their inadequate operationalisation.
- ***The firm characteristics model is markedly complete.*** The inclusion of class of firm size as an explanatory variable changed the proportions of explained variance and regression coefficients only slightly, which indicates that the model is noticeably complete.
- ***Firms that create new business from e-business adoption exhibit entrepreneurial behaviour*** (**7.4**). The firm characteristics model was also used to compare firms that reported the creation of strategic value from e-business by opening up new

1 Only two relations were found insignificant: customer and competitor orientation – e-business adoption, and using the environment as a source of ideas – e-business adoption.

markets, or market channels, and introduce new products and services ('entrepreneurial' firms), with firms that did not ('optimising' firms). Optimising firms 'only' created organisational value from e-business by improving the efficiency and effectiveness of their business processes. Analysis revealed that 'entrepreneurial' firms differ significantly from 'optimising' firms on a wide range of firm characteristics. In particular, the 'entrepreneurial' firms used a greater number of network contacts to find information on e-business. The perception that time and money are available for e-business proved to be higher than in 'optimising' firms. Most important is that there is significant difference in entrepreneurial orientation between 'entrepreneurial' firms and 'optimising' firms. This proves that SMEs that are capable of creating new business from e-business adoption, exhibit distinct, entrepreneurial, behaviour.

III The complete model

In the complete model, the perceptions model and the firm characteristics model are combined. The model is based on the presumption that perceptions are formed in the context of the firm. So, in addition to all relations in the other two models, this model includes relationships between the firm characteristics and perceived opportunity characteristics. The conclusion of testing was that the estimation of the complete model produced an interesting, yet inconclusive result (**7.3.5**). In the solution, the variables perceived innovation roles and perceived dedication of resources appeared to overlap with perceived relative advantage and perceived compatibility. In innovation adoption literature, questions have been raised about the independence of perceived relative advantage and perceived compatibility. Also, it has been observed that the two variables are broad in character. These attributes probably caused contamination with the other variables. In this study, it proved impossible to draw conclusions on the relations between firm characteristics and perceived opportunity characteristics. At the same time however, the indefinite results call for an interesting discussion on the usability of perceived innovation characteristics in adoption research. This issue will be discussed in the next section (**8.3**).

8.3 What are the differences in explaining e-business adoption from an innovation adoption perspective compared to an entrepreneurship perspective?

The main conclusion from comparing the two perspectives is that ***both innovation adoption theory and entrepreneurship theory are relevant to explaining e-business adoption*** (**7.3.6**). Innovation adoption theory as well as entrepreneurship theory provides a valuable source of knowledge on the conceptualisation of e-business adoption, innovative behaviour, and related firm characteristics. From reviewing both streams of literature, relevant firm characteristics emerged, pointing in the same direction: the importance of knowledge and experience, network contacts, and a positive attitude towards change. With the empirical findings from the preceding sections, I can now reflect on the differences in explaining e-business adoption ensuing from the two perspectives. My overall conclusion is that ***an entrepreneurship perspective offers a better and more comprehensive understanding of e-business adoption and value creation*** (**7.3.6**). In particular, an entrepreneurship perspective:

- ***Links e-business adoption to value creation***
- ***Gives insight into the characteristics of firms that are successful in creating new business from e-business adoption***
- ***Points at the role of the social network***
- ***Used as an alternative perspective, enables demonstrating the shortcomings of perceived innovation characteristics as explanatory factors***

After reviewing literature relevant to the adoption of e-business, I observed four issues that need to be addressed when using an innovation adoption perspective to assess and explain e-business adoption (**2.4**). In this section, the two perspectives on e-business adoption are compared based on those four issues. The aforementioned conclusions on the entrepreneurship perspective relate to the issues and will be clarified in detail:

1 The nature of e-business

In innovation adoption literature many innovations described are technological innovations or tools, as for example in Rogers' classic overview of innova-

tion research (Rogers, 1995). In the case of e-business adoption, I contend that it actually is the combination of technology (e.g. e-mail, Internet) and characteristics of the firm that form an opportunity to create value. E-business is not a well defined, ready-to-use, 'of the shelf', innovation, but the adopter largely determines its features. After all, the firm decides *how* to use e-mail or the Internet to create value. Entrepreneurship theory provides the framework to better understand this idea. Opportunities play a central role in entrepreneurship. The opportunity concept links innovation to entrepreneurship, because innovation offers the possibility to create new business. In my view, e-business is about the introduction of ICTs that opens up possibilities to create value for the firm. So, ***e-business adoption is more about finding profitable ways to deploy technological innovations like the Internet, than about accepting or rejecting a technological innovation.*** Consequently, in the case of e-business, the much-used perceived innovation characteristics relate to the e-business *opportunities* rather than to the technologies. Therefore, I propose to use the term perceived opportunity characteristics.

Another consequence of this viewpoint on e-business is that, in order to understand a firm's perceptions of e-business, it is necessary to investigate the context in which the evaluation is made. The empirical results demonstrate that using the firm characteristics as explanatory variables is much more effective ànd insightful in explaining e-business adoption than using perceived opportunity characteristics. The firm characteristics model explains e-business adoption to a much greater extent (71%) than the perceptions model (42%). Moreover, the firm characteristics model gives more detailed information on firm attributes relevant to e-business adoption and value creation. Then, are perceived opportunity characteristics redundant to explain e-business adoption? Yes and no. Yes, because firm characteristics evidently explain much more variance in e-business adoption than perceived opportunity characteristics, and provide a better insight into relevant circumstances of the firm. The perceptions model does not reveal any of the context in which the perceptions are formed. It remains unclear what makes a firm perceive e-business as compatible or advantageous. No, because nevertheless the adopter's attitude plays an important role in the innovation adoption process. However, when using the firm characteristics model to explain e-business adoption, this attitude is not made explicit, even

though it is there. For, in the end, the decision to adopt is the result of a subjective deliberation about the consequences of exploiting the e-business opportunities. Seemingly, looking at the difference in explained variance, the variables perceived relative advantage and perceived compatibility just do a disappointing job in making the adopter's attitude explicit.

2 The entrepreneurial aspect of innovation

From the e-business adoption literature review, I concluded that e-business adoption is often characterised on the basis of value created or achieved benefits. This reflects the idea that innovation adoption is not a goal in itself for any company. The adoption always serves a purpose, whether it is to reduce costs, to improve communications, to introduce a new service, or even to create a modern company image. Again, the opportunity concept provides the connection between innovation and value creation. Now, the characteristics of the business opportunity are dependent on the ability of the adopting firm to find profitable ways to deploy ICTs. The kind of value that is created from adopting ICTs is dependent on the ability of a firm to recognise business opportunities. The empirical findings support this statement: ***firms that were able to create strategic value from adopting e-business exhibit distinct entrepreneurial behaviour.*** This behaviour is not merely a favourable attitude towards change, as is recognised to stimulate adoption in innovation literature. There, evidence of this positive attitude is often sought in organisational support or the presence of individuals fulfilling innovation roles. Entrepreneurial behaviour however, is not only a positive attitude towards change, but also a pro-active, risk-taking mentality focussed on the discovery, development and exploitation of business opportunities. Moreover, entrepreneurial firms are externally oriented towards creating value in the market, rather than the (internal) optimisation of business processes.

3 The influence of the social network

In most innovation adoption research the attention is on the adopter and the internal process of innovation adoption. The social network is mainly recognised as a source of knowledge, feedback and resources. In opportunity recognition literature, interaction with the social network is much more obvious through the whole process of discovering, and developing opportunities.

There is evidence that the use of social network contacts explains the number of ideas and opportunities recognised, the number of opportunities pursued, and the number of opportunities unrelated to the current business (Singh, 2000). De Koning (1999) demonstrates that the opportunity recognition process is *rooted* in the social context. My empirical findings support the fact that ***e-business adoption is embedded in the firm's social context,*** specifically for the 'entrepreneurial' firms. Firstly, in the perceptions model, perceived compatibility has an important influence on e-business adoption. Looking at the composition of the construct (**table 6.9** in **chapter 6**), the item loading of perceived compatibility with customers stands out from the other compatibility items. Secondly, in the firm characteristics model, the activated information network and perceived external pressure significantly influence e-business adoption and value creation. Looking at the properties that distinguish 'entrepreneurial' firms from 'optimising' firms, the importance of social embeddedness is even more clearly perceptible. Activated information network and perceived external pressure are among the four most distinguishing factors.

4 The KAP-gap

In many innovation adoption studies, significant importance is attributed to the role of perceived innovation characteristics. It is implicitly supposed that when the adopter evaluates an innovation as advantageous to the firm, adoption follows as a matter of course. A KAP-gap exists when a relatively high level of knowledge about the innovation (K), and a positive attitude (A) do not lead to adoption of the innovation (P), or vice versa (limited knowledge and negative attitude leading to adoption). This study demonstrates that a high level of perceived relative advantage does not always match a high level of e-business adoption (**7.2.2**). It seems that some firms that did not perceive e-business as advantageous, adopted nevertheless. This may be the result (in part) of the perceived opportunity variables not representing the adopter's attitude well, as I concluded earlier. In other words, the adopter's attitude *is* positive, but the variable does not adequately address it. For example, in hindsight we know that the level of IT use is an important determinant of e-business. However, knowledge and experience with IT are not addressed in the items for perceived compatibility. Hence, the impact of a positive evaluation by the adopter, because e-business suits the firm's experience with IT, is not expressed in the relation between

perceived compatibility and e-business adoption. By looking at the direct influence of firm characteristics, we apparently come closer to reality. This is not directly attributable to the entrepreneurship perspective. Nevertheless, ***by using another perspective on explaining e-business, the limited value of perceived characteristics came to light.***

8.4 Practical implications

In this section, I will discuss what the outcomes of this research mean to SMEs, policy makers and other actors involved in SME consultancy or support. Important to note is that the sample by and large represents the Dutch SME population in terms of firm size and 9 different lines of business. Therefore, the practical suggestions concern the majority of Dutch SMEs.

8.4.1 Implications for SMEs

An important finding in this study is that e-business adoption and value creation are largely dependent on the choices SMEs make themselves. There is virtually no evidence that uncontrollable outside factors determine the chances of SMEs to adopt and benefit from e-business. So the good news to SMEs is that they have the opportunity to influence their own future regarding the use of ICTs. However, stimulating e-business adoption involves a wide range of firm factors that comes down to the following suggestions for SMEs:

1 **Gain experience with IT**

Above all, improving the level of IT use in the company appears to be the best preparation for the adoption of e-business. IT in this respect refers to more conventional, non-Internet related information technologies like office automation, internal networks, integrated information systems, and external connections like EDI. Buying hard- and software is but one element of gaining experience with IT. More importantly, experience with IT refers to everything that comes along with it: going through selecting and implementing ITs (including dealing with IT-suppliers), adapting to new ways of working, dealing with new technologies, training and education, etc, etc. All this knowledge and experi-

ence forms a valuable knowledge base that facilitates the absorption of related new knowledge about for example e-mail and the Internet.

2 Entrepreneurship matters

To actually capitalise on knowledge and experience with IT, adopt e-business and create value from it, an entrepreneurial strategic posture is what really matters. In effect, an entrepreneurial orientation is about a firm's willingness to really act upon business opportunities, a pro-active, risk-taking and innovative mentality. In entrepreneurship literature there is an ongoing discussion on whether entrepreneurship can be taught or not. Drucker has a clear opinion about the issue: 'The entrepreneurial mystique? It's not magic, it's not mysterious, and it has nothing to do with the genes. It's a discipline. And, like any discipline, it can be learned' (Drucker, 1985). In an earlier article, we explored characteristics that are important to entrepreneurship and opportunity recognition in particular. We concluded that knowledge and experience, cognitive mechanisms and networking abilities are necessary ingredients to entrepreneurship (Wakkee & Van der Veen, 2004). Basically, knowledge and experience play a key role in discovering and developing business opportunities. The knowledge base provides a domain of interest and curiosity that may lead to the (unexpected) discovery of a new business idea. Also, it facilitates the assessment of opportunities for new business. The results of this study indicate that especially knowledge and experience with IT constitutes a valuable knowledge base. Network contacts can be used to expand this knowledge base. A pro-active attitude towards searching and processing information, utilising the social network, and change, enables the firm to actually organise and benefit from the opportunities identified. In sum, an entrepreneurial orientation is the result of choices consciously made within the firm.

3 Use your network

The findings show that an active use of network contacts facilitates the adoption of e-business and creating value from it. A variety of network contacts proves to be useful in acquiring information about e-business and expanding the knowledge base. Sources of e-business related information are not only suppliers of ICTs or consultants. Equally important are contacts with for example customers, suppliers, competitors, friends and family. Each of them may contribute in their

own way to the discovery and development of business opportunities based on ICTs by providing information, and feedback. What is more, network contacts provide support and motivation. The perception of a social pressure to adopt makes it easier to positively evaluate e-business adoption.

4 Commit resources

To actually comply with good intentions to adopt e-business, the investment in resources is a next step towards adoption. Dedicating time and money to e-business seems very obvious, however it is just as important that people within the firm have the perception that time and money are available. This will stimulate any opportunity recognition behaviour. Resources include human resources: the presence of individuals that take on certain innovation roles stimulates e-business adoption. A 'gatekeeper' that is enthusiastic and well informed about e-business can acquaint the organisation with new knowledge. The 'champion' turns ideas for business opportunities into concrete proposals for the adoption of e-business. Finally, training and education, whether general or related to e-business, support e-business adoption.

Apart from the above suggestions, this study provides another insight for SMEs. Many companies benefit from e-business adoption by improving the efficiency and effectiveness of their business processes (organisational value creation). It seems that this type of value creation is realistically attainable for most small or medium-sized firms, regardless of their size or line of business. In this sample, 82% of the respondents indicated that e-business adoption resulted in saving time and money, improved communication, customer service or an improved company image. Strategic value creation however, is more difficult to achieve. In the sample, 38% of the companies reported that e-business adoption resulted in entering a new market, opening up a new market channel, the introduction of a new service or product, or a higher turnover associated with these changes. Further analysis of SMEs that report strategic value creation showed that these firms exhibit distinct entrepreneurial behaviour. Ergo, by and large any SME can benefit from e-business adoption. However, the introduction of new economic activity is particularly attributable to SMEs exhibiting more pro-active, entrepreneurial behaviour.

8.4.2 Implications for policy making

Policy measures concerning the stimulation of e-business adoption in SMEs have not been studied in this research. However, based on the findings two types of recommendations can be made to policy makers, and other parties involved like sector organisations, innovation agencies like Syntens[2], and commercial consultants. The first recommendation concerns the relation between the use of information technology and e-business. The second suggestion deals with the importance of entrepreneurship.

The empirical findings in this study demonstrate a strong relation between the level of IT use, the adoption of e-business, and value creation ensuing from that adoption. This apparently obvious relation that is well known with Syntens' consultants, has now been explicitly established. SMEs gain valuable knowledge and experience by selecting hard- and software, dealing with IT-suppliers and consultants, comparing complicated offers, deciding on new ways of working, training employees, etc. etc. This knowledge base plays an essential part in the adoption of e-business. Earlier e-business stimulation projects, notably the SpOED[3] project, had an emphasis on the use of the Internet and the World Wide Web, in a way taking the level of IT use for granted. As discussed in the introduction of this study, current policy initiatives stress the integration of ICTs in businesses. The government agenda is explicitly aimed at stimulating better preparation of SMEs for the switch to e-business, stressing the integrated e-business concept (EZ, 2004a). The policy is aimed at advanced information and communication technologies such as Internet related technologies, mobile data communication, open source software and broadband applications, *as well as* more conventional information technologies like process and office automation, networks, and integrated information systems. This study shows that conventional IT plays an important role in bringing about advanced ICT innovation. Knowledge and experience with IT provides a springboard to bridge the gap towards advanced applications of ICT. It may be tempting for policy makers and consultants to address attention and resources to exciting new ICT applications. However,

2 Syntens has been actively involved in this research. Their contribution to this research is discussed in chapter 5.

3 The SpOED project (1998-2001) offered a.o. personalised advice to SMEs on the strategic introduction of ICT (EZ, 2001). In practice however, the Ministry of Economic Affairs directed consultancy towards the introduction of Internet related technologies in particular.

policy measures aimed at stimulating e-business adoption in SMEs need to include more conventional (and attainable) types of information technology.

This study has shown that entrepreneurship is essential for e-business adoption to lead to new economic activity. SMEs that manage to create new economic activity from adopting e-business, exhibit distinct entrepreneurial behaviour. They interact more with their environment, commit resources to e-business, and above all behave in a pro-active, risk-taking and innovative manner. This shows that entrepreneurship enables the creation of new business from the application of ICTs. Now, the importance of entrepreneurship for the Dutch economy is beyond dispute (EZ, 2004b). The Ministry of Economic Affairs aims at an increase of the number of entrepreneurs, as well as an increase of entrepreneurs that consciously work on the growth of their existing firm (EZ, 2004b). Entrepreneurship is predominantly associated with starting new ventures and existing ventures seeking growth. However, entrepreneurial behaviour is just as important in existing companies, of which only a minority is growth seeking (ECSB, 2003). Moreover, there is an essential link between entrepreneurship and ICT, *other* than entrepreneurship in the ICT sector.

In a recent report on ICT policy, there is a strong sense that ICT needs to be 'put to work' and that policy measures should shift from connectivity to the uptake of ICT (EZ, 2004c). The empirical findings of this study suggest that entrepreneurial behaviour is a necessary ingredient to make the chemistry between SMEs and ICT work. ICT is a tool for business development and offers opportunities for creating new economic activity. Policy measures should support SMEs in recognising and seizing those opportunities. In this respect, policy measures for stimulating entrepreneurship in general are just as relevant for stimulating e-business adoption and value creation. This includes measures as suggested in the debate on entrepreneurship in Europe such as improving the status of entrepreneurship, training business skills, promoting networking, and facilitating access to information, support, R&D, and capital (European Commission, 2003e). The question remains to what extent these measures really cater for entrepreneurs in existing companies in non-ICT sectors, which form the main part of our economic engine. To develop our national economy, we should not only rely on new ventures, the survival of those ventures, or entrepreneurship in new

sectors (like ICT or biotechnology). Stimulating renewed entrepreneurship, intrapreneurship or corporate entrepreneurship is just as valuable for our economy and competitive position.

In the end, the responsibility to innovate lies with the SME. However, to equip entrepreneurs with more knowledge and skills seems a daunting task: 'Interestingly in terms of the education to existing entrepreneurs, there is a paradox in that whereas there is a high need for further training and development, entrepreneurs in general have a high need for independence and do not like being supported' (ECSB, 2003: p. 8). Perhaps the knack of the matter is to emphasise that policy measures are meant to support entrepreneurs in achieving *their* goals easier and better, rather than focussing on education, 'pushing' new technologies or business growth. Entrepreneurship literature shows us that knowledge and experience and network contacts are valuable ingredients to the recognition of business opportunities. In my view, that is exactly where support can be effective to entrepreneurs. Good examples of knowledge exchange are the well-visited Syntens workshops within the 'Nederland gaat Digitaal' project. These workshops play an important role in making entrepreneurs aware of (entrepreneurial) business opportunities with ICT and how to seize them. In addition, the meetings proved to be much appreciated opportunities for networking, and the exchange of experiences with ICTs.

8.5 Limitations

In this study various choices have been made that influence or limit the results. In this section, I will comment on these choices and their consequences. This research has been conducted in an empirical setting. Syntens[4] and the 'Nederland gaat Digitaal' project offered a unique opportunity to stay closely in touch with the reality of SMEs and e-business adoption. In particular, as described in **chapter 5**, Syntens' consultants were involved in the development of the questionnaire. However, the collaboration also gave rise to limitations. Working in an organisation means that the course of the research is influenced by day-to-day business. This expressed itself in a time-pressure to finish the questionnaire. As a consequence, the time to work on theory construction was limited.

4 Syntens and the role of Syntens is discussed in chapter 5.

This resulted in an eclectic, mostly inductive way of working, combining theories that appear to be best or true for the subject under study. As a result, our understanding of the coherence of the variables is limited, and other variables may have been overlooked. The choice to work inductively also resulted in a selection of relatively 'simple' constructs. The constructs have not been selected deductively from a more fundamental model of firm behaviour, as for example Groen (1994) did. Consequently, the constructs in this study do not represent more abstract theoretical concepts. As a result, I refrained from using latent constructs, and only included directly measured (or unweighed summations of measured variables) variables in the structural model. Effectively, each construct is measured by one empirical indicator. Nevertheless, the explanation of e-business adoption turned out to be effective and insightful. Moreover, the findings from the two theoretical perspectives led to a relatively consistent result.

Further, choices have been made regarding the operationalisation of theoretical constructs into measurable variables. Firstly, choices made regarding the operationalisation of constructs limit the scope of the empirical variables. In this respect, the two main dependent variables deserve a closer look. Value creation is operationalised into two empirical variables: strategic and organisational value creation. These measures are qualitative, which means we do not have insight into any quantitative effect of creating new economic activity like job creation, profit, or the number of new products. Nevertheless, the empirical findings on value creation provide interesting information on what e-mail and the Internet are used for. The operationalisation of e-business adoption is the product of theoretical as well as practical considerations. As a result, the emphasis of e-business adoption is on business process support with e-mail and the Internet. This means that the measure insufficiently addresses new products and services. The limited scope of this operationalisation of e-business adoption came to the fore in the analysis of non-estimated relations in the firm characteristics model (**7.3.4**). Even so, the empirical results show that for the majority of SMEs business process support is exactly what e-mail and the Internet are used for. Further, my choice not to include a measure of first time of use in the operationalisation of e-business adoption made it impossible to distinguish first-users from experienced users. As a consequence, experienced users that do not

see the relative advantages as stated, because they have found their own applications, cannot be discriminated from inexperienced users that apply ICT without seeing the benefits. This limits the interpretation of the results.
Secondly, the time constraint on finishing the questionnaire also expressed itself in the operationalisation of constructs. As discussed in **chapter 6**, in hindsight some empirical variables proved to be less effective. For example, the indicator for a formal level of education was not detailed enough to show for variance in the sample. For some variables I have provided suggestions to improve the shortcomings of the operationalisations used.

Further limitations are inherent to the research design and method used. Firstly, the time variable is ignored in this one-shot cross sectional survey. The level of e-business adoption is measured at the same time as the explanatory variables. As a consequence, determining causality between the explanatory variables and the explained variables is limited to theoretical and statistical considerations. However, analysis of the non-estimated relations indicated in the LISREL output by high modification indices did not reveal any causal relations pointing in a direction opposite from what was hypothesised. Another effect of a one-shot survey may be that the measurement of perceived opportunity characteristics is influenced by the adoption, as both variables are measured at the same time. Although practical considerations underpin this choice, the more time-consuming choice being a longitudinal design, this remains a precarious issue. Another consequence of this research design is that we have no insight into the 'black box' of the opportunity recognition process. By studying firm characteristics in relation to the outcome of the process, the box remains closed. Secondly, one respondent has been contacted to represent the firm, and self-reported measures were used. Both methods to collect data may have resulted in response bias, as they were not validated by other respondents from the same firm or by more objective measures. However, under the circumstances it seemed like the most efficient and economical way to collect the data.

Finally, there are limitations to the value of the results in a wider context. This study concentrates on Dutch established companies in 9 different sectors with less than 100 employees. Analysis revealed that the respondents reliably reflect the Dutch SME population in terms of firm size. This means that the results

are representative for Dutch SMEs with less than 100 employees. Differences between or within the three classes of firm size (0-9, 10-49, and 50-99 employees) have not been investigated here. With respect to the different sectors, the statistical generalisation of the results is limited. The response rates from the financial service sector, and the catering and hotel industry were relatively low compared to the other sectors. However, it may be questioned to what extent these two sectors actually differ from the other sectors included in this research.

8.6 Suggestions for future research

There are several propositions for future research that logically arise from the findings and limitations of this research. In the first place, future research could shed more light on issues raised in this study. Firstly, the findings of this research call for more empirical research into the opportunity recognition process on firm level. In this study, I presumed certain firm factors to be important to opportunity recognition on firm level. I inferred firm level factors from opportunity recognition research on the individual level. However, what is an appropriate operationalisation of firm level alertness or creativity? Opening the black box of the (e-business) opportunity recognition process could reveal what happens during this process. To do so, variables concerning opportunity recognition behaviour could be included with reference to the work of for example Puhakka (2002) or Singh (2000). Secondly, in innovation adoption research the role of subjective perceptions is often taken for granted. However, this study did not succeed in investigating the relation between subjective perceptions and more objective measures of relative advantage and compatibility. Nevertheless, this type of research is worthwhile, as it will shed more light on the background of perceptions (Tornatzky & Klein, 1982). For example, does compatibility refer to compatibility of e-business with the IT knowledge and experience present in the firm (practical compatibility), or does it mean that it is appropriate because the firm likes to try new things (value compatibility)? Thirdly, in this research, the importance of entrepreneurship to e-business adoption was demonstrated. Multi-level research could include the influence of the entrepreneur into the explanation. In addition, it might prove useful to include a scale for entrepre-

neurial management by Brown, Davidsson & Wiklund (2001) into the model. This scale has been developed to measure the degree of entrepreneurship as a set of opportunity based management practices, particularly in existing firms. The measure is more comprehensive than the entrepreneurial orientation scale (which it includes).

Obviously, future research could continue the research conducted in this study. It would be interesting to test the firm characteristics model in a different context, for example in larger firms, or different lines of business. Also, longitudinal testing could be useful to observe causal relations between the explanatory variables and e-business adoption and value creation. A longitudinal design overcomes problems in observing a time lag between the explanatory variables and e-business adoption, and between e-business adoption and value creation. This may also shed light on learning effects, for example does the type of value creation influence future e-business adoption? In this study, the operationalisation of constructs lead to the development of several new and reliable scales (in Dutch) for organisational and strategic value creation, reliance on ICT, e-business adoption in the supply, internal and sales process, and entrepreneurial orientation. Future research could confirm the reliability and usefulness of these scales.

A final suggestion for future research would be to find out whether a deductive approach leads to a different set of firm factors. Such an approach could start with a general theory on firm behaviour, from which more specific propositions are then deduced for the phenomenon under study. For example, Groen (1994) used four behavioural mechanisms derived from social systems theory to explain innovation adoption, and modelled them as (unobservable) capitals (strategic, cultural, economic, and social). Next, he used auxiliary theories to select indicators for each construct, and arrived at a comprehensive explanatory model. In similar empirical research conducted at the Dutch Institute for Knowledge Intensive Entrepreneurship (NIKOS) this proved to be a fruitful approach. A similar approach can be used in the research on e-business adoption in order to verify the interesting results from the more eclectic way of working in this dissertation. This will shed even more light on why particular firm attributes are instrumental in e-business adoption.

Appendices

Appendix 2.1 An overview of studies measuring electronic business adoption

				Dimension of e-business adoption						
	Author(s)	Year	Measure of adoption	Activity	Application	Value creation	Intensity of use	First time of use	Stage of development	Other
1	Abell & Lim	1996	Business use of internet	•	•	•				
2	Cockburn & Wilson	1996	Business use of www	•		•		•		•
3	LaRose & Hoag	1996	Internet adoption		•[d]					
4	Poon, Swatman & Vitale	1996	Internet usage	•	•					
5	Agarwal & Prasad	1997	Use of www				•			
6	Colarelli, O'Connor & O'Keefe	1997	Role and use of the web						•	
7	Gefen & Straub	1997	E-mail use				•			
8	Poon & Strom , Poon & Swatman	1997	Status of internet use	•		•			•	
9	Ng, Pan & Wilson	1998	Business use of www	•		•		•		•
10	Sillince, Macdonald, Lefang & Frost	1998	E-mail adoption	•	•[d]			•		
11	Teo & Tan	1998	Internet adoption		•	•	•			
12	Webb & Sayer	1998	Web adoption and usage	•						
13	Busselle, Reagan, Pinkleton & Jackson	1999	Internet use				•			
14	Dutta & Evrard	1999	Networks/internet use	•	•[d]	•				
15	Greaves, Kipling & Wilson	1999	Business use of www	•		•		•		•
16	Poon & Swatman	1999	Internet commerce	•		•			•	
17	Premkumar & Roberts	1999	Adoption of ict technologies	•	•					
18	Riemenschneider & McKinney	1999	Web-based e-commerce adoption		•[d]					
19	Teo, Lim & Lai	1999	Internet usage	•			•			
20	Cheung, Chang & Lai	2000	Internet/www usage				•			
21	Lederer, Maupin, Sena & Zhuang	2000	Website				•			
22	Nambisan & Wang	2000	Web technology adoption					•		
23	Teo & Too	2000	Business use of internet	•		•				

	Author(s)	Year	Measure of adoption	Dimension of e-business adoption: Activity	Application	Value creation	Intensity of use	First time of use	Stage of development	Other
25	Walczuch, Van Braven & Lundgren	2000	Internet-adoption	•	•	•				
26	Beatty, Shim & Jones	2001	Web adoption					•		
27	Chang & Cheung	2001	Intention to use internet/ www							•
28	De Berranger, Tucker & Jones	2001	Internet difusion			•				
29	Eder & Igbaria	2001	Intranet diffusion and infusion				•	•	•	
30	Griffin	2001	Internet-usage		•					
31	Katz & Dennis	2001	Internet use		•	•				
32	Kendall, Tung, Chua, Hong, Ng & Tan	2001	E-commerce adoption	•	•					
33	Mehrtens, Cragg & Mills	2001	Internet adoption		•					
34	Moon & Kim	2001	www				•			
35	Raymond	2001	Website implementation	•		•				
36	Wei, Ruys, Van Hoof & Combrink	2001	Uses of internet	•			•	•		•
37	Cheng, Cheung & Chang	2002	Internet & www usage				•			
38	Cheung & Huang	2002	Commercial usage of www	•						
39	Daniel & Grimshaw	2002	E-commerce adoption			•				
40	Daniel, Wilson & Myers	2002	Adoption of e-commerce	•					•	
41	Ellis-Chadwick, Doherty & Hart	2002	Internet adoption	•	• [d]					
42	Lal	2002	E-business adoption		•					
43	Lewis & Cockrill	2002	E-commerce usage		• [d]				•	•
44	Sadowski, Maitland & Van Dongen	2002	Strategic use of internet		• [d]					
45	Van Beveren & Thomson	2002	Use of electronic commerce		•					
	Number of studies (total number of studies: 45)			21	18	14	11	8	6	6
	% of studies			47	40	31	24	18	13	13

d=dichotomous variable

Appendix 2.2 An overview of studies explaining electronic business adoption

	Author(s)	Year	Level of analysis[b]	Measure of adoption	Perceived innovation characteristic	Reported relationship to adoption[a]	Other determinants	Reported relationship to adoption[a]
1	LaRose & Hoag	1996	F	Internet adoption	Compatibility	+	Adoption of clusters of related IT-innovations	++
					Relative advantage	o	Size	+
					Security	o	Information sector classification	+
					Easy to use	o	Organisational support	++ (champion)
					Complex to use	o		
2	Agarwal & Prasad	1997	I	Current use of www (intention to use www in future)	Relative advantage	o (+)	Voluntariness	+ (o)
					Ease of use	o (o)	Current use	(o future use)
					Compatibility	+ (o)		
					Trialability	+ (o)		
					Visibility	+ (o)		
					Result demonstrability	o (+)		
					Image	o (o)		
3	Gefen & Straub	1997	I	E-mail use	Perceived usefulness	+	Perceived social presence of e-mail	+ (indirect)
					Perceived ease of use	o	Gender	o
4	Sillince, Macdonald, Lefang & Frost	1998	F	Email adoption			Email use by trading partners	+
							Company size	+
							Promotion efforts by senior mgt.	+
							Development of improved email products	+
							Influence of managers	+
5	Busselle, Reagan, Pinkleton & Jackson	1999	I	Internet use	Complexity	o	Resources	o
					Perceived advantages	+	Need for innovativeness	+
							Use of technologies	+
							Media use	o
							Gender	o
							Age	o
6	Premkumar & Roberts	1999	F	Adoption of ICT technologies	Relative advantage	+	Top management support	+ partly
					Cost	o	Size	+ partly
					Complexity	o	IT expertise	o
					Compatibility	o	External pressure	+ partly
							Competitive pressure	+ partly
							External support	o
							Vertical linkages	-
7	Teo, Lim & Lai	1999	I	Internet usage	Perceived usefulness	++		
					Perceived ease of use	+(s.d.)		
					Perceived enjoyment	+(s.d.)		

	Author(s)	Year	Level of analysis[b]	Measure of adoption	Perceived innovation characteristic	Reported relationship to adoption[a]	Other determinants	Reported relationship to adoption[a]
8	Cheung, Chang & Lai	2000	I	Internet/www usage	Complexity	-	Social factors	+
					Affect	o	Facilitating conditions	+
					Near-term consequences	+		
					Long-term consequences	o		
9	Lederer, Maupin, Sena & Zhuang	2000	I	Website	Ease of use	+	Ease of use antecedents	+ (indirect)
					Usefulness	+	Usefulness antecedents	+ (indirect)
10	Nambisan & Wang	2000	F	Web technology adoption	Complexity	+(a.t.)	Knowledge barriers (3 types)	- (adoption time)
					Compatibility	-(a.t.)	Degree of involvement of supply side institution	+
					Cost	(c.c.)	Size	o
					Benefit	+(a.t.)	Competitive intensity	o
11	Teo & Too	2000	F	Business use of Internet			Information systems orientation	significant (market responsiveness)
12	Beatty, Shim & Jones	2001	F	Web adoption	Benefits	+	Top management support	+
					Organisational compatibility	+		
					Complexity	o		
					Technical compatibility	+		
13	Chang & Cheung	2001	I	Intention to use Internet/www	Affect	+	Social factors	+
					Near-term consequences	+	Facilitating conditions	+
					Complexity	-(ind.)		
					Long-term consequences			
14	De Bessanger, Tucker & Jones	2001	F	Internet diffusion	Strategic benefits	+	Knowledge about the internet	not reported
							Change agent infusion method	+
							Personal characteristics of change agents	+
							Provision of training/ support	+
15	Eder & Igbaria	2001	F	Intranet diffusion and infusion			Earliness of adoption	++
							Top management support	+
							Organisational structure	o
							Organisational size	partly +
							IT infrastructure	partly +
							IS structure	o
16	Griffin	2001	F	Internet-usage	Perceived benefits	+	Organisational readiness	+
					Perceived problems		External pressures	+
17	Katz & Dennis	2001	F	Internet use			Business strategy	o
							Innovation strategy	o

Appendix 2.2 (continued)

	Author(s)	Year	Level of analysis[b]	Measure of adoption	Perceived innovation characteristic	Reported relationship to adoption[a]	Other determinants	Reported relationship to adoption[a]
18	Kendall, Tung, Chua, Hong, Ng & Tan	2001	F	E-commerce adoption	Relative advantage	++		
					Compatibility	+		
					Complexity	o		
					Trialability	+		
					Observability	o		
19	Mehrtens, Cragg & Mills	2001	F	Internet adoption	Perceived benefits	+	Organisational readiness	+
							External pressure	+
20	Moon & Kim	2001	I	www	Perceived usefulness	+	Attitude toward using	+
					Perceived ease of use	+	Behavioural intentions	++
					Perceived playfulness	+		
21	Raymond	2001	F	Website implementation S=strategic, T=transactional, I=informational	Characteristics of EC	+ (S), o (I, T)	Environmental context	+ (I, T), o (S)
							Marketing strategy	+ (S), o (I,T)
							Managerial context	o (I, T, S,)
							Organisational context	+ (S), o (I,T)
22	Wei, Ruys, Van Hoof & Combrink	2001	F	Uses of Internet			Hotel size	+
							Hotel star rating	+
							Hotel type	+
23	Cheng, Cheung & Chang	2002	I	Internet & www usage	Perceived complexity	o	Social factor	manufacturing:+ service:o
					Near term consequences	manufacturing: o service: +	Facilitating conditions	+
					Long-term consequences	o		
					Affect	manufacturing: o service: +		
24	Daniel & Grimshaw	2002	F	E-commerce adoption	Expansion of market reach	minority of sme's agrees	Competitive pressure	majority agrees
					Provide enhanced customer service	majority agrees	Customer pressure	minority agrees
					Direct communication	majority agrees	Supplier pressure	minority agrees
					Operational efficiency/ reduce costs	minority agrees		
25	Lal	2002	F	E-business adoption	Effect on efficiency	+	Managing directors education	+
					Effect on competitiveness	+	Technological collaboration	+
							Bandwidth	+
							Wage rate	+
							Firm size	+
							Export intensity	+
							Profit margins	o
26	Sadowski, Maitland & Van Dongen	2002	F	Strategic use of Internet			Communication requirements	+
							Intensity of competition	o
							Support and incentives	o
							Sector	o
							Size	o

a ++ = strongly positive; + = positive; o = insignificant; - = negative

b F=firm level, I = Individual level

s.d.=some dimensions; a.t.=adoption time; c.c.=correlated with complexity; ind.= indirect

Appendix 5.1 Questionnaire (paper version)

Vragenlijst innoveren met elektronisch zakendoen

Toelichting Het doel van deze vragenlijst is om te bekijken in welke mate uw onderneming op dit moment elektronisch zaken doet.
Uw antwoorden blijven volstrekt anoniem.
Het invullen van deze vragenlijst kost 15 à 20 minuten.

De vragenlijst bestaat uit drie onderdelen:

A internetgebruik in uw onderneming
B toepassingen in bedrijfsprocessen
C uw innovatievermogen en -ambitie met elektronisch zakendoen
D algemene vragen.

Als u vragen heeft bij het invullen van deze lijst kunt u contact opnemen met Johan Baukema of Hans Donkers van EIM, tel. 079 341 36 34, e-mail: info@eim-stratus.nl.

A Internetgebruik in uw onderneming

v11a Heeft uw bedrijf één of meerdere aansluitingen op internet?

o Ja
o Nee

v11b (als *v11a* = nee)
Heeft uw bedrijf plannen om de komende 12 maanden een aansluiting op internet te nemen?

o Ja
o Nee

v12a Is uw bedrijf aanwezig op internet (website, elektronische etalage)?

o Ja
o Nee

v12b *(als v12a = nee)*
Heeft uw bedrijf plannen om de komende 12 maanden een website of elektronische etalage op internet te richten?

o Ja
o Nee

v13a Doet uw bedrijf wel eens elektronisch zaken (het uitvoeren van zakelijke transacties via internet of op andere elektronische wijze)?

o Ja
o Nee

v13b *(als v13a = nee)*
Heeft uw bedrijf plannen om in de komende 12 maanden elektronisch zaken te gaan doen?
- o Ja
- o Nee

v14 Wordt er in uw bedrijf gebruikgemaakt van de volgende toepassingen *(kruis aan)*?
- A o E-mail
- B o Internet, intranet of extranet
- C o Mobiele datacommunicatie (zoals SMS, WAP, GPS, toepassingen op handheld terminals, maar géén mobiel bellen of faxen)

Als vraag 14A én 14B én 14C is 'nee', ga dan naar vraag 31

B Toepassingen van ICT in bedrijfsprocessen

De volgende vragen gaan over het toepassen van Informatie- en Communicatietechnologie (ICT) in bedrijfsprocessen. We maken een onderscheid naar de inkoop, interne bedrijfsprocessen en de verkoop.

v21 *(meerdere antwoorden mogelijk)*
Hieronder staan negen inkoopactiviteiten. Wilt u per activiteit aangeven of uw bedrijf daarbij gebruikmaakt van
- E-mail
- Internet / intranet
- Mobiele datacommunicatie (zoals SMS, WAP, GPS, toepassingen op handheld terminals, maar géén mobiel bellen of faxen)
- Overige toepassingen?

	e-mail	**internet, extranet**	**mobiele datacom geen spraak!**	**overig**
a Informatie zoeken over toeleveranciers en hun producten of diensten	o	o	o	o
b Selecteren van producten en diensten	o	o	o	o
c Aanvragen van offertes	o	o	o	o
d Verlenen van opdrachten/plaatsen van bestellingen	o	o	o	o
e Opvragen van logistieke informatie (over beschikbaarheid, orderstatus, voortgang, e.d.)	o	o	o	o
f Ontvangen van facturen	o	o	o	o
g Betalen van inkopen/ telebankieren	o	o	o	o
h Elektronisch ontvangen van producten/diensten	o	o	o	o
i After sales-service van leveranciers (elektronisch klachten indienen, vragen stellen, handleidingen opvragen e.d.)	o	o	o	o

v22 Stel dat uw bedrijf géén gebruik meer zou kunnen maken van e-mail, internet, extranet en mobiele datacommunicatie, bijvoorbeeld vanwege een defect. Welke gevolgen heeft dit voor het inkoopproces in uw bedrijf?

Het inkoopproces...

- O ligt stil
- O ondervindt veel hinder
- O ondervindt weinig hinder
- O ondervindt geen hinder
- O weet niet/niet van toepassing

v23 *(meerdere antwoorden mogelijk)*

De volgende vraag gaat over de interne processen in uw bedrijf. Daaronder verstaan wij: alle bedrijfsprocessen behalve inkoop en verkoop. Hieronder staan tien activiteiten uit het interne bedrijfsproces. Wilt u per activiteit aangeven of uw bedrijf daarbij gebruikmaakt van

- E-mail
- Internet / intranet
- Mobiele datacommunicatie (zoals SMS, WAP, GPS, toepassingen op handheld terminals, maar géén mobiel bellen of faxen)
- Overige toepassingen?

Aan medewerkers elektronisch informatie bieden over:	**e-mail**	**internet, extranet**	**mobiele datacom geen spraak!**	**overig**
a Personeelszaken (CAO, personeelshandboek, 'smoelenboek', e.d.)	o	o	o	o
b Kwaliteitszorg (specificaties, handleidingen, procedures, e.d.)	o	o	o	o
c Management (rapporten, plannen, budgetten, e.d.)	o	o	o	o
d Proces (voortgang, doorlooptijden, uren, e.d.)	o	o	o	o
Overige activiteiten:				
e Communicatie tussen medewerkers	o	o	o	o
f Werving nieuw personeel	o	o	o	o
g Telewerken	o	o	o	o
h Kennismanagement (intern verzamelen en uitwisselen van kennis)	o	o	o	o
i Het volgen van opleiding en cursussen	o	o	o	o
j Elektronische goedkeuring van contracten, facturen, certificaten, e.d.	o	o	o	o

v24 Stel dat uw bedrijf géén gebruik meer zou kunnen maken van e-mail, internet, intranet en mobiele datacommunicatie, bijvoorbeeld vanwege een defect. Welke gevolgen heeft dit voor de interne processen in uw bedrijf?

De interne bedrijfsprocessen...

- O liggen stil
- O ondervinden veel hinder
- O ondervinden weinig hinder
- O ondervinden geen hinder
- O weet niet/ niet van toepassing

v25 *(meerdere antwoorden mogelijk)*
De volgende vraag gaat over de toepassingen van ICT in de verkoopprocessen in uw bedrijf.
Hieronder staan tien verkoopactiviteiten. Wilt u per activiteit aangeven of uw bedrijf daarbij gebruikmaakt van

- E-mail
- Internet / intranet
- Mobiele datacommunicatie (zoals SMS, WAP, GPS, toepassingen op handheld terminals, maar géén mobiel bellen of faxen)
- Overige toepassingen?

	e-mail	**internet, extranet**	**mobiele datacom geen spraak!**	**overig**
a Informatie zoeken over toeleveranciers en hun producten of diensten	o	o	o	o
b Selecteren van producten en diensten	o	o	o	o
c Aanvragen van offertes	o	o	o	o
d Verlenen van opdrachten/plaatsen van bestellingen	o	o	o	o
e Opvragen van logistieke informatie (over beschikbaarheid, orderstatus, voortgang, e.d.)	o	o	o	o
f Ontvangen van facturen	o	o	o	o
g Betalen van inkopen/ telebankieren	o	o	o	o
h Elektronisch ontvangen van producten/diensten	o	o	o	o
i After sales-service van leveranciers (elektronisch klachten indienen, vragen stellen, handleidingen opvragen e.d.)	o	o	o	o

v26 Stel dat uw bedrijf géén gebruik meer zou kunnen maken van e-mail, internet, extranet en mobiele datacommunicatie, bijvoorbeeld vanwege een defect. Welke gevolgen heeft dit voor het verkoopproces in uw bedrijf?

Het verkoopproces...
- O ligt stil
- O ondervindt veel hinder
- O ondervindt weinig hinder
- O ondervindt geen hinder
- O weet niet/ niet van toepassing

v27 Wat heeft uw bedrijf concreet bereikt als gevolg van elektronisch zakendoen (meerdere antwoorden mogelijk)?
- O Niets
- O Tijd-/kostenbesparing (efficiencyverbeteringen)
- O Extra distributiekanaal aangeboord
- O Betere klantenservice
- O Hogere omzet
- O Betere uitstraling van het bedrijf
- O Betere communicatie met toeleveranciers en klanten
- O Betere interne communicatie tussen medewerkers
- O Het aanbieden van nieuwe producten en diensten
- O Het bedienen van (een) nieuwe markt(en)
- O Anders, nl. .....
- O Weet niet

v28 Welke negatieve gevolgen heeft uw bedrijf ondervonden als gevolg van elektronisch zakendoen?

.....
.....
.....
.....

- O Weet niet

D Innovatievermogen en -ambitie met elektronisch zakendoen

v31 *(meerdere antwoorden mogelijk)*
Welke van de volgende omschrijvingen zijn van toepassing op uw bedrijf?

- O Wij zijn niet geautomatiseerd, maken geen gebruik van computers.
- O Wij hebben één of meerdere bedrijfsfuncties (productie, verkoop, etc.) geautomatiseerd, zoals een boekhoudprogramma voor de administratie of een klantenbestand voor de verkoop.
- O Wij hebben verschillende bedrijfsfuncties (productie, verkoop, etc.) geautomatiseerd, waarbij de computers onderling zijn verbonden in een netwerk.
- O Wij hebben verschillende bedrijfsfuncties (productie, verkoop, etc.) geautomatiseerd, die gebruikmaken van eenzelfde gegevensbestand door middel van een geïntegreerd informatiesysteem, zoals een ERP-programma of een managementinformatiesysteem.
- O Wij hebben bedrijfsfuncties (productie, verkoop, etc.) geautomatiseerd, die zijn verbonden met het informatiesysteem van een andere partij in de keten (bijvoorbeeld een leverancier of klant).
- O Weet niet.

v32 *(meerdere antwoorden mogelijk)*
Bij welke partijen heeft uw onderneming wel eens informatie gezocht over elektronisch zakendoen?

- O Geen enkele
- O Klanten
- O ICT-leveranciers of -adviseurs
- O Overige leveranciers
- O Collega-bedrijven/concurrenten
- O Buren/familie/kennissen
- O Syntens
- O Brancheorganisatie
- O Accountant/boekhouder
- O Overige dienstverleners/adviseurs
- O Kennisinstellingen (universiteit, HBO, IPL-TNO, e.d.)
- O Rijksoverheid
- O Anders, namelijk .....

v33 *(meerdere antwoorden mogelijk)*
Door welke partijen wordt uw onderneming gemotiveerd om elektronisch zaken te doen?

- O Geen enkele
- O Klanten
- O ICT-leveranciers of -adviseurs
- O Overige leveranciers
- O Collega-bedrijven/concurrenten
- O Buren/familie/kennissen
- O Syntens
- O Brancheorganisatie
- O Accountant/boekhouder
- O Overige dienstverleners/adviseurs

(vervolg v33)

- o Kennisinstellingen (universiteit, HBO, IPL-TNO, e.d.)
- o Rijksoverheid
- o Anders, namelijk .....

v34 Wat vindt u van elektronisch zakendoen? Hieronder verstaan wij het zakendoen met behulp van en ondersteund door toepassingen als e-mail, internet en mobiele datacommunicatie. Geef aan in hoeverre u het met de volgende stellingen eens bent.

	helemaal mee oneens				**helemaal mee eens**	**weet niet**
a Door elektronisch zakendoen kan een bedrijf kosten en/of tijd besparen	o	o	o	o	o	o
b Door elektronisch zakendoen kan een bedrijf zijn klanten veel beter bedienen	o	o	o	o	o	o
c Elektronisch zakendoen maakt nieuwe producten of diensten mogelijk	o	o	o	o	o	o
d Elektronisch zakendoen is belangrijk om bij te blijven met de concurrentie	o	o	o	o	o	o
e In ons bedrijf is veel belangstelling voor elektronisch zakendoen	o	o	o	o	o	o
f Onze producten of diensten zijn zeer geschikt voor elektronisch zakendoen	o	o	o	o	o	o
g Onze klanten zijn helemaal klaar om elektronisch zaken te doen	o	o	o	o	o	o
h Onze leveranciers zijn helemaal klaar om elektronisch zaken te doen	o	o	o	o	o	o
i Wij hebben genoeg kennis in huis om elektronisch zaken te kunnen doen	o	o	o	o	o	o
j Wij maken ons geen zorgen over de veiligheid van elektronisch zakendoen	o	o	o	o	o	o
k In ons bedrijf wordt geld vrijgemaakt om te investeren in elektronisch zakendoen	o	o	o	o	o	o
l In ons bedrijf wordt tijd vrijgemaakt om elektronisch zakendoen in te voeren	o	o	o	o	o	o
m Wij hebben (minstens) één medewerker in ons bedrijf die erg enthousiast en goed op de hoogte is van elektronisch zakendoen en probeert dat over te brengen op collega's	o	o	o	o	o	o
n Wij hebben (minstens) één medewerker in ons bedrijf die elektronisch zakendoen 'oppakt' en concrete voorstellen doet voor toepassing	o	o	o	o	o	o

v35 De volgende stellingen gaan over verschillende strategische kenmerken van uw bedrijf. Geef aan in hoeverre elke stelling van toepassing is.

	helemaal mee oneens				**helemaal mee eens**	**weet niet**
a Typerend voor ons bedrijf is dat wij acties initiëren waar de concurrentie dan op reageert	o	o	o	o	o	o
b Ons bedrijf is doorgaans de eerste die nieuwe producten, diensten of technieken introduceert	o	o	o	o	o	o
c In de afgelopen drie jaar heeft ons bedrijf veel nieuwe productgroepen of diensten op de markt gebracht	o	o	o	o	o	o
d Veranderingen in onze productgroepen of diensten zijn drastisch van aard	o	o	o	o	o	o
e Vanwege de omgeving waarin we opereren, zijn ingrijpende en risicovolle acties nodig om de doelstellingen van ons bedrijf te bereiken	o	o	o	o	o	o
f In onzekere situaties zetten we alles op alles om er zeker van te zijn dat we kansen benutten	o	o	o	o	o	o
g Ons bedrijf heeft sterk de voorkeur voor risicovolle projecten (met kans op hoge opbrengsten)	o	o	o	o	o	o

v36 De volgende stellingen zeggen iets over de externe oriëntatie van uw bedrijf. Geef aan in hoeverre elke stelling van toepassing is.

	helemaal mee oneens				**helemaal mee eens**	**weet niet**
a Ons bedrijf besteedt veel aandacht aan het begrijpen van klantenwensen	o	o	o	o	o	o
b Wij besteden veel aandacht aan het opsporen van kansen om concurrentievoordeel te kunnen behalen	o	o	o	o	o	o
c Onze doelen worden hoofdzakelijk bepaald door het oordeel van klanten	o	o	o	o	o	o
d Wij reageren zeer snel op acties van concurrenten	o	o	o	o	o	o
e Onze medewerkers bezoeken vaak beurzen, seminars en bijeenkomsten om ideëen op te doen	o	o	o	o	o	o
f Samenwerken met andere bedrijven vinden we belangrijk om succesvol te zijn	o	o	o	o	o	o
g Wanneer we een probleem tegenkomen, zoeken we meestal buiten het bedrijf of er al een oplossing bestaat	o	o	o	o	o	o

E Algemene vragen

v41 Hoeveel medewerkers (inclusief eigenaren, meewerkende gezinsleden en tijdelijke krachten) in uw bedrijf hebben de volgende opleiding?

HBO/universitaire opleiding	..... (aantal)
MBO	..... (aantal)
Weet niet/onbekend	o

v42 Hoeveel medewerkers hebben het afgelopen jaar bij- of nascholing gevolgd op het gebied van elektronisch zakendoen (bijv. een internet-workshop)?

- o ..... (aantal)
- o Weet niet/onbekend

v43 Wat is uw functieomschrijving?

- O Directeur/eigenaar
- O Directeur
- O Bedrijfsleider
- O Manager/afdelingshoofd
- O Anders, namelijk .....

v44x *(alleen schriftelijke vragenlijst)*
Op welk e-mailadres kunnen wij u in de toekomst bereiken?

.....

Appendix 6.1 Factor analysis and principal component analysis

In **chapter 6**, principal component analysis is used to reduce original sets of variables into smaller sets of components. Strictly speaking, principal component analysis is not equivalent to factor-analysis, although the two terms are often used interchangeably. Principal components are exact linear combinations of the observed variables. The correlation of each variable with a component is maximised. In factor-analysis, the factors are hypothetical constructs (latent variables) that can not be measured directly. Each observed variable is specified as a weighed sum of the common factors plus a factor that represents variance that is not explained by the common factors (which can be interpreted as measurement error) (De Heus, Van der Leeden & Gazendam, 1995). Principal component extraction is particularly useful to find a small number of components that explains as much variance of the observed variables as possible (De Heus et al, 1995). Components are extracted with an eigenvalue larger than one. Variables that have a low extraction communality (below 0,3) are removed as they do not fit well with the factor-solution i.e. their estimated variance is not well accounted for by the extracted components. Varimax rotation is used to maximise component loadings and facilitate the interpretation of the components. Factor analysis is also used to determine the unidimensionality of a scale (see under Reliability in **section 5.6**).

Appendix 6.2 Overview of variables and their items

Variable		Original items	Remark
Strategic value creation	VCSTRAT2	Opening up an additional market channel	
		Opening up a new market	
		Higher turnover	
		Offering a new product or service	
Organisational value creation	VCO2	Saving time/money	
		Improved company image	added after pilot test
		Improved customer service	
		Improved communication between employees	
		Improved communication with suppliers and customers	
		Higher cost	removed from scale
Supply process supported with e-mail	E21TOT	Searching information about suppliers	
		Selecting products/services	
		Requesting quotations	
		Ordering a product or service	
		Inquiring about logistics	
		Receiving invoices	
		Payment of supplies/ electronic banking	removed from scale
		Electronically receiving products/services	
		After sales-service	
Supply process supported with Internet	I21TOT	Searching information about suppliers	
		Selecting products/services	
		Requesting quotations	
		Ordering a product or service	
		Inquiring about logistics	
		Receiving invoices	removed from scale
		Payment of supplies/ electronic banking	
		Electronically receiving products/services	
		After sales-service	
Organisation supported with e-mail	E23TOT	Human resource management	
		Quality management	
		General management	
		Process management	
		Communication between employees	
		Recruitment of new personnel	
		Teleworking	
		Knowledge management	
		Taking courses and education	removed from scale
		Electronic approval of contracts, invoices, etc.	removed from scale
Organisation supported with Internet	I23TOT	Human resource management	
		Quality management	
		General management	
		Process management	
		Communication between employees	
		Recruitment of new personnel	
		Teleworking	removed from scale
		Knowledge management	
		Taking courses and education	
		Electronic approval of contracts, invoices, etc.	removed from scale
Sales process supported with e-mail	E25TOT	Looking for information on customers and/or competitors	
		Offering information on the company and its products/services	
		Assisting customers with purchasing	
		Quoting	
		Receiving orders	
		Offering logistics information	
		Sending invoices	removed from scale
		Offering the possibility of electronic payment	removed from scale
		Electronic delivery of products or services	
		After-sales service	

Variable		Original items	Remark
Sales process supported with Internet	I25TOT	Looking for information on customers and/or competitors	
		Offering information on the company and its products/services	
		Assisting customers with purchasing	
		Quoting	
		Receiving orders	
		Offering logistics information	
		Sending invoices	removed from scale
		Offering the possibility of electronic payment	
		Electronic delivery of products or services	
		After-sales service	
Reliance on ICT	RELIAN2	Reliance on ICT for the supply process	
		Reliance on ICT for the organisation	
		Reliance on ICT for the sales process	
Perceived relative advantage	RELADV	Electronic business can save a company costs and/or time	
		Electronic business allows a company to better serve its customers	
		Electronic business enables new products or services	
		Electronic business is important to keep up with the competition	
Perceived compatibility	COMP	Our products or services are very suitable for electronic business	
		Our customers are completely ready for electronic business	
		Our suppliers are completely ready for electronic business	
		In our company there is a lot of interest in electronic business	
		We have enough knowledge available in the company for electronic business	
		We do not worry about the security of of electronic business	removed from scale
Customer and competitor orientation	CUSTORIE	Our company is very attentive to understanding customer's wishes	
		We are very alert to opportunities to gain competitive advantage	
		Our goals are primarily defined by the customer's opinion	
		We respond very quickly to competitor's actions	
Environment as a source of ideas	ENVIRON	Our employees regularly visit exhibitions, seminars and conferences to get ideas	
		We consider collaboration with other companies important for success	
		When confronted with a problem, we usually look outside the firm if a solution already exists	
Entrepreneurial orientation	EO	Our company typically initiates actions to which the competition then responds	
		Our company is usually the first to introduce new products, services or technologies	
		In dealing with competitors, our company typically adopts a very competitive, 'undo-the-competitors' posture	removed from scale
		In, general, the top managers of my firm favor a strong emphasis on the marketing of tried and true products	removed from scale
		In the past 3 years our company put many new product-groups or services on the market	
		Changes in our product-groups or services are drastic in nature	
		Because of the environment in which we operate, radical and risky actions are necessary to reach the goals of our company	
		In uncertain situations we do everything to make sure that we exploit opportunities	
		Our company strongly prefers risky projects (with the chance of high returns)	
Presence of innovation roles	INNROL	We have (at least) 1 colleague in our company who is very enthusiast and well informed about electronic business and who tries to convey that to colleagues	
		We have (at least) 1 colleague in our company who 'picks up' electronic business and makes concrete propositions	
Perceived dedication of resources	DEDRES	In our company money is being released to invest in electronic business	
		In our company time is being released to implement electronic business	

Appendix 6.3 Factor analysis (PCA)[a]

Organisational value creation (VCO2)

Comp.	λ
1	2,237
2	0,866
3	0,700
4	0,616
5	0,581

Strategic value creation (VCSTRAT2)

Comp.	λ
1	2,033
2	0,716
3	0,642
4	0,608

Supply supported with e-mail (E21TOT)

Comp.	λ
1	3,644
2	0,930
3	0,841
4	0,683
5	0,558
6	0,532
7	0,447
8	0,364

Supply supported with Internet (I21TOT)

Comp.	λ
1	3,465
2	0,985
3	0,837
4	0,690
5	0,659
6	0,529
7	0,492
8	0,343

Organisation supported with e-mail (E23TOT)

Comp.	λ
1	3,789
2	0,846
3	0,759
4	0,661
5	0,563
6	0,540
7	0,433
8	0,409

Organisation supported with Internet (I23TOT)

Comp.	λ
1	4,031
2	0,780
3	0,698
4	0,651
5	0,586
6	0,515
7	0,401
8	0,338

Sales supported with e-mail (E25TOT)

Comp.	λ
1	3,903
2	0,843
3	0,784
4	0,614
5	0,546
6	0,481
7	0,442
8	0,388

Sales supported with Internet (I25TOT)

Comp.	λ
1	3,605
2	1,122
3	0,879
4	0,721
5	0,655
6	0,587
7	0,526
8	0,465
9	0,440

Reliance on ICTs (RELIAN2)

Comp.	λ
1	2,366
2	0,358
3	0,277

Perceived relative advantage (RELADV)

Comp.	λ
1	2,809
2	0,556
3	0,357
4	0,277

Perceived compatibility (COMP)

Comp.	λ
1	2,887
2	0,821
3	0,599
4	0,420
5	0,274

Customer and competitor orientation (CUSTORIE)

Comp.	λ
1	2,340
2	0,753
3	0,569
4	0,338

Environment as a source of ideas (ENVIRON)

Comp.	λ
1	1,641
2	0,764
3	0,595

Entrepreneurial orientation (EO)

Comp.	λ
1	4,103
2	0,888
3	0,655
4	0,473
5	0,378
6	0,304
7	0,199

Presence of innovation roles (INNROL)

Comp.	λ
1	1,848
2	0,152

Perceived. dedication of resources (DEDRES)

Comp.	λ
1	1,882
2	0,118

a λ is the eigenvalue of the first component in the principal component analysis

Appendix 7.1 Multiple linear regression

(Multiple) Linear regression is a the appropriate method when the research problem involves a single metric dependent variable presumed to be related to one or more metric independent variables. The objective of linear regression is to predict changes in the dependent variable in response to change in the independent variables. The basic formulation of a multiple linear regression equation is $Y_1=a+b_1X_1 + b_2X_2 +.....+ b_eX_e + \epsilon$ where Y is the dependent variable, $X_{1..e}$ are the independent variables, b the regression coefficients for X, a the intercept (constant term) and ϵ the residual (error term). To estimate the regression equation usually (and in this study) the least square method is used that aims to minimise the total sum of squared residuals. The residual is the difference between the observed and predicted value for the dependent variable (Hair, Anderson, Tatham & Black, 1998). The regression coefficient represents the amount of change in the dependent variable for a one-unit change on the independent variable. The value of the regression coefficient ranges form 0 to 1. Usually standardised regression coefficients (β) are used that are independent of the units of measurement. Beta can be interpreted as follows: when X increases with 1 standard deviation, Y increases with β * standard deviations (De Heus et al., 1995). To determine the variance explained in Y, adjusted R^2 is used. The values of adjusted R^2 range from 0 to 1. The adjusted R^2 is preferred over the sample R^2 as this measure tends to optimistically estimate how well the model fits the population. Adjusted R^2 corrects R^2 to more closely reflect the goodness of fit of the model in the population (De Heus et al., 1995).

Multiple regression analysis is based on four assumptions (De Heus et al., 1995):

- Metric variables. Both the independent variable(s) and the dependent variable are metric (ordinal or continuous)
- Linear relations. The linearity of the relationship between the dependent and independent variables represents the degree to which a change in the dependent variable is associated with the independent variable. An examination of the residuals (using a plot of the predicted values against the residuals) should show a horizontal 'cloud' (De Heus et al., 1995). Partial regression plots of each independent variable against the dependent variable should show a linear pattern. In the case of non-linear relationships, linear regression results do not adequately represent the relationship.
- Independent variables fixed, dependent variable random. The dependent variable is random for every independent variable. Linear regression is totally robust to violations of this assumption (De Heus et al., 1995).
- Residuals. The residuals are assumed to be (De Heus et al., 1995):
  (a) Independent. This assumption is hard to examine, however in survey-research, when observations are independent, this assumption is met.
  (b) Normally distributed. In a visual examination of the normal probability plot of the residuals, all value should fall along the diagonal (Hair et al, 1998: p. 172). In case of large samples (>100), a violation of this assumption usually does not lead to problems.
  (c) No pattern (homoscedacity). An examination of a plot of the residuals against the predicted values of the dependent variable should not show any pattern of increasing or decreasing values. The error terms are assumed to have the same vari-

ance for every predicted value of the dependent variables. If this assumption is violated, the results of the regression may not be reliable.

In addition to the above assumption, a check is necessary on possible multicollinearity and outliers. Multicollinearity occurs when one independent variable is highly correlated with another independent variable. To check for multicollinearity the tolerance and VIF values (which are provided in SPSS multiple linear regression) need to be examined. Tolerance is the amount of variability of the selected independent variables not explained by the other independent variables. The VIF value is the inverse value of the tolerance value. A usual threshold value for the VIF value is 10.0, corresponding to a tolerance of 0.10). Large VIF values and low tolerance values indicate a high degree of collinearity (Hair et al., 1998).

Outliers are observations that have a substantial difference between the actual value for the dependent variable and the predicted value. Cases that are substantially different with regard to either independent or dependent variables are often termed outliers as well (Hair et al., 1998). In this study, outliers are identified when their standardised residual is larger than 3.

Appendix 7.2 Descriptive statistics of outliers

	Scores on variables													
Case-number	**EBUSADG3**	**VCO2**	**VCSTRAT2**	**RELADV**	**COMP**	**PERCHOPL**	**ITSCORE4**	**CUSTORIE**	**EO**	**INNROL**	**DEDRES**	**PERCBIJS**	**ACTINFO**	**EXPRESS**
920	63	5	2	1,25	1,6	0,00	5	3,75	4,00	2,00	2,00	0,17	4	3
6913	42	1	4	5	4,4	0,11	2	4	3,29	3,50	5,00	0,00	7	4
7053	32	4	4	1	1,4	0,00	3	1	1,71	1,00	1,00	.	5	4
7853	72	4	0	1,25	2	0,00	2	4	1,86	1,00	2,50	.	3	3
7987	12	1	2	4,5	4	0,40	2	3,5	1,00	1,00	1,00	0,00	2	2
10035	67	3	4	4,75	3,8	0,00	5	4,75	3,86	4,00	5,00	0,02	6	4
10055	69	4	2	1,25	1,4	0,00	4	2	1,71	2,00	1,00	0,93	2	2
13333	36	3	2	1,25	2,8	0,38	3	4,5	4,00	1,00	2,00	0,88	4	4
14156	5	0	0	1,25	2,2	0,00	2	4,5	1,43	2,50	2,00	0,14	2	2
53672	.	3	4	4,25	3,6	0,00	3	4,25	4,00	5,00	5,00	0,00	6	3
54904	62	5	2	1,25	2,2	0,27	5	4	4,00	5,00	5,00	0,33	6	3
610469	48	2	0	3	1	0,04	3	4,75	3,43	3,00	3,50	0,08	4	1
612272	72	3	0	1,75	2	0,00	6	4,5	2,71	1,50	1,50	.	4	3
617319	84	4	0	4,5	4	0,29	5	3,25	2,43	5,00	3,00	0,00	3	3
652067	22	3	0	1	1,6	1,00	2	2	1,00	3,00	5,00	0,00	6	6
652470	66	5	1	4,25	3,6	0,01	2	4,5	1,71	5,00	5,00	0,05	10	9
652869	69	4	0	1,75	1,2	.	3	.	1,86	1,00	1,00	.	6	4
652928	49	4	1	1	1,2	0,00	5	4	3,29	1,00	1,00	0,00	10	3
653370	46	3	2	2	2	0,17	3	4,5	1,71	5,00	5,00	0,00	3	2
N	18	19	19	19	19	18	18	18	19	19	19	15	19	19
Mean outliers	50,89	3,21	1,58	2,43	2,42	0,15	3,28	3,76	2,58	2,76	2,97	0,17	4,89	3,42
Mean sample	**27,76**	**2,34**	**0,70**	**3,88**	**3,03**	**0,15**	**3,01**	**3,86**	**2,58**	**3,25**	**3,22**	**0,11**	**2,83**	**1,95**
Minimum	5	0	0	1	1	0,00	2	1	1,00	1	1	0,00	2	1
Maximum	84	5	4	5	4,4	1,00	5	4,75	4,00	5	5	0,93	10	9
Std. Dev.	22,42	1,40	1,54	1,55	1,13	0,25	1,23	1,07	1,10	1,64	1,73	0,31	2,38	1,74
Kurtosis	-0,44	0,28	-1,06	-1,47	-1,30	7,22	-1,39	1,66	-1,62	-1,57	-1,82	3,07	0,40	5,40
Skewness	-0,66	-0,83	0,50	0,66	0,50	2,48	0,48	-1,54	0,10	0,31	0,17	2,04	0,86	1,94

Appendix 7.3 Structural equation modelling

(for this section the following literature has been used: Jöreskog, 2004; Hair, Anderson, Tatham & Black, 1998; Jöreskog & Sörbom, 1993)

Structural equation modelling (SEM) is a multivariate technique, specifically designed to estimate multiple and interrelated dependence relationships. Where in multiple regression analysis several independent (explanatory) variables are related to one dependent (explained) variable, in SEM it is possible to relate a set of independent variables to more than one dependent variable. Also, the dependent variables may be related. In SEM, independent variables are sometimes referred to as exogenous variables; dependent variables are labelled endogenous variables. The process of SEM can be divided in several stages (see **Table 1** below).

Table 1 Stages in the process of structural equation modelling (Hair et al., 1998)

Stage	Stage description	Activities
1	Develop a theoretically based model	Assess role in modelling strategy, specify theoretical model
2	Construct a path diagram	Define exogenous (explanatory) and endogenous (explained) constructs, link relationships in path diagram
3	Convert the path diagram	Translate the structural equations, specify the measurement model, identify correlations of constructs and indicators
4	Choose the input matrix	Correlation or variance/covariance matrix
	Research problem	Assumptions of SEM, missing data, assess adequacy/impact of sample size, select method of model estimation
5	Assess the identification of the model	Determine the degrees of freedom, diagnosis and remedy of identification problems
6	Evaluate the model estimates and goodness-of-fit	Identify/correct offending estimates, overall fit measure, measurement model fit, structural model fit, comparison of competing models
	Model interpretations	Examine standardised residuals, consider modification indices, identify potential model changes
7	Model modification	If modifications are indicated, can theoretical justification be found for the proposed model changes?

SEM is always strictly guided by theory, and usually not used in exploratory analysis. Especially since the modern software packages for SEM, in this study LISREL 8.30 is used, offer easy experimentation with different dependencies and models, it is essential to ground a systematic set of relationships on theory. Otherwise relationships may be found that are theoretically irrelevant, and solely the result of statistical techniques. Theory can be defined as a systematic set of relationships providing a consistent and comprehensive explanation of the phenomenon. In this study, SEM is used to test whether the hypothesised theoretical model is statistically significant, and fit the empirical data (a confirmatory modelling strategy). In addition, a competing models strategy is applied, as the perceptions model and the firm characteristics models are compared (**chapter 7**).

The hypothesised relationships between the variables are specified in a path diagram. This is a graphical display of the complete set of relationships using boxes and various types of arrows. Two assumptions underlie path diagrams: 1) all causal relationships are indicated i.e. theory specifies whether any relationship between variables is included or excluded from the path diagram, 2) the nature of the causal relationships is assumed to be linear. The next step is to translate the path diagram into a set of structural equations that specify the model in more formal terms. Basically, a structural equation has the following form: $Y_1=b_1X_1 + b_2X_2 +.....+ b_eX_e + b_2Y_2 + ...+ b_eY_e + \epsilon$, where Y_1 is the dependent variable, $X_{1..e}$ are the independent variables, $Y_{1..e}$ the other dependent variables, b the regression coefficients for X and Y, and ϵ the residual (error term). The complete set of structural equations making up the model is called the structural model.

Regarding the inputting data (the empirical data) several assumptions of SEM need to be considered: (1) observations are independent, (2) the sample of respondents is randomly selected, and (3) all relationships are linear. In addition, SEM is sensitive to variables with non-normal distributions, and missing data need to be dealt with, for example by 'solving' missing data through pairwise deletion, listwise deletion or imputation methods. The essence of SEM is that the covariance matrix of the input (the empirical data) is compared to the covariance matrix as predicted by the model. The closer the similarity between the matrices, the better the theoretical model fits the empirical data. The choice for a particular type of input matrix (variance-covariance matrix, or correlations matrix) is dependent on the estimation method and the type of observed variables (continuous or ordinal data). The covariance matrix has the advantage of providing valid comparisons between different populations or samples. The disadvantage is that the interpretation of the results is somewhat difficult, as the coefficients must be interpreted in terms of the units of measurement. Correlation matrices have a common range that makes it possible to directly compare the coefficients within the model. The most popular estimation method is maximum likelihood (ML). This method however is sensitive to non-normal data. Alternative methods like weighted least squares (WLS), or generalised least squares (GLS) are less sensitive in this respect. In this study, WLS is used. WLS requires a large sample size; as a rule of thumb the sample size should have a ratio of 15 respondents for each estimated parameter. Also, WLS is recommended when a mix of ordinal and contin-

uous data are used. If both variables are ordinal, polychoric correlations are preferred, if one is ordinal and the other variable continuous than polyserial correlations are preferred over Pearson product-moment correlations. These correlations are not computed from actual scores, but are rather theoretical correlations of the underlying unobserved continuous variable of which the ordinal variable may be regarded as a crude measurement. The WLS method requires an asymptotic covariance matrix to weigh the sample's variances and covariances, or correlations matrix. These matrices are calculated using PRELIS 2.30, a preprocessor available for LISREL.

When the estimation procedure and input matrix are selected, the model is estimated in LISREL. LISREL output provides all the information to assess the fit between the theoretical model (structural model) and the empirical data. The goodness-of-fit measures selected in this study, are discussed in **appendix 7.6**.

Appendix 7.4 Overview of the models structural equations

Model	Dependent (explained) variable		Independent (explanatory) variables	+ dependent variables	+error
I	VCSTRAT2	=		βa*VCO2+ βb*EBUSADG3	+ $e_{vcstrat2}$
	VCO2	=		βc*EBUSADG3	+ e_{vco2}
	EBUSADG3	=	βn*RELADV + βo*COMP		+ $e_{ebusadg3}$
II	VCSTRAT2	=		βa*VCO2+ βb*EBUSADG3	+ $e_{vcstrat2}$
	VCO2	=		βc*EBUSADG3	+ e_{vco2}
	EBUSADG3	=	βd*PERCHOPL + βe*ITSCORE4 + βf*CUSTORIE + βg*ENVIRON + βh*EO+ βi*PERCBIJS +βj* INNROL + βk*DEDRES + βl*ACTINFO + βm*EXPRESS		+ $e_{ebusadg3}$
III	VCSTRAT2	=		βa*VCO2+ βb*EBUSADG3	+ $e_{vcstrat2}$
	VCO2	=		βc*EBUSADG3	+ e_{vco2}
	EBUSADG3	=	βd*PERCHOPL + βe*ITSCORE4 + βf*CUSTORIE + βg*ENVIRON + βh*EO+ βi*PERCBIJS +βj* INNROL + βk*DEDRES + βl*ACTINFO + βm*EXPRESS	βn*RELADV + βo*COMP	+ $e_{ebusadg3}$
	RELADV	=	βp*PERCHOPL + βq*ITSCORE4 + βr*CUSTORIE + βs*ENVIRON + βt*EO+ βu*PERCBIJS + βv* INNROL + βw*DEDRES + βx*ACTINFO + βy*EXPRESS		+ e_{reladv}
	COMP	=	βz*PERCHOPL + βaa*ITSCORE4 + βab*CUSTORIE + βac*ENVIRON + βad*EO+ βae*PERCBIJS + βaf* INNROL + βag*DEDRES + βah*ACTINFO + βai*EXPRESS		+ e_{comp}

Note that:

βA TO βAI = Regression coefficients for respective variables
VCSTRAT2 = Strategic value creation
VCO2 = Organisational value creation
EBUSADG3 = E-business adoption
RELADV = Perceived relative advantage
COMP = Perceived compatibility

General firm characteristics:

PERCHOPL = % of employees with a university or higher vocational training
ITSCORE4 = Sophistication of IT infrastructure
CUSTORIE = Customer and competitor orientation
ENVIRON = Environment as a source of ideas
EO = Entrepreneurial orientation

Specific firm characteristics:

PERCBIJS = % of employees with an e-business-related training
INNROL = Presence of innovation roles
DEDRES = Perceived dedication of resources
ACTINFO = Activated information network
EXPRESS = Perceived external pressure

Appendix 7.5 Missing value analysis[a]

Variable		n	Missing	Missing%	Mean	St. Dev.	Skewness	Kurtosis	Min.	Freq.	Max.	Freq.
SECTOR	listwise	353	242	41%					1.000	47	9.000	28
	pairwise	595	0	0%					1.000	73	9.000	74
	EM	595	0	0%					1.000	73	9.000	74
KWP	listwise	353	242	41%					1.000	80	3.000	117
	pairwise	595	0	0%					1.000	193	3.000	163
	EM	595	0	0%					1.000	193	3.000	163
VCO2	listwise	353	242	41%	2.516	1.667	-0.066	-1.229	0.000	57	5.000	50
	pairwise	540	55	9%	2.306	1.645	0.113	-1.193	0.000	98	5.000	63
	EM	595	0	0%	2.289	1.572	0.149	-1.027	0.000	98	5.000	63
VCSTRAT2	listwise	353	242	41%	0.748	1.096	1.452	1.223	0.000	208	4.000	13
	pairwise	540	55	9%	0.674	1.045	1.573	1.678	0.000	336	4.000	16
	EM	595	0	0%	0.647	1.010	1.646	2.049	0.000	370	4.000	16
RELADV	listwise	353	242	41%	4.056	0.850	-1.166	1.210	1.000	1	5.000	63
	pairwise	572	23	4%	3.930	0.914	-0.997	0.573	1.000	5	5.000	87
	EM	595	0	0%	3.924	0.897	-0.995	0.678	1.000	5	5.000	87
COMP	listwise	353	242	41%	3.179	0.930	-0.240	-0.549	1.000	8	5.000	5
	pairwise	575	20	3%	3.052	0.968	-0.103	-0.728	1.000	18	5.000	9
	EM	595	0	0%	3.044	0.953	-0.079	-0.666	1.000	18	5.000	9
PERCHOPL	listwise	353	242	41%	0.156	0.243	2.203	4.366	0.000	124	1.000	14
	pairwise	581	14	2%	0.154	0.260	2.215	4.091	0.000	248	1.000	31
	EM	595	0	0%	0.154	0.257	2.242	4.265	0.000	248	1.000	31
ITSCORE4	listwise	353	242	41%	3.278	0.975	0.048	-0.826	1.000	4	5.000	38
	pairwise	563	32	5%	3.005	1.061	0.106	-0.716	1.000	35	5.000	48
	EM	595	0	0%	3.005	1.032	0.110	-0.585	1.000	35	5.000	48
CUSTORIE	listwise	353	242	41%	3.952	0.791	-1.011	1.062	1.000	1	5.000	31
	pairwise	575	20	3%	3.863	0.831	-0.946	0.798	1.000	3	5.000	47
	EM	595	0	0%	3.861	0.817	-0.954	0.916	1.000	3	5.000	47
ENVIRON	listwise	353	242	41%	3.421	0.917	-0.585	-0.016	1.000	9	5.000	12
	pairwise	573	22	4%	3.313	0.949	-0.432	-0.278	1.000	18	5.000	20
	EM	595	0	0%	3.310	0.932	-0.430	-0.183	1.000	18	5.000	20
EO	listwise	353	242	41%	2.735	0.980	-0.029	-0.693	1.000	22	5.000	2
	pairwise	570	25	4%	2.583	1.007	0.096	-0.776	1.000	57	5.000	4
	EM	595	0	0%	2.576	0.986	0.118	-0.680	1.000	57	5.000	4
INNROL	listwise	353	242	41%	3.500	1.352	-0.597	-0.866	1.000	45	5.000	90
	pairwise	562	33	6%	3.266	1.424	-0.336	-1.228	1.000	96	5.000	127
	EM	595	0	0%	3.250	1.387	-0.310	-1.155	1.000	96	5.000	127
DEDRES	listwise	353	242	41%	3.484	1.290	-0.650	-0.684	1.000	42	5.000	75
	pairwise	570	25	4%	3.226	1.361	-0.354	-1.133	1.000	91	5.000	101
	EM	595	0	0%	3.212	1.335	-0.328	-1.080	1.000	91	5.000	101
DEDMEA	listwise	353	242	41%	3.491	1.242	-0.700	-0.625	1.000	32	5.000	48
	pairwise	573	22	4%	3.238	1.315	-0.382	-1.104	1.000	73	5.000	70
	EM	595	0	0%	3.224	1.293	-0.356	-1.061	1.000	73	5.000	70
PERCBIJS	listwise	353	242	41%	0.101	0.193	2.867	8.784	0.000	182	1.000	6
	pairwise	458	137	23%	0.103	0.212	2.836	7.974	0.000	260	1.000	12
	EM	595	0	0%	0.103	0.186	3.224	11.202	0.000	260	1.000	12
ACTINFO	listwise	353	242	41%	3.119	2.070	0.703	0.691	0.000	38	10.000	4
	pairwise	595	0	0%	2.768	2.089	0.804	0.677	0.000	92	10.000	5
	EM	595	0	0%	2.768	2.089	0.804	0.677	0.000	92	10.000	5
EXPRESS	listwise	353	242	41%	2.133	1.877	1.176	2.249	0.000	83	10.000	3
	pairwise	595	0	0%	1.904	1.792	1.183	2.108	0.000	163	10.000	3
	EM	595	0	0%	1.904	1.792	1.183	2.108	0.000	163	10.000	3
EBUSADG3	listwise	353	242	41%	31.946	19.948	0.341	-0.935	0.000	3	80.000	1
	pairwise	556	39	7%	27.007	21.177	0.524	-0.780	0.000	62	84.000	1
	EM	595	0	0%	26.971	20.589	0.543	-0.665	0.000	62	84.000	1

a for this analysis all variables except SECTOR and KWP were regarded as continous in Prelis to enable the calculation of means and standard deviations

Appendix 7.6 Goodness of fit measures for SEM

To evaluate a model estimated with structural equation modelling (LISREL), several goodness-of-fit measures are available. This is a list of the criteria that are used in this study to evaluate the results:

1 Degrees of freedom (df)

Degrees of freedom is the difference between the number of correlations (or covariances) and the actual number of coefficients in the proposed model. A model is considered identified when the model's degrees of freedom is larger than or equal to zero (Hair et al., 1998). Over-identification (df>0) is the goal for all structural equation models as there is more information in the data matrix than the number of parameters to be estimated.

2 Overall model fit

To assess the overall fit of the model, several goodness-of-fit measures are available that measure the correspondence of the actual or observed input (covariance or correlation) matrix with that predicted from the proposed model. In many studies the Chi-square ($\chi 2$) measure is used. Low values of $\chi 2$ relative to the degrees of freedom signifies that the observed and estimated matrices do not differ significantly (resulting in significance levels of 0,05 or 0,01). Chi-square however is sensitive to sample size (especially when N>200) (Hair et al., 1998), and therefore, in this study, this statistical measure is replaced by more appropriate measures of fit (Jöreskog & Sörbom, 1993):

- Estimated Non Centrality Parameter (NCP). NCP is an alternative to the Chi-square statistic and less affected by sample size (Hair et al., 1998).
- Adjusted Goodness-of-Fit (AGFI). This goodness-of-fit measure is an extension of the GFI measure, adjusted by the ratio of degrees of freedom. AGFI does not depend on sample size explicitly and measures how much better the model fits as compared to no model at all (Jöreskog & Sörbom, 1993). The recommended acceptance level is a value greater than or equal to 0,90 (Hair et al., 1998).
- Root Mean Square Residual (RMR). RMR measures the square root of the average of the fitted residuals.
- Root Mean Square Residual of Approximation (RMSEA). Similar to RMR, RMSEA is a measure of discrepancy per degree of freedom. However, contrary to RMR, the value of RMSEA is representative of the goodness-of-fit that could be expected if the model were estimated in the population, not just the sample drawn from the population. A value of 0,05 indicates a close fit, whereas values up to 0,08 represent reasonable errors of approximation in the population (Jöreskog & Sörbom, 1993). An empirical examination found that RMSEA was best suited in a confirmatory or competing models strategy with larger samples (Hair et al., 1998).
- Expected Cross-validation Index (ECVI). The disadvantage of $\chi 2$ as a measure of fit is that the value always decreases when parameters are added to the model, adding to the risk of capitalising on chance (Jöreskog & Sörbom, 1993). ECVI is an approximation of the goodness-of-fit for the estimated model using another sample of the same size, taking into account the number of parameters (Hair et al., 1998). ECVI is a so-called information measure of fit and can be used to compare alternative models on parsimony and fit. The

model with the smallest value of ECVI is preferred.

3 Offending estimates

'Offending' estimates need to be identified that exceed acceptable limits. Common examples of offending estimates are negative error variances or nonsignificant error variances for any construct, standardised coefficients exceeding or very close to 1.0, and very large standard errors associated with an estimated coefficient (Hair et al., 1998).

4 Detailed model fit

The residuals, standardised residuals and modification indices are inspected to assess the fit of the estimated model in detail and locate possible misspecification in the structural model (Jöreskog & Sörbom, 1993). A residual is an observed minus a fitted covariance (variance). A standardised residual is a residual divided by its estimated standard error and is independent of the unit of measurement of the variable (contrary to fitted residuals). The standardized residuals may be examined collectively in a stem leaf plot. A good model is characterized by a stem leaf plot in which the residuals are symmetrical around zero, with most in the middle and fewer in the tails. Modification indices are calculated for each non-estimated relationship in the model and their value corresponds approximately to the reduction in chi-square that would occur if the coefficients were estimated. A value of 3,84 or greater suggests a statistically significant reduction in the chi-square obtained (Hair et al., 1998). However, model changes based on modification indices should always be underpinned theoretically to avoid chance capitalisation.

5 Examination of the solution

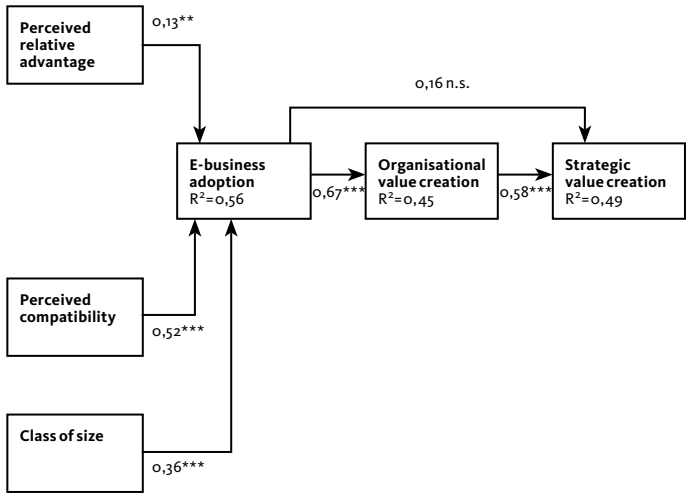
To examine the structural model and the proposed solution, first the signs of the estimated coefficients need to be examined and checked against the direction as specified in the theoretical model (Hair et al, 1998; Jöreskog & Sörbom, 1993). Second, the significance of the estimated coefficients is assessed against critical t-values. For each estimated coefficient, standard errors and calculated t-values are provided. The t-value is the ratio between the estimate and its standard error. When the direction of a relationship is pre-specified, a one-tailed t-test can be used to assess significance (one-tailed test: 1,64 ($p<0,05$), 2,33 ($p<0,01$), 3,09 ($p<0,001$); a two-tailed test is used otherwise (increasing the critical t-value to 1,96 ($p<0,05$), 2,58 ($p<0,01$), 3,29 ($p<0,001$) (Hair et al., 1998). Third, for each structural equation, an overall coefficient of determination (R^2) is calculated. R^2 is a measure of the strength of linear relationship. A small R^2 indicates a weak relationship and suggests the model is not effective (Jöreskog & Sörbom, 1993).

Appendix 7.7 Results of Model I and II including class of size

	Goodness-of-fit measures:	Model I: The perceptions model	Model IK: The perceptions model + class of size
1	Degrees of freedom ≥0	4	6
2	Overall model fit		
	Estimated Non Centrality Parameter	NCP = 19,31	NCP = 17,81
	Adjusted Goodness-of-Fit >0,90	AGFI = 0,98	AGFI = 0,98
	Root Mean Square Residual	RMR = 0,094	RMR = 0,077
	Root Mean Square Residual of Approximation <=0,05-0,08	RMSEA = 0,090 confidence interval: 0,057 - 0,13 RMSEA < 0,05 (p = 0,025)	RMSEA = 0,071 confidence interval: 0,043 - 0,10 RMSEA < 0,05 (p = 0,11)
	Expected Cross Validation Index	ECVImodel = 0,077	ECVImodel = 0,091
3	Offending estimates	no	no
4	Detailed model fit		
	Inspection of residuals	stem leaf plot symmetrical around 0	stem leaf plot symmetrical around 0
	Modification indices	no misspecification indicated	no misspecification indicated
5	Examination of the solution		
	Signs of coefficients	as hypothesised	as hypothesised
	Significance of coefficients	4 of 5 estimates significant	5 of 6 estimates significant
	Squared multiple correlations (R^2)	R^2 (Organisational value creation) = 0,43 R^2 (Strategic value creation) = 0,56 R^2 (E-business adoption) = 0,42	R^2 (Organisational value creation) = 0,45 R^2 (Strategic value creation) = 0,49 R^2 (E-business adoption) = 0,56

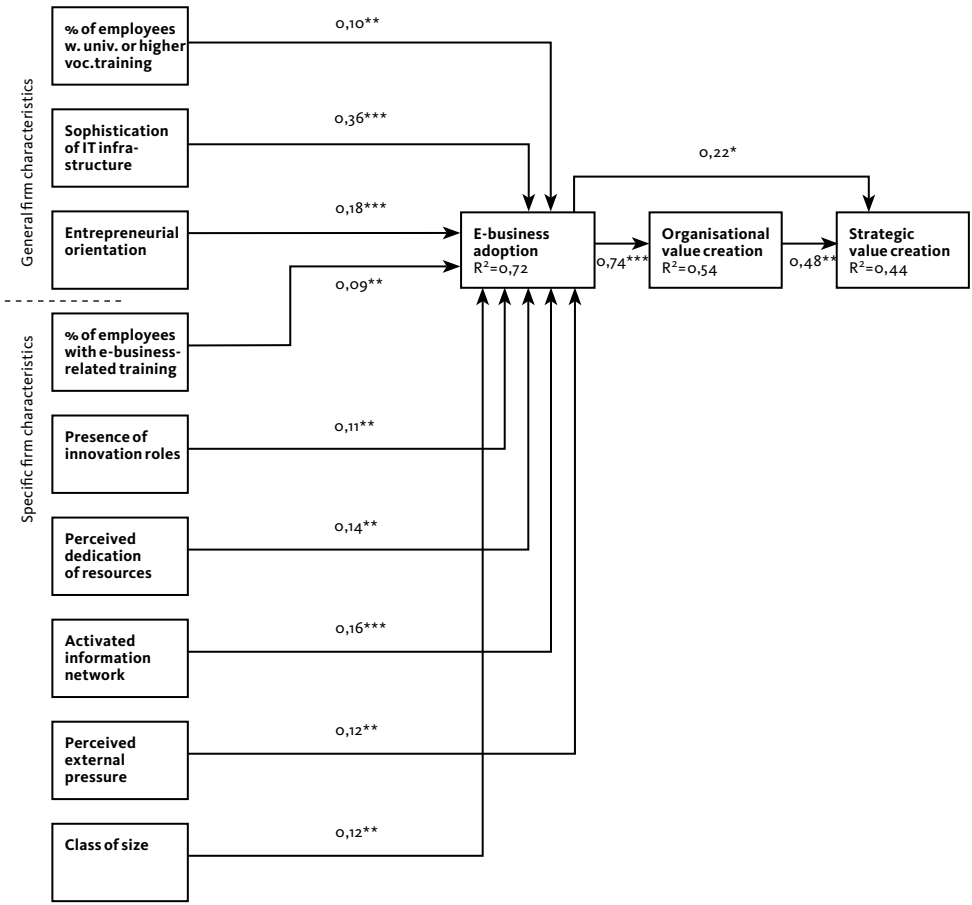
	Goodness-of-fit measures:	Model II: The firm characteristics model	Model IIK: The firm characteristics model + class of size
1	Degrees of freedom ≥0	16	18
2	Overall model fit		
	Estimated Non Centrality Parameter	NCP = 6,60	NCP = 8,66
	Adjusted Goodness-of-Fit >0,90	AGFI = 0,99	AGFI = 0,99
	Root Mean Square Residual	RMR = 0,047	RMR = 0,051
	Root Mean Square Residual of Approximation <=0,05-0,08	RMSEA = 0,027 confidence interval: 0,0 - 0,050 RMSEA < 0,05 (p = 0,95)	RMSEA = 0,029 confidence interval: 0,0 - 0,050 RMSEA < 0,05 (p = 0,95)
	Expected Cross Validation Index	ECVImodel = 0,21	ECVImodel = 0,25
3	Offending estimates	no	no
4	Detailed model fit		
	Inspection of residuals	stem leaf plot symmetrical around 0	stem leaf plot symmetrical around 0
	Modification indices	no misspecification indicated	no misspecification indicated
5	Examination of the solution		
	Signs of coefficients	as hypothesised	as hypothesised
	Significance of coefficients	11 of 11 estimates significant	12 of 12 estimates significant
	Squared multiple correlations (R^2)	R^2 (Organisational value creation) = 0,56 R^2 (Strategic value creation) = 0,43 R^2 (E-business adoption) = 0,71	R^2 (Organisational value creation) = 0,54 R^2 (Strategic value creation) = 0,44 R^2 (E-business adoption) = 0,72

Appendix 7.8 Estimated model I K: the perceptions model including class of size



Causal coefficients are standardised beta coefficients significant at:
*p<=0,05, **p<=0,01, ***p<=0,001 (one-tailed test), n.s.=not significant

Appendix 7.9 Estimated model II K: the firm characteristics model including class of size



Causal coefficients are standardised beta coefficients significant at:
*p<=0,05, **p<=0,01, ***p<=0,001 (one-tailed test), n.s.=not significant

Appendix 7.10 Results of the estimated Complete Model (Model III)

	Goodness-of-fit measures:	Model III: The complete model
1	Degrees of freedom ≥0	36
2	Overall model fit	
	Estimated Non Centrality Parameter	NCP = 48,43
	Adjusted Goodness-of-Fit >0,90	AGFI = 0,98
	Root Mean Square Residual	RMR = 0,056
	Root Mean Square Residual of Approximation <=0,05-0,08	RMSEA = 0,048 confidence interval: 0,035 - 0,061 RMSEA < 0,05 (p = 0,58)
	Expected Cross Validation Index	ECVImodel = 0,43
3	Offending estimates	yes (see the solution below)
4	Detailed model fit	
	Inspection of residuals	stem leaf plot symmetrical around 0
	Modification indices	no misspecification indicated
5	Examination of the solution	
	Signs of coefficients	7 contrary to what was hypothesised
	Significance of coefficients	11 of 24 estimates significant
	Squared multiple correlations (R^2)	R^2 (Organisational value creation) = 0,61 R^2 (Strategic value creation) = 0,51 R^2 (E-business adoption) = 0,80 R^2 (Perceived relative advantage) = 0,45 R^2 (Perceived compatibility) = 1,01

Appendix 7.10 (cont.) Results of the estimated Complete Model (Model III)

Dependent (explained) variable	Independent (explanatory) variables	+ dependent variables	+error
Strategic value creation =		0,50*vco2 (2,44) + 0,26*ebusadg3 (1,74)	+ 0,49
Organisational value creation =		0,78*ebusadg3 (8,85)	+ 0,39
E-business adoption =	0,06*perchopl (1,94) + 0,49 *itscore4 (4,39) + 0,12*eo (2,51) + 0,06*percbijs (1,76) + 0,10* innrol (0,07) -0,05 *dedres (-0,03) + 0,10*actinfo (2,14) + 0,11 *express (2,51)	0,03*reladv (0,83) + 0,29*comp (2,05)	+ 0,19
Perceived relative advantage =	-0,15*itscore4 (-0,61) + 0,08 *custorie(0,49) + 0,08*environ (2,03) **-4,14* innrol** (-1,15) + **4,73*dedres** (1,32)		+ 0,56
Perceived compatibility =	-0,74*itscore4 (-0,86) -0,31*custorie(-0,67) + 0,27*eo (1,42)-0,06 *percbijs (-0,44) - **10,84* innrol** (-0,76) + **11,98*dedres** (0,82)		**-0.01**

Note that:
Offending estimated regression coefficients and error variances are in bold
Numbers in brackets are t-values

VCSTRAT2=Strategic value creation
VCO2=Organisational value creation
EBUSADG3=E-business adoption
RELADV=Perceived relative advantage
COMP=Perceived compatibility

General firm characteristics:

PERCHOPL=% of employees with a university or higher vocational training
ITSCORE4=Sophistication of IT infrastructure
CUSTORIE=Customer and competitor orientation
ENVIRON=Environment as a source of ideas
EO=Entrepreneurial orientation

Specific firm characteristics:

PERCBIJS=% of employees with an e-business-related training
INNROL=Presence of innovation roles
DEDRES=Perceived dedication of resources
ACTINFO=Activated information network
EXPRESS=Perceived external pressure

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Nederlandse samenvatting

Elektronisch zakendoen of e-business wordt vaak geassocieerd met grote bedrijven als Dell, Amazon of Cisco. Echter, ook in het Midden– en Klein Bedrijf (MKB) zijn voorbeelden te vinden van ondernemingen die er in geslaagd zijn om hun bestaande manier van werken te veranderen en economische waarde te creëeren door het gebruik van bijvoorbeeld het Internet. Gezien het feit dat het MKB een belangrijk deel uit maakt van onze economie, is het van belang om elektronisch zakendoen te stimuleren in het MKB en zo de concurrentiepositie te verbeteren. Er is echter weinig inzicht in wat MKB-bedrijven beweegt om elektronisch zaken te doen. In dit proefschift beschrijf ik een vragenlijst onderzoek naar de adoptie van elektronisch zakendoen onder een groep van 614 Nederlandse MKB-bedrijven uit verschillende sectoren. Hierbij wordt elektronisch zakendoen vanuit twee theoretische perspectieven benaderd: het innovatie-adoptieperspectief en het ondernemerschapsperspectief. De onderzoeksvragen luiden:

1 ***Wat is elektronisch zakendoen?***
2 ***Welke bedrijfskenmerken verklaren de adoptie van elektronisch zakendoen?***
3 ***Wat zijn de verschillen in de verklaring van de adoptie van elektronisch zakendoen vanuit een innovatie-adoptieperspectief in vergelijking met een ondernemerschapsperspectief?***

Voor het beantwoorden van de onderzoeksvragen is allereerst een onderzoek gedaan naar literatuur die de adoptie van elektronisch zakendoen beschrijft en verklaart. In de 45 bestudeerde studies wordt de conceptualisering van de adoptie van elektronisch zakendoen nauwelijks uitgewerkt of bediscussieerd. In de meeste studies wordt een combinatie van aspecten of kenmerken van elektronisch zakendoen gebruikt om dit schijnbaar complexe fenomeen te karakteriseren. Meer algemene literatuur op het gebied van innovatie-adoptie beveelt aan om een multidimensionele maat te gebruiken om zo de mate van adoptie in een organisatie te beschrijven. In de bestudeerde literatuur over de adoptie van elektronisch zakendoen is een dergelijke maat niet voorhanden. Opvallend is dat in de literatuur elektronisch zakendoen regelmatig wordt geassocieerd met het behalen van

voordelen of het creëren van waarde door het toepassen van ICT. Dit geeft aan dat de conceptualisering van de adoptie van elektronisch zakendoen verder gaat dan het beschrijven van geïmplementeerde ICT's en verbonden is met waardecreatie. De bestudeerde literatuur geeft niet aan hoe dit idee nader vormgeven zou kunnen worden.

Literatuur over ondernemerschap biedt een nuttig perspectief op de conceptualisering van de adoptie van elektronisch zakendoen. In deze literatuur wordt innovatie expliciet verbonden aan waardecreatie door het concept *opportunity*. Een *opportunity* is een mogelijkheid om door de exploitatie van een innovatie nieuwe economische waarde te creëren. In dit perspectief biedt de adoptie van elektronisch zakendoen een *opportunity*. Immers, de toepassing van ICT's biedt de kans om waarde te creëeren voor een bedrijf.

Beide theoretische perspectieven bieden aanknopingspunten voor het conceptualiseren en meetbaar maken van e-business adoptie.

De suggesties uit de innovatie-adoptieliteratuur dragen bij aan het effectief operationaliseren van elektronisch zakendoen als de mate waarin een bedrijf ICT's toepast om haar bedrijfsprocessen te ondersteunen. In deze studie worden twee empirische variabelen gebruikt om de adoptie van e-business te meten: *business process support* en *intensity of use*. *Business process support* geeft aan welke bedrijfsactiviteiten ondersteund worden met e-mail of Internet in drie bedrijfsprocessen: inkoop, organisatie en verkoop. De resultaten van het survey onderzoek geven aan dat in de praktijk het inkoopproces het meest wordt ondersteund door e-mail en/of het Internet, gevolgd door het verkoopproces en de interne processen. Ook blijkt dat het Internet voornamelijk passief wordt gebruikt voor bijvoorbeeld het zoeken naar informatie over potentiële leveranciers (80%), of klanten (71%). Meer actief gebruik van Internet bijvoorbeeld voor het verschaffen van informatie over produkten of diensten (63%), of het werven van personeel (38%) komt minder voor. De mate waarin een bedrijf e-mail en Internet gebruikt geeft nog niet aan hoe vaak of intensief deze technologieën worden gebruikt. Hiervoor wordt de variabele *intensity of use* gebruikt die meet in welke mate de drie bedrijfsprocessen afhankelijk zijn van het gebruik van e-mail en het Internet.

Het ondernemerschapsperspectief biedt de verbinding met waardecreatie en het ontwikkelen van nieuwe *business*. De adoptie van elektronisch zakendoen kan leiden tot twee soorten waardecreatie: (a) Organisatorische waardecreatie, gerelateerd aan verbeteringen in de efficiency en effectiviteit van de bedrijfsprocessen, en (b) Strategische waardecreatie, gerelateerd aan de introductie van nieuwe producten en diensten, of het betreden van nieuwe markten. De resultaten van het survey onderzoek tonen aan dat de adoptie van e-business inderdaad leidt tot de creatie van economische waarde, waarbij organisatorische en strategische waardecreatie twee onderscheidbare dimensies van waardecreatie zijn. De onderzoeksresultaten laten zien dat e-business adoptie vaker leidt tot organisatorische (in 82% van de bedrijven) dan strategische waardecreatie (38%). Bovendien blijkt organisatorische waardecreatie een voorwaarde te zijn voor het creeëren van strategische waarde.

De onderzoeksresultaten geven aan dat e-business adoptie geconceptualiseerd en gemeten kan worden als de mate waarin een bedrijf ICT's toepast om haar bedrijfsprocessen

te ondersteunen met als doel het creeëren van economische waarde. De volgende onderzoeksvraag is dan: Welke bedrijfskenmerken verklaren de adoptie van elektronisch zakendoen en de creatie van waarde? Om deze vraag te kunnen beantwoorden zijn 26 studies bestudeerd die de adoptie van elektronische zakendoen verklaren. De meeste studies gebruiken de perceptie van de adopter over bijvoorbeeld het relatieve voordeel van adoptie of de mate waarin e-business bij het bedrijf past als verklaring voor adoptie. Echter, in deze studies wordt de achtergrond van de perceptie niet onderzocht. Er van uitgaande dat een bedrijf haar mening vormt in haar eigen context, is het relevant om te onderzoeken welke bedrijfskenmerken een rol spelen in de totstandkoming van die perceptie. In de bestudeerde e-business adoptie literatuur is hierover weinig te vinden. Meer algemene literatuur over organisatorische innovativiteit wijst op het belang van relevante kennis en ervaring in het bedrijf, netwerk invloeden, en een positieve houding ten opzichte van verandering.

Literatuur over ondernemerschap bestudeert het ontdekken, ontwikkelen en exploiteren van *opportunities* voor het creeeren van nieuwe *business*. Vanuit een ondernemerschapsperspectief gaat de adoptie van elektronisch zakendoen dus over het herkennen van kansen om ICT in te zetten met als doel het creeëren van economische waarde voor het bedrijf. Deze veronderstelling houdt in dat, om de adoptie van e-business te verklaren, we moeten onderzoeken welke bedrijfskenmerken het herkennen van kansen met betrekking tot de inzet van ICT faciliteren. De meeste literatuur die *opportunity recognition* verklaart, is gebaseerd op onderzoek op individueel niveau; slechts enkele studies hebben het fenomeen in bedrijven onderzocht. De resultaten op beide niveaus maken het aannemelijk dat drie bedrijfskenmerken een belangrijke rol spelen bij *opportunity recognition*: kennis en ervaring, netwerk contacten en de strategische houding van het bedrijf.

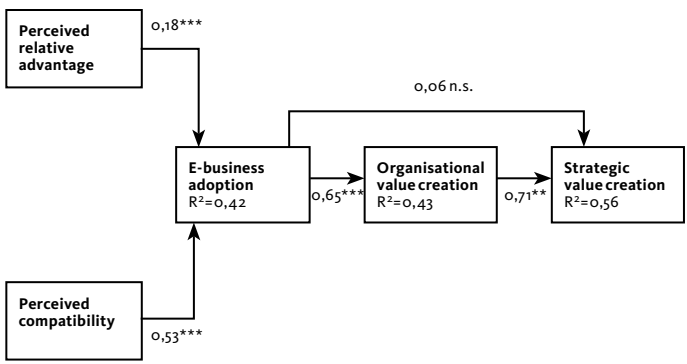
De bevindingen uit zowel de innovatie-adoptieliteratuur als de ondernemerschapsliteratuur zijn gebruikt om een theoretisch model te ontwikkelen en 15 hypothesen te formuleren. Om de hypothesen te testen is een vragenlijst ontwikkeld. Deze is voorgelegd aan 1538 MKB-bedrijven die de Nederlandse MKB populatie vertegenwoordigt in 9 sectoren onderverdeeld in drie grootte-klassen: 0-9, 10-49, en 50-99 medewerkers. De respons was 40% en de responsgroep omvat 614 bedrijven. Voor de data-analyse is gebruik gemaakt van lineaire regressie en *structural equation modelling* (LISREL).

In de datanalyse worden twee modellen voor het verklaren van e-business adoptie en waardecreatie met elkaar vergeleken, die ieder een ander theoretisch perspectief op e-business adoptie laten zien. Het *perceptions model* vertegenwoordigd het innovatie-adoptieperspectief. In dit model verklaren de percepties van het bedrijf over elektronisch zakendoen de adoptie van e-business met als gevolg organisatorische en strategische waardecreatie. Het *firm characteristics model* verklaart de adoptie van e-business en waardecreatie vanuit een ondernemerschapsperspectief. In dit model verklaren bedrijfskenmerken die de herkenning van *business opportunities* op basis van ICT's faciliteren, de adoptie van elektronisch zakendoen en waardecreatie.

In de analyse van de data zijn de gegevens van 595 MKB-bedrijven gebruikt. De resultaten van de *structural equation modeling* (verklaarde varianties en regressiecoefficienten) staan weergegeven in de figuren. Van de 15 geformuleerde hypothesen kunnen er 13 bevestigd

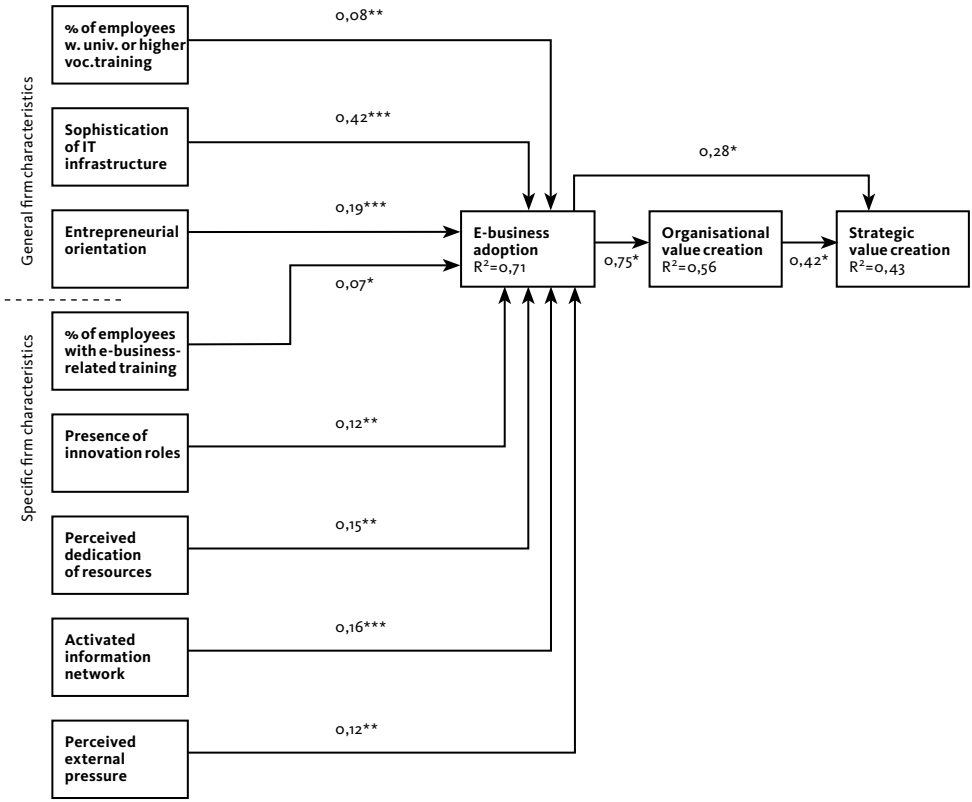
worden. Uit de resultaten blijkt dat beide modellen goed passen bij de empirische data en effectief zijn in het verklaren van e-business adoptie en waardecreatie. In het *perceptions model* verklaren slechts twee variabelen 42% van de variantie in e-business adoptie. De resultaten laten zien dat e-business adoptie een sterke relatie heeft met organisatorische waardecreatie, wat vervolgens weer positief gerelateerd is aan strategische waardecreatie. E-business adoptie wordt vooral verklaard door de mate waarin een bedrijf vindt dat elektronische zakendoen past bij de waarden en de bestaande praktijk van het bedrijf en haar waardeketen (*perceived compatibility*). Minder sterk is de relatie met de mate waarin het bedrijf relatief voordeel ziet in elektronisch zakendoen (*perceived relative advantage*).

The perceptions model (n=595)



Het *firm characteristics model* verklaart 71% van de variantie in e-business adoptie. Ook in dit model is de adoptie van e-business positief gerelateerd aan organisatorische en strategisch waardecreatie. Nagenoeg alle geïdentificeerde bedrijfskenmerken zijn significant voor het verklaren van adoptie en waardecreatie, wat duidt op een coherent verklarend raamwerk. De *sophistication of IT infrastructure* is dominant als verklarende variabele. Het herkennen van kansen voor het benutten van e-mail en Internet wordt gefaciliteerd door een goede basis aan kennis en ervaring die is opgedaan met de implemenatie en gebruik van IT in het bedrijf. Verder faciliteert een ondernemende houding (*entrepreneurial orientation*) het herkennen en benutten van kansen. Het actief benutten van het sociale netwerk om informatie te vinden over elektronisch zakendoen blijkt ook van belang (*activated information network*). Een positieve evaluatie van de mogelijkheden van elektronisch zakendoen wordt ondersteund door motivatie en steun die het bedrijf ervaart uit haar omgeving (*external pressure*). Verder van belang is de mate waarin er geld en tijd beschikbaar is voor e-business (*perceived dedicaton of resources*) en de aanwezigheid van personen die bepaalde innovatierollen vervullen (*presence of innovation roles*).

The firm characteristics model (n=595)



De resultaten van de data-analyse bevestigen de veronderstelde relaties vanuit beide theoretische perspectieven. Echter, de op *opportunity recognition* theorie gebaseerde bedrijfskenmerken verklaren e-business adoptie en de daarop volgende waardecreatie effectiever dan de percepties van het bedrijf. Een nadere analyse van het *firm characteristics model* laat zien dat bedrijven die met e-business strategische waarde creeëren, op diverse bedrijfskenmerken significant verschillen van bedrijven die 'slechts' de efficiency en effectiviteit van hun bedrijfsprocessen verbeteren. MKB-ers die in staat zijn om met e-business nieuwe markten te betreden, nieuwe marktkanalen te benutten of nieuwe producten en diensten te introduceren, blijken zich duidelijk 'ondernemend' te gedragen. Ze maken meer gebruik van hun netwerk, hebben meer tijd en geld ter beschikking voor

e-business en hebben een strategische houding die gekenmerkt wordt door innovatief, pro-actief en risico-nemend gedrag.

Het *firm characteristics model* biedt een duidelijk hogere verklaarde variantie van e-business adoptie (71%) dan het *perceptions model* (42%). Het model geeft bovendien beter inzicht in relevante bedrijfskenmerken. Het ondernemerschapsperspectief biedt een relevante theoretische basis voor de verklaring van de adoptie van elektronisch zakendoen en daaraan gerelateerde waardecreatie. Dit perspectief verbindt de adoptie van e-business aan waardecreatie, geeft inzicht in factoren die van belang zijn bij het ontwikkelen van nieuwe *business* en benadrukt de rol van het sociale netwerk. De vergelijking van de beide perspectieven laat, naast het nut, ook de beperkingen zien van het gebruik van percepties als verklaring voor innovatie-adoptie.

Ondanks de beperkingen van een eenmalig vragenlijstonderzoek in een praktische setting biedt deze studie interessante uitkomsten voor zowel theorievorming als voor MKB-bedrijven en beleidsmakers. Op basis van non-respons analyse blijken de resultaten representatief voor het Nederlandse MKB in 7 van de 9 sectoren met minder dan 100 werknemers. De uitkomsten van dit onderzoek betekenen praktisch voor MKB-bedrijven dat ze er goed aan doen kennis en ervaring op te doen met 'conventionele' IT (als proces- en kantoorautomatisering, interne netwerken en geïntegreerde informatiesystemen). Deze basis aan kennis faciliteert het opdoen van nieuwe gerelateerde kennis over bijvoorbeeld e-mail en Internet. Innovatief, pro-actief en risico-nemend gedrag in het bedrijf kan ervoor zorgen dat ontdekte kansen voor het benutten van e-mail en Internet daadwerkelijk worden benut. Een actief gebruik van het sociale netwerk speelt hierbij een belangrijke rol evenals het vrijmaken van tijd en geld. Verder laat dit onderzoek zien dat het voor ieder MKB-bedrijf mogelijk moet zijn om de efficiency en effectiviteit van de bedrijfsprocessen te verbeteren door het gebruik van e-mail en Internet. Het creeëren van nieuwe *business* blijkt lastiger om te realiseren en is voorbehouden aan bedrijven die zich duidelijk extern oriënteren en ondernemend gedragen.

Voor beleidsmakers is de boodschap van dit onderzoek in de eerste plaats dat naast het stimuleren van geavanceerde ICT's in het MKB, er oog moet zijn voor de aanschaf, implementatie en gebruik van meer conventionele IT. Die kennis en ervaring vormt een 'springplank' naar de integratie van meer geavanceerde ICT's (als Internet-gerelateerde technologieën, mobiele datacommunicatie, of breedbandtoepassingen). In de tweede plaats is het stimuleren van *corporate* of hernieuwd ondernemerschap in MKB-bedrijven van belang om er voor te zorgen dat uit het toepassen van e-mail en Internet daadwerkelijk nieuwe economische activiteit ontstaat.

About NIKOS and Syntens

The Dutch Institute for Knowledge Intensive Entrepreneurship (NIKOS) is part of the School of Business, Public Administration and Technology at the University of Twente in the Netherlands. Within NIKOS research, teaching, and business development projects are gathered under one roof. NIKOS research looks at micro interaction patterns in networks of entrepreneurs and other actors leading to innovation, new business and consequently change in economic structure on micro-, meso, and macro level. Our special interests in this field are:

- Development of (starting) knowledge intensive enterprises,
- Entrepreneurial processes in the context of technological innovation, and
- University-industry-interaction in the context of academic entrepreneurship.

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Syntens is a national, independent, not for profit organisation that consults SMEs on the subject of innovation, and is funded by the Dutch Ministry of Economic Affairs. With fifteen branches, and around 300 consultants, Syntens has a local presence throughout the Netherlands. Syntens' largest project is Nederland gaat Digitaal ('The Netherlands goes Digital') with a total budget of around 36 million Euro (2002-2005). The project is aimed at encouraging Dutch SMEs to use Internet, e-mail, and other ICTs to improve their competitiveness. The project offers free workshops, individual consultancy and a sector-program. The research in this dissertation has been partly funded by the project.

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Ministerie van Economische Zaken

About the author

Marijke van der Veen (1967) studied Business Administration at the University of Twente. After finishing her thesis on lead-time control, she received her Masters degree in 1992, and continued working for plastics manufacturer Wavin. In 1993 she joined Vredestein Bicycle Tyres to optimise internal logistics. After a short career in logistics with Heinz in 1996, she moved to Bhopal, India in 1997. She pioneered at a local tyre manufacturer to initiate the production for Vredestein Bicycle Tyres. After returning to the Netherlands, Marijke acquired a PhD position at NIKOS, University of Twente in 1999. Simultaneously she joined Syntens, in order to combine academic research with practical work. Syntens, a Dutch agency, executes the 'Netherlands goes Digital' project for the Ministry of Economic Affairs. Marijke's role with Syntens was to monitor the project and support consultants. She designed an on-line instrument to measure longitudinal effects of the project. She set up and supervised a national survey (August 2002) among 600 SMEs from nine sectors. The results of the survey formed a benchmark for consultants and SMEs, and input for the Ministry of Economic Affairs. Also, the results of the survey formed the basis for her PhD research. The research has resulted in several academic papers, and international conference presentations. Currently, Marijke is responsible for knowledge management with Syntens. At the same time, she continues her academic work at NIKOS. Her main ambition is to build bridges between academic research, policy makers, small business consultants and SME practice.