LAPPEENRANTA UNIVERSITY OF TECHNOLOGY
Department of Industrial Management

Master's Thesis

SCENARIO METHOD IN ANTICIPATING FUTURE OPPORTUNITIES OF E-BUSINESS IN THE FOREST INDUSTRY

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Lappeenranta, 2nd July 2007

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ABSTRACT

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Subject: Scenario method in anticipating future opportunities of e-business in the forest industry

Department: Industrial Management

Year: 2007 **Place:** Lappeenranta

Master's Thesis. Lappeenranta University of Technology.

115 pages, 21 figures, 7 tables, 3 appendices

Supervisor: Professor Tuomo Kässi

Hakusanat: skenaariomenetelmä, teknologinen muutos, e-business

Keywords: scenario method, technological change, e-business

The aim of the study was to anticipate the development of e-business by using one of the most widely used future studies method, scenario method. The main area of interest was e-business' future solutions in the forest industry. In the study the characteristics of the scenario method, the principles of scenario planning and the scenario method's suitability for studying technological and industrial change were attempted to clarify.

In the theoretical part of the study technological change's impact on industry evolution was examined. It was stated that technological change has a strong impact on industrial changes and that every industry is seen to follow a certain trajectory. The firms in an industry need to be aware of the pace and directions of technological change and follow the rules of industrial evolution. The radical nature of changes in the forest industry and the fast development of ICT technology pose challenges concerning the e-business field.

In the empirical part, three different scenarios of e-business' future in the forest industry were formed. The scenarios were built based mostly on the current knowledge of e-business specialists who were invited in a scenario workshop. In the scenario forming qualitative and quantitative elements were combined. The three formed scenarios indicate that the future of e-business is seen rather positive by its impacts and that the firms in the forest industry field need to take an active and agile role in the development to be able to utilize the electronic solutions in their business actions effectively.

TIIVISTELMÄ

Tekijä: Kirsi Hellsten

Työn nimi: Skenaariomenetelmän käyttö metsäteollisuuden liiketoimintaprosessien sähköistämisen tulevaisuuden mahdollisuuksien ennakoimisessa

Osasto: Tuotantotalous

Vuosi: 2007 **Paikka:** Lappeenranta

Diplomityö. Lappeenrannan teknillinen yliopisto.

115 sivua, 21 kuvaa, 7 taulukkoa ja 3 liitettä

Työn ohjaaja: professori Tuomo Kässi

Hakusanat: skenaariomenetelmä, teknologinen muutos, e-business

Keywords: scenario method, technological change, e-business

Tutkimuksen tavoitteena oli ennakoida liiketoimintaprosessien sähköistymisen (e-business) kehittymistä käyttämällä skenaariomenetelmää, yhtä laajimmin käytetyistä tulevaisuuden tutkimisen menetelmistä. Tarkastelun kohteena olivat erityisesti tulevaisuuden e-business -ratkaisut metsäteollisuudessa. Tutkimuksessa selvitettiin skenaariomenetelmän ominaisuuksia, skenaariosuunnittelun periaatteita sekä menetelmän sopivuutta teknologian ja toimialan muutosten tarkasteluun.

Tutkimuksen teoriaosassa selvitettiin teknologian muutoksen vaikutusta toimialojen kehitykseen. Todettiin, että teknologisella muutoksella on vahva vaikutus toimialojen muutoksiin, ja että jokainen toimiala seuraa tietynlaista kehitystrajektoria. Yritysten tulee olla tietoisia teknologisen muutoksen nopeudesta ja suunnasta, ja seurata toimialansa kehityksen sääntöjä. Metsäteollisuudessa muutosten radikaali luonne sekä ICT-teknologian nopea kehitys asettavat haasteita liiketoimintaprosessien sähköistämisen kentässä.

Empiriaosuudessa luotiin kolme erilaista skenaariota e-busineksen tulevaisuudesta metsäteollisuudessa. Skenaariot perustuivat pääosin aiheen asiantuntijoiden tämän hetkisiin näkemyksiin, joita koottiin skenaariotyöpajassa. Skenaarioiden muodostamisessa yhdistettiin kvalitatiivisia ja kvantitatiivisia elementtejä. Muodostetut kolme skenaariota osoittavat, että e-busineksen vaikutukset tulevaisuudessa nähdään pääosin positiivisina, ja että yritysten tulee kehittyä aktiivisesti ja joustavasti pystyäkseen hyödyntämään sähköisiä ratkaisuja tehokkaasti liiketoiminnassaan.

FOREWORD

When I started my second university degree at the Department of Industrial Management at LUT, I would never have believed what an interesting path I was going to walk through. At the beginning, my primary objective was to complement my first degree of economics, but one day I noticed that the roles had turned the other way around. My all-time-increasing interest in the studies of technology may have been a surprise for the people who have known me well in the past, because they might not characterize me as a "technical" or "practical" person at all. J

I would like to thank the persons who have supported me along this process and helped me out the difficult, sometimes almost desperate moments. First, I want to thank Professor Tuomo Kässi for his instructions and constructive feedback. The colleagues from Talikko project and Kalle Piirainen from the Department of Industrial Management deserve great thanks for their support – I'm happy that our cooperation will continue further. The scenario workshop participants had an invaluable role in the scenario building process – thank you for your time and interest!

I would also like to thank my parents who have always believed in me – you are the greatest! And finally, special thanks belong to the most important person in my life, Sampo – with you everything seems so much easier.

In Lappeenranta, 2nd July 2007

Kirsi Hellsten

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1 INTRODUCTION

Future includes many surprising new events, and several potential futures are possible. The future and its uncertainties can not be ignored, but the future has to be explored actively. (du Preez & Pistorius 1999) The ways to do business today might be totally obsolete after a couple of years, because the world is changing continually. One can never escape the fact that all our knowledge is about the past, but all our decisions are about the future. To be able to do business effectively in the future, the firms need to be prepared for the arising changes. Although the future can never be predicted with certainty, the ability to anticipate the development and trends is vital for the firms. (Coyle, 1997, Ralston & Wilson 2006)

In many industries, the pace of change can be seen to accelerate (McGahan 2004a). One of the reasons for the acceleration of change and the evolution of industries is the fast development of technology. Most technological change is incremental which means that each innovation constitutes a relatively small step. But there are also radical innovations which can change the whole rules of the game in an industry. (Tidd et al. 2005) In order to succeed in the developing world, it is necessary that the firms are able to anticipate the directions, strength and dynamics of technological change in their industry. As technology has become an increasingly important component of the ability of firms to compete and even survive, the capability of a firm or an industry to identify emerging technologies and take appropriate action is vitally important. (du Preez & Pistorius 1999, Lundgren 1991) In this study, scenario method is used to anticipate technological and industrial change.

Scenario method is one of the most widely used future studies methods. A scenario is a description of a future situation and the course of events which allows one to move from the original situation to the future (Godet & Roubelat 1996). Most often, scenario method is used by managers to provide a better understanding of the range of possible business environments they might have to face up in the future (Millett 2003). Scenario method is a great tool for thinking over the possible futures in an industry. Used correctly and effectively, scenario method is a powerful strategic tool for decision

makers. The end result of a scenario process is not an accurate picture of tomorrow, but it may help to make better decisions about the future (Schwartz 1998).

In this study, the focus is also on possible business environments, especially in the field of electronic business in the forest industry. The empirical part of the thesis concentrates on studying the future of e-business in the forest industry by a scenario process. It is seen that with effective e-business solutions, the success of the forest firms can be notably assisted. However, many of the impacts and possibilities of ICT on the forest sector are relatively new or still in the horizon. (Hetemäki & Nilsson 2005) The forest firms need to be aware of the events and changes in their business environment, agile and willing to shape their actions according to them and that way able to exploit the opportunities that e-business can offer. That requires an active role of all the participants in value chains.

In the following sections, technological change's features and its impact on industries and the possibilities to anticipate the changes are studied both theoretically and empirically. The thesis is a part of research project "Talikko – creating new business concepts in the intersections of industries" conducted by Technology Business Research Center (TBRC), Lappeenranta University of Technology. The Talikko project is shortly introduced next.

1.1 Talikko project

Traditional boundaries of the industries are eroding and new business opportunities are emerging in the intersections of industries. Because of that, the changing industry structures and business environment demand new approaches to understand and recognize the new opportunities for the companies and develop them to successful business concepts.

The primary objective of Talikko research project is to identify new business opportunities in the intersections of three industries: Electricity networks and

generation, Forest, and ICT, and to find out how to exploit these revealed opportunities on the company level. The secondary objective is to develop methodology for integrating industry analysis and company level business analysis.

On the grounds of the first round of the Delphi study conducted in the project, four different intersections have been selected to be explored more deeply. These intersections have so far been researched by three Delphi questioning rounds, interviews of the specialists and a couple of idea generation sessions. The four selected intersections are shown in figure 1.

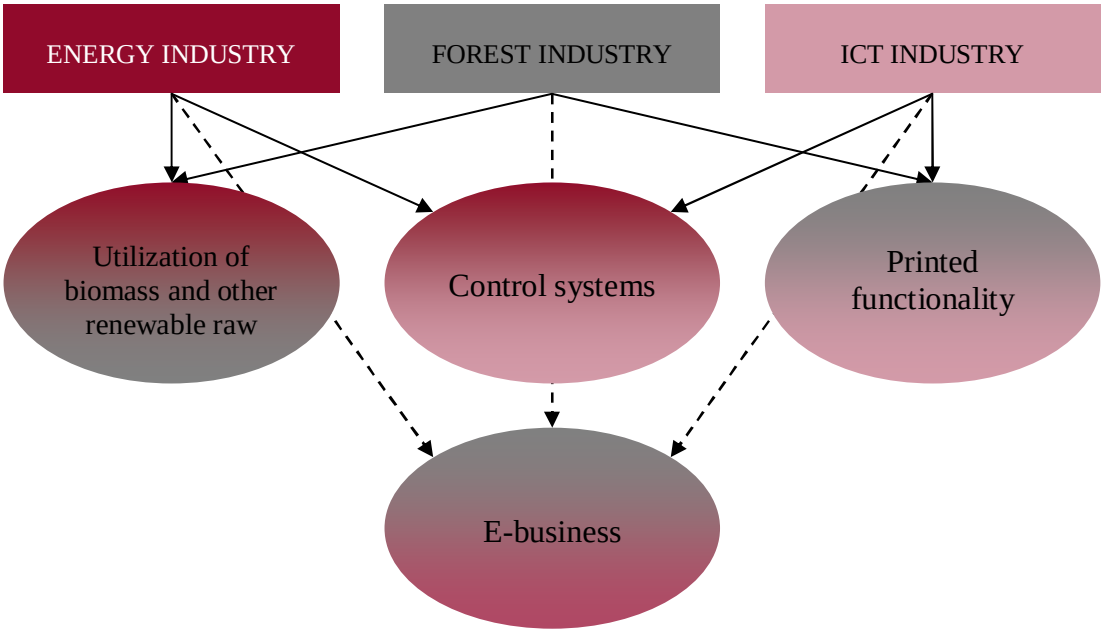


Figure 1: Industry interfaces (defined on the grounds of the Delphi study)

The intersection called electronic business, which is, as seen in figure 1, the shared interface for all three above mentioned industries, is explored in this study. Anyhow, because of the empirical part's emphasis on the ICT and forest industries, the study concentrates only on e-business solutions in the forest industry.

1.2 Research objectives and limitations of the study

The main objective of the thesis is to study the applicability of scenario method in anticipating the development of e-business in the forest industry. The characteristics of scenario method and the advantages which can be reached by its utilization are defined and scenarios of the research field are built based on the internal and external factors affecting the changes and events. Also the features of technological change and industrial evolution are examined. The main research question and the sub-questions are introduced in figure 2.

Main research question:

How scenario method is suited to anticipate the development of e-business solutions in the forest industry?

Sub-questions:

How technology and industries change and how technological changes can be anticipated?

What is scenario planning and how it suits for studying technological and industrial change?

What kind of scenarios can be built for the e-business' future in traditional industries (especially in the forest industry) on the basis of current knowledge?

Figure 2: The research questions

Because the fast pace of changes of ICT technology, the firms doing business electronically need to be able to react to the changes rapidly. Even though the future can not be predicted perfectly, it is necessary to try to anticipate the possible future stages that can emerge. In this study, the scenario method is used in thinking over multiple

plausible futures that forest industry's e-business solutions might face in the year 2017. The existing knowledge is about today and past, but by the scenario method the understanding of the future can probably be increased.

Although e-business is becoming a common way of doing business in many industries, the focus of the study is on the forest industry. The subject chosen is strongly connected to the intersection theme of the Talikko project. E-business is a common interface of all three industries examined in the project, but because of the absence of representatives from the electricity networks and generation industry in the conducted scenario process, only the forest industry is included in the study. The forest industry has recently gone and is still going through many relatively radical changes which will necessarily affect the business actions made by the forest firms. From the writer's point of view the forest industry is thus an interesting and appropriate field for the research of e-business' future influences.

E-business is a large concept for which there is no an exact definition in the literature. It can be seen to consider the electrification of organizations' internal business processes, business processes between the organizations and the electrification of customer interface. The study concentrates rather to the management of interfaces between different systems and the functionality of the whole value chain from the producer to the end customers than to the electrification and technological functionality of individual systems conducted by the firms.

The scenario process was conducted mainly in a face-to-face workshop in the GDSS (Group Decision Support Systems) laboratory at the Department of Industrial Management at Lappeenranta University of Technology. The group of workshop participants consisted of representatives from ICT and forest industries and researches and other specialists from the e-business field. The scenario storylines were written by the writer based on the ideas generated and conversation held during the workshop.

1.3 Structure of the thesis

In figure 3, the main building blocks of the thesis are introduced.

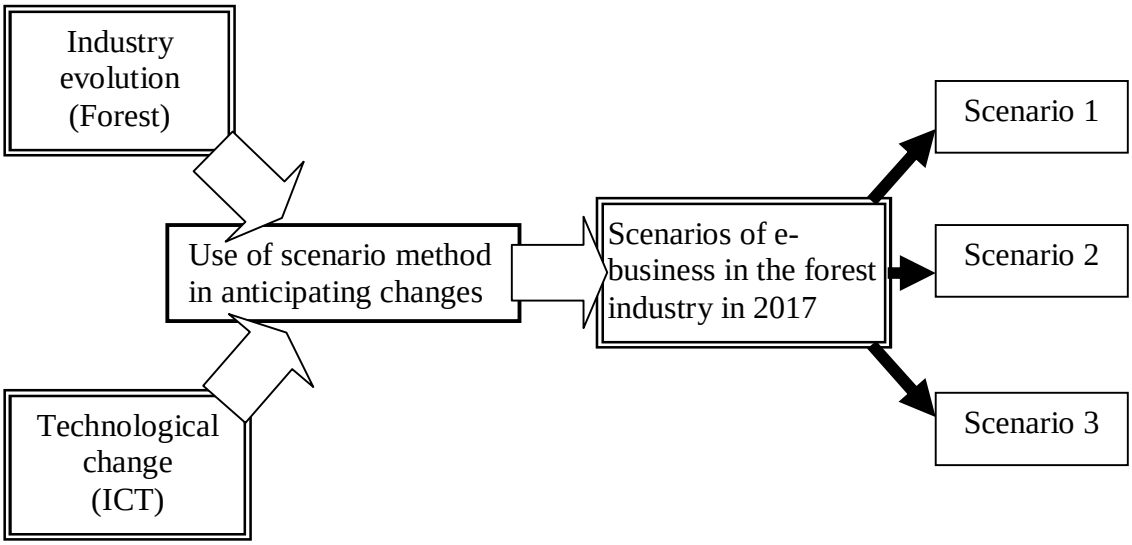


Figure 3: The outline of the study

The theoretical part of the thesis consists of three chapters. In chapter 2, the ICT and forest industries are shortly introduced and e-business and its current state in the forest industry are discussed. Chapter 3 concentrates on technological change and industry evolution. In the chapter, possible categorizations of technological innovation and a model of technology life cycle are shown, trajectories of technology and industry evolution are discussed, types of competition in different industries are introduced and the importance of anticipation of technological and industrial change is tried to clarify. Chapter 4 covers the issues concerning the scenario method.

The empirical part deals with the conducted scenario process and its results – i.e. three different scenarios of e-business' future in the forest industry. The used methodology is discussed in chapter 5, the conducted scenario process is introduced in chapter 6 and the scenario stories are told in chapter 7. Finally, in chapter 8, the conclusions based on the study are made and further discussion is held. A summary of the study is introduced in chapter 9. The structure of the thesis is shown as an input-output-framework in figure 4.

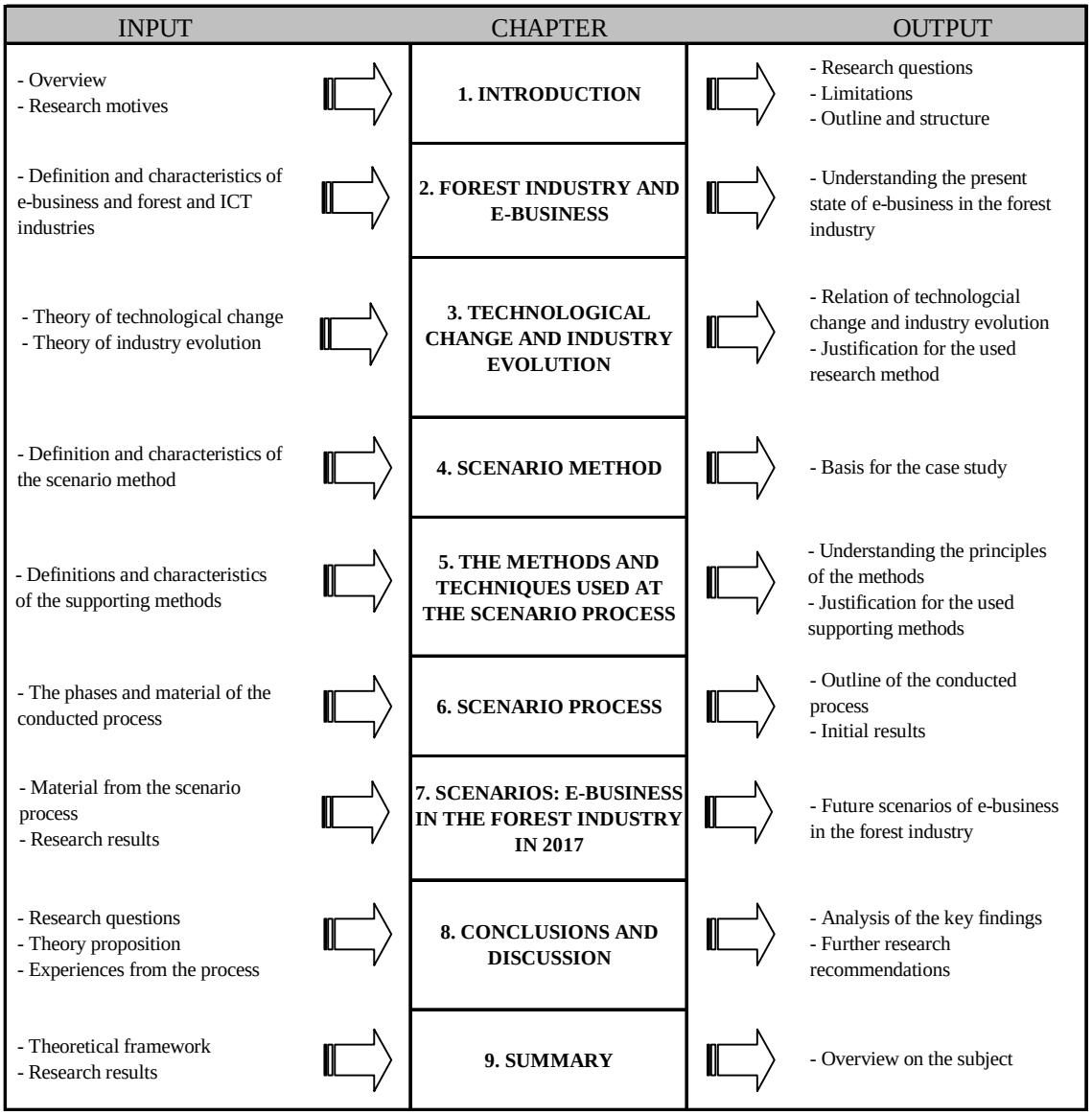


Figure 4: The structure of the thesis

2 E-BUSINESS IN THE FOREST INDUSTRY – A SHORT LOOK AT TODAY

In this chapter a short look at e-business and its use in the forest industry's today's business actions is taken. At first, ICT and forest industries and their phases of development are shortly introduced. After that, e-business as a phenomenon is presented. And last, information technologies and especially e-business's use in the forest industry's business actions is discussed.

2.1 ICT industry

Information and communication technologies, ICT as an industry is still quite unclear and an agreed international "frame of reference" for ICT does not exist. The Finnish ICT industry is often seen as an information and communication cluster, which is more exposed to global competition than other industry clusters. The key industries of the ICT cluster are ICT equipment manufacturing, network operations and service provision (Meristö et al. 2002).

The ICT industry has a great impact on the Finnish economy. Rapidly-developing technology has been the main reason for the fast growth of the ICT industry. The ICT industry differs greatly from traditional industries, as it is characterized as a sector with high technology and market uncertainty and very high research and development expenses. One characteristic for the Finnish ICT cluster is that Finland is rather a forerunner in producing technology than in using it. (Meristö et al. 2002, Paija 2000)

Due to the generic nature of ICT, the cluster has countless interfaces with other clusters. ICT industry can be seen as an enabler of business for other industries. Therefore, in the future the economic impact of ICT is likely to be more powerful on the demand-side of the technology than on the supply-side, because ICT applications are changing the

traditional business models and ways of action in many sectors. (Meristö et al. 2002, Paija 2000)

2.2 Forest industry

The forest industry is one of the basic strategic industries in the world. This can be explained by its global presence and major impact on national economies. The Finnish forest cluster has developed around the key products of the forest industry: pulp, paper, paperboard and sawn wood and the production of these products has given rise to specialty input providers, engineering, chemical firms and service providers. (Lammi 2000)

The forest industry's impact on Finnish economy has endured stable. The strength of the Finnish forest industry can be seen in two ways: first, in every part of the forest cluster there are strong, often competing firms with the supporting actions by the government officials, research centers and other organizations, and second, all the parts of the cluster are successful in global competition and the Finnish companies are market leaders in many different products. (Seppälä 2000, Lammi 2000) The forest cluster has traditionally had a special stature relating to Finnish economic policy. But nowadays it is not anymore the only engine of economic growth, and the diminishing impact on the economy has also intensified diminishing impact on politics. (Lammi 2000)

The Finnish forest companies have concentrated forcefully into large groups of companies for the last 15 years. Technology and concentration are closely interlinked with the decisions made by the companies of the forest industry in the past. The forest industry can be seen strongly path dependent as the companies have often chosen their paths for decades to come, e.g. the technology decision processes. This can be seen to have had both positive and negative side effects On the positive side the companies are able to make long-term plans and commitments, but on the negative side, there can be seen the damage made to the future development due to unsuccessful investments. (Näsi

et al. 2001) At the moment, the forest industry is going through many changes which are shortly discussed next.

2.2.1 Forest industry in a phase of changes

The major markets for the Finnish forest industry are in Europe but the companies are also moving fast on to other continents. The markets of Asia are growing fast – the fastest growth at the moment is in China. (Finnish Forest Industries Federation 2000) Due to the globalization the growth of foreign ownership and international expansion of the companies has made the Finnish forest industry less nationally oriented than before and the value chains are becoming truly global. That creates many new challenges for the business actions of the forest industry firms as the success in global competition environment demands proactive, future anticipating approaches. (Finnish Forest Industries Federation 2000, Vinaccia 2005) The ways that paper and paperboard are purchased, consumed and utilized are changing fast. The changes happen e.g. in retailing, channels of distribution, expectations from customers and increasing time pressure moving products into the marketplaces. (Ince et al. 2005)

There are different views in the literature about ICT's impacts on paper product consumption. Some researchers see that increasing electronic media is a severe threat to the communication paper markets, as others see that new media are not substitutes for paper and will not replace the paper products. However, consumer preference for electronic rather than print media is likely to strengthen in the future because of the generational factor. (Hetemäki 2005)

The forest industry is also going through other changes. The prices of the most important input factors within the paper and pulp industry are drastically changing. Also the balance between virgin and non-virgin fibers is changing. The increase of energy prices has an influence on decisions to organize global production. (Finnish Forest Industries Federation 2000)

One notable challenge is the decreasing amount of available workforce. Despite the fact that along with the technological development the overall need for workforce decreases, the age structure of the Finnish forest companies' workforce, which is similar to other industries, causes the need for new workforce. Also the need for highly educated personnel is increasing. (Lahti-Nuuttila et al. 2000)

2.2.2 ICT as a tool for responding to the changes

As discussed earlier, the ICT industry can be seen as an enabler to other industries. It thus can be seen that with effective ICT solutions the success of the forest industry can be notably assisted. Anyhow, many of the impacts and possibilities of ICT on the forest sector are relatively new or still in the horizon. This is quite understandable, because some of the major ICT innovations tend to be of recent origin themselves. It is however seen that the ICT revolution is causing fundamental transformations in the global forest sector. (Hetemäki & Nilsson 2005)

Hetemäki and Nilsson (2005) argue that because the forest industry is such a large entity, ICT cannot have a uniform and simultaneous impact on every part of it. For many sub sectors, ICT appears to provide a new engine for progress and opportunity. For others, it can anyhow be a disruptive technology (see Tidd et al. 2005). In many instances, too, ICT impacts can not yet be clearly seen. The speed at which the ICT development influences the sector is likely to vary among different geographical locations and sub sectors.

The ICT-related field more especially examined in this study is electronic business. The countries where the public investment in ICT infrastructure has been high are also achieving high scores on e-business environment, e.g. market environment, business readiness and business usage. These countries are located in North America, Northern and Western Europe, and along the Pacific Rim. (Nyrud & Devine 2005) In the field of electronic business actions a large amount of new possibilities can be seen to open for the forest industry. Next, short looks at the electronic business as a concept and today's electronic business in the forest industry are taken, and the future possibilities and

events which might occur in the field of e-business solutions in the forest industry are discussed in the empirical part of the study.

2.3 Electronic business

Electronic business means utilizing ICT in business activities. According to Nyrud and Devine (2005) and Mallat et al. (2004) e-business comprises business processes that are conducted over networks – not only buying and selling but also servicing customers and collaborating with business partners – i.e. e-commerce, consumer relationship management (CRM) and supply chain management (SCM). E-business can be seen to consider as well technologies and changes in organization's activities as participating to the company's business value chain. (E-business.fi 2007) According to Seppä et al. (2005), electronic business can be divided into electrification of organizations' internal processes, electrification of processes between organizations and electrification of customer interface. Nevertheless, one exact definition, which everyone would see satisfactory is almost impossible to create. Whatever the definition, the most important thing is to examine how e-business as a phenomenon evolves and affects companies' business activities. (Seppä et al. 2005)

The electrification of business processes has started in the late 1950's or early 1960's when computers were introduced in enterprises. The next steps in the development happened in 1970's by minicomputers and in 1980's by the arrival of personal computers (PCs). Since then, the electrification of companies' business activities has started from implementation of operation-aimed applications, and developed through technological and methodological breakthroughs to nearly every field of business. The software is less than before used as autonomous applications and systems. They are integrated more deeply into business processes and combine the actions of different networked organizations. The development of information technology's efficiency makes it possible to integrate it into nearly every kind of products and processes. (Seppä et al. 2005)

It is widely seen that by utilizing solutions that e-business offers, remarkable cost savings in many industries can be reached and whole new business opportunities can be found. In the future, exploitation of existing technologies and industry boundaries breaking networked business based on trust and partnerships will emerge as essential challenges to companies. Instead of just using separate information technologies, it is essential to the companies to be willing and able to exploit different technologies in business and gain the full advantage of them. (Seppä et al. 2005, Mallat et al. 2004)

2.3.1 Forest industry's e-business today and possibilities in the future

In recent years, business-to-business communication and e-commerce have revolutionized raw material procurement and the marketing of end products in the forest cluster, especially in the paper industry. One important development has been the launching of papiNet in 1999. papiNet is a global initiative to develop, maintain and promote the implementation of electronic transaction XML messaging standards to facilitate the information flow and computer-to-computer communications among all parties who are engaged in buying, selling and distribution of forest, paper and wood products. The objectives of papiNet are to reduce costs, enhance relationships and improve decision making through the use of secure, industry-specific, transaction-processing network and also improve the quality of customer service (papiNet 2007). The development of industry standards that will enable efficient transactions between customers and suppliers and prevent fragmented and costly e-commerce infrastructure is a critical part of the foundation of e-business. (Ince et al. 2005)

Vertical business-to-business exchanges, e-marketplaces, were established to help the industry to decrease inefficiencies in their supply chains and to better cope with the cyclical nature of the markets at the dawn of the 21st century. After the economic slowdown and the "dotcom crash" the amount of them has nevertheless decreased. The forest companies have instead got interested in private exchanges and extranet solutions. (Ince et al. 2005)

However, according to IBM's Forest and Paper Innovation Centre's (FPIC) research last year, e-business solutions are used on the average only in 5-20 percent of business actions in the forest industry which is notably less than for example in the car or electronics industries. The most progressive forest firms manage 40 percent of their sales operations along electronic business solutions. (IBM 2006)

There can be found four emerging trends in e-business' development in the forest industry. First, the increasing demands from the customers fasten the integration of supply chains. Second, the implementation of international papiNet-standards becomes more common in the outwards headed parts of the supply chains. Third, the objectives for costs savings and increasing efficiency further e-business integration in the forest companies' supply management. And fourth, the integration which would cover the whole supply chain along the producers, suppliers, partners and customers is still at its beginning. (IBM 2006)

According to Lindström et al. (2004), the central thing is that the ICT infrastructure as a basis for production, logistics and sales management supports the applications everywhere in the companies' operating area. A great challenge is to integrate the forest companies' business to customers and suppliers and build effective partner networks.

The largest gains that can be made by deploying ICT systems are through business transformation and the development of collaborative business relationships among various actors e.g. logistics, service providers and manufacturing centers, through integrated value chain networks. This can allow for increased economic efficiency and customer service through collaborative processes which share information among the different levels of supply chain. This sharing is not however without its problems, especially when the companies are acting globally. (Boston 2005) And as Lindström et al. (2004) point out, ICT has not usually been a part of core activities in the forest companies so there is a lot to change. ICT can be used to support old business practices, or new, inventive e-business ideas can focus on adding value for customers through functional integration and innovation (Nyrud & Devine 2005).

It must be remembered that ICT is just a tool. Even though the advantages of e-business are obvious, the usage of e-business solutions is not a response to emerging business challenges as itself. (Vlosky 1999) According to Ince et al. (2005) there is no reason to expect that all producers in a particular commodity market quickly take full advantage of e-business and that all firms eventually experience similar production efficiencies and cost savings. The most difficult factor is to manage the changes in business strategies and internal corporate processes that must take place for a company to take advantage of e-business.

McAfee and Brynjolfsson (2007) argue that a key lesson for executives is to treat IT efforts as opportunities to define and deploy new ways of working rather than just as projects to install, configure and integrate the systems. They suggest three broad areas of focus for top managers. First, the managers to look at how the company should be doing business differently, i.e. which tasks should be enabled with technology and how widely. Second, they need to lead the deployment of new procedures to success, as people do not like changes in their ways of doing work dictated from outside, and the resistance must be overcome. And third, the managers need to foster innovation e.g. by encouraging experimentation, collaboration and dialogue. These areas of focus can be seen to be relevant also for the managers in the forest firms.

As can be seen, the decisions to adopt IT in business are influenced by many internal and external factors, and many factors besides ICT or the Internet are responsible for the expansion of capacity also in different countries. (Boston 2005, Ince et al. 2005). In this study, these factors are tried to find by ideating different kind of drivers of change. Events which are seen probable to happen in the e-business' development especially in the Finnish forest industry's future are then generated based on these drivers.

3 TECHNOLOGICAL CHANGE AND INDUSTRY EVOLUTION

Industries are created and extended continuously. That vindicates that the conditions within and the boundaries between industries are not given and unchangeable factors, but individual actors have a possibility to change them. The companies don't have to compete within certain boundaries. (Kim and Mauborgne 2005) According to Hamel (2001), settling down to an industry has never meant less than nowadays. A process of industrial transformation that accompanies radical innovation (see chapter 3.1.1 about types of innovation) which Schumpeter calls "creative destruction" has really become into action.

The picture of cost-based determinants of competitive performance decisively changed at the end of 20th century as the concern turned to technological and institutional determinants of economic development. The economists increasingly began to research technological innovations and their macroeconomic consequences. This also raised the interest in the dynamic aspects of the competitive process, putting much emphasis on entrepreneurship and evolutionary changes. Also the acceptance of the particular role of information and knowledge in the economic development is widespread. These changes in perspective reflect the apparent acceleration of technological and organizational change. (Peneder 2001)

New technologies have often given rise to entire new industries, which often lead to the demise of old ones. It is also seen that inter-industry flow of technology is one of the major sources behind the resurrection of some industries. As technology has become an increasingly important component of the ability of companies to compete and even survive, the capability of a company or an industry to identify emerging technologies and take appropriate action is vitally important. (du Preez & Pistorius 1999, Lundgren 1991) The research of technology change and technological life cycles has led many researchers to think, what happens to a firm or an industry as a technology matures (Nelson 1998).

In this part of the study industry evolution and technological change's influence to industrial evolution are discussed. First, technological change and its features are explored and the co-evolution of technology and industry are discussed. Next, a thought about firms' and industries' path-dependency is introduced. After that, three different types of competition and a framework for combining them are introduced. Last, the possibilities to anticipate technological changes and their influence are discussed and a short summary of technological change's and industry evolution's features is made.

3.1 Technological change

When a technology is new, there is uncertainty both about how the technology can improve the business and about what the customers really want. Both these uncertainties make it difficult to say, which paths of development would be successful in meeting the needs better. (Nelson & Winter 2002) Most technological change is incremental, i.e. each innovation constitutes a relatively small step, but there are also radical innovations, which can change the whole rules of the game (Rosenbloom & Christensen 1998, Tidd et al. 2005) In order to understand technological changes' impact on industrial evolution, it is necessary to understand the dynamics of technological change, which will be discussed next.

3.1.1 Types of innovation

In this chapter, three different categorizations of innovations which are seen relevant for this study are discussed. The first categorization is based on the form of change which by Tidd et al. (2005) can be related to product, process, position or paradigm, which they call "the 4Ps of innovation". By *product innovation* they mean changes in the products or services that an organization offers. *Process innovations* mean changes in the ways in which the products and services are created and delivered. *Position innovations* are changes in the context in which the products or services are introduced.

And last, *paradigm innovations* are changes in underlying mental models which frame what the organization does.

The second categorization deals with the degree of novelty involved. The categorization divides the innovations into incremental and radical innovations. *Incremental* or continuous innovations are ongoing improvements to the existing products or activities – i.e. doing things better. *Radical* or discontinuous innovations for their part usually offer a possibility to something completely new – i.e. doing things differently. (Tidd et al. 2005) According to Henderson and Clark (1990) radical and incremental innovations have different competitive consequences because they require quite different organizational capabilities. Incremental innovations reinforce the capabilities of established organizations while radical innovations force them to draw on new technological and commercial skills and to employ new problem-solving approaches.

Each of the 4Ps of innovation can take place along an axis running from incremental through radical change. This is shown in figure 5.

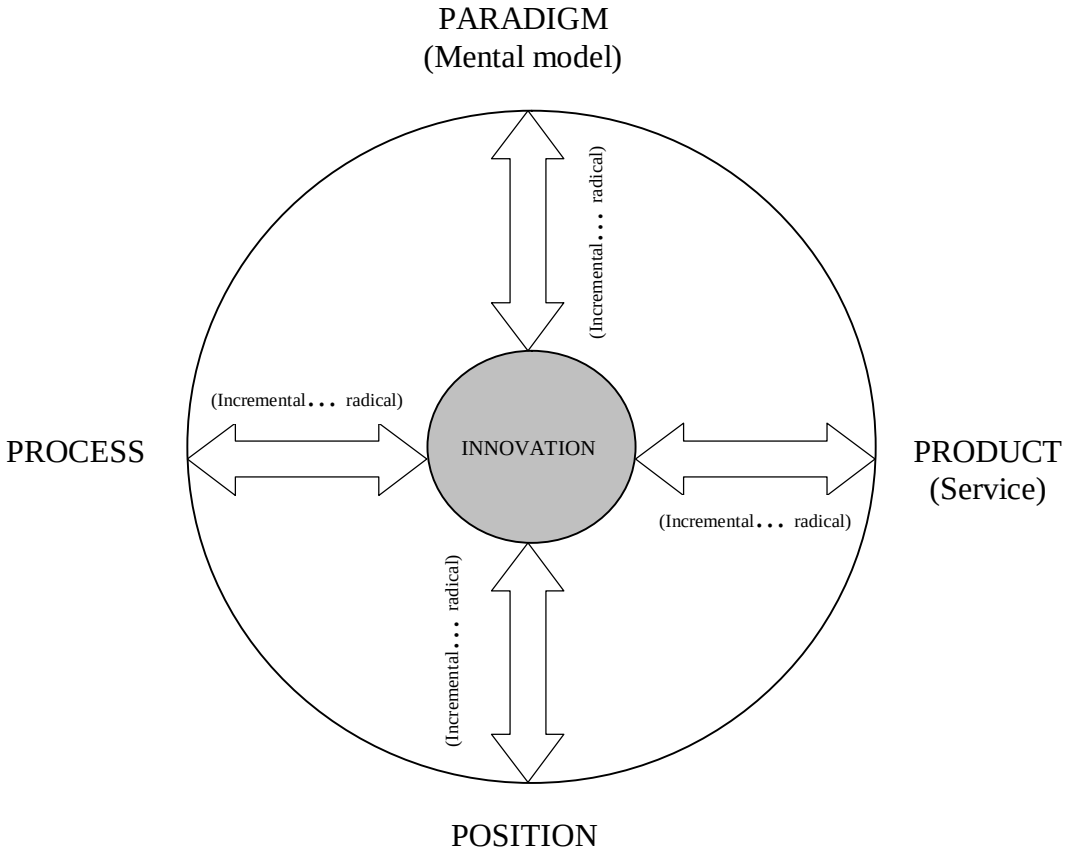


Figure 5: Innovation space (Adapted from Tidd et al. 2005)

Henderson and Clark (1990) argue that the traditional categorization of innovation as either incremental or radical is anyhow incomplete and misleading. They look closely at the kinds of knowledge involved on different kinds of innovation and argue that innovation rarely involves dealing with a single technology or market but rather a bundle of knowledge which is brought together into a configuration. Successful innovation management requires getting hold of and using knowledge about *components* but also about how those can be put together, i.e. *architecture* of an innovation. In figure 6, innovations are classified along two dimensions: innovation's impact on components and its impact on the linkages between the components.

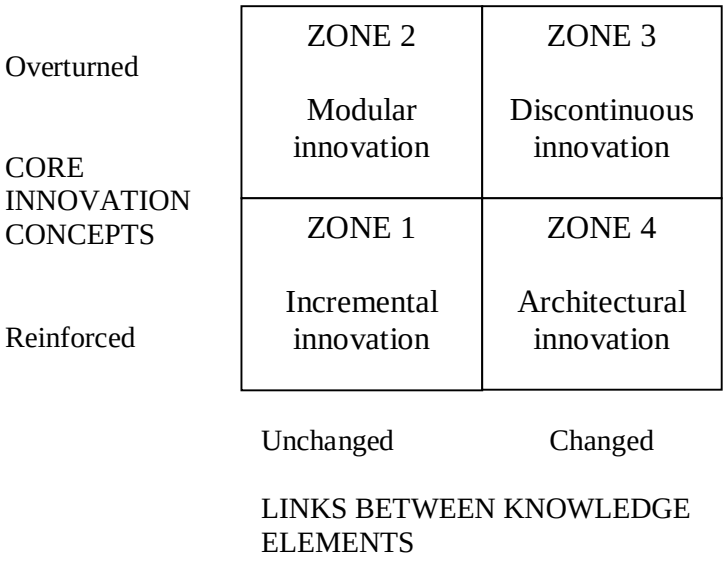


Figure 6: Component and architecture innovation (Tidd et al. 2005)

Most technological change in industries and firms is incremental, i.e. each innovation constitutes a relatively small step built on the base of established practice. Although the steps would be small, the cumulative economic consequences of incremental changes can be large. In many industries, leading firms have succeeded extended periods by exploiting a series of incremental technological innovations built on their technological and organizational capabilities. (Rosenbloom & Christensen 1998) Also Tidd et al. (2005) remind that even if emphasis is usually on radical developments, it is important not to neglect incremental, sustainable change. It is shown that compared to dramatic and radical change, incremental changes result better efficiency and greater cumulative gains over time.

However, because of its capacity to render those capabilities obsolete, radical change in technology is one of the greatest threats to incumbents in an industry whose competitive positions were built in that way. Most of the time innovation takes place within a set of rules of the game which are clearly understood and involves players trying to innovate by doing what they have been doing (product, process and position), but better. But occasionally a radical innovation can change the rules of the game by opening up new

opportunities but also challenging existing players to reframe what they are doing in the light of new conditions. (Rosenbloom & Christensen 1998, Tidd et al. 2005)

Du Preez and Pistorius (1999) argue that any organization can be considered to be *technology-based* to some degree. Some organizations are merely users of technology whilst others actually develop and produce technological solutions. As any organization is technology-based to some degree, it implies that technology has the ability to affect the bottom line of any organization in one way or another. In the light of the fact that technologies change continuously, whether incrementally or radically, technological changes will therefore affect the bottom line of organizations. These changes are often driven by political, social, economical or related issues. According to Tushman (1997), to be successful over time, a company has to be able to reorganize and redefine itself to stay "in sync" with external forces and events. Long-term success has to do with managing streams of innovation: processes for incremental, component, architectural and radical innovations, rather than singular innovation events.

3.1.2 The model of cyclical technology change

Many technologies seem to go through a "life cycle" (see figure 7). Understanding the basic evolutionary cycles of a technology can help an organization to predict the timing of radical change. The cycle begins with a technological discontinuity - the discovery or invention of a new possibility. When a new technology comes into existence, there is high rate of innovation and uncertainty regarding which of a variety of possible variants will succeed, and substantial technological rivalry is held between the alternatives. However, after a period of time and competition, called "era of ferment" (see e.g. Anderson & Tushman 1990), social, political and organizational dynamics select one or a few of these variants to become to dominate the others, and attention and resources become concentrated on these at the expense of the others – a "dominant design" emerges. (Nelson 1998, Tushman 1997, Anderson & Tushman 1990)

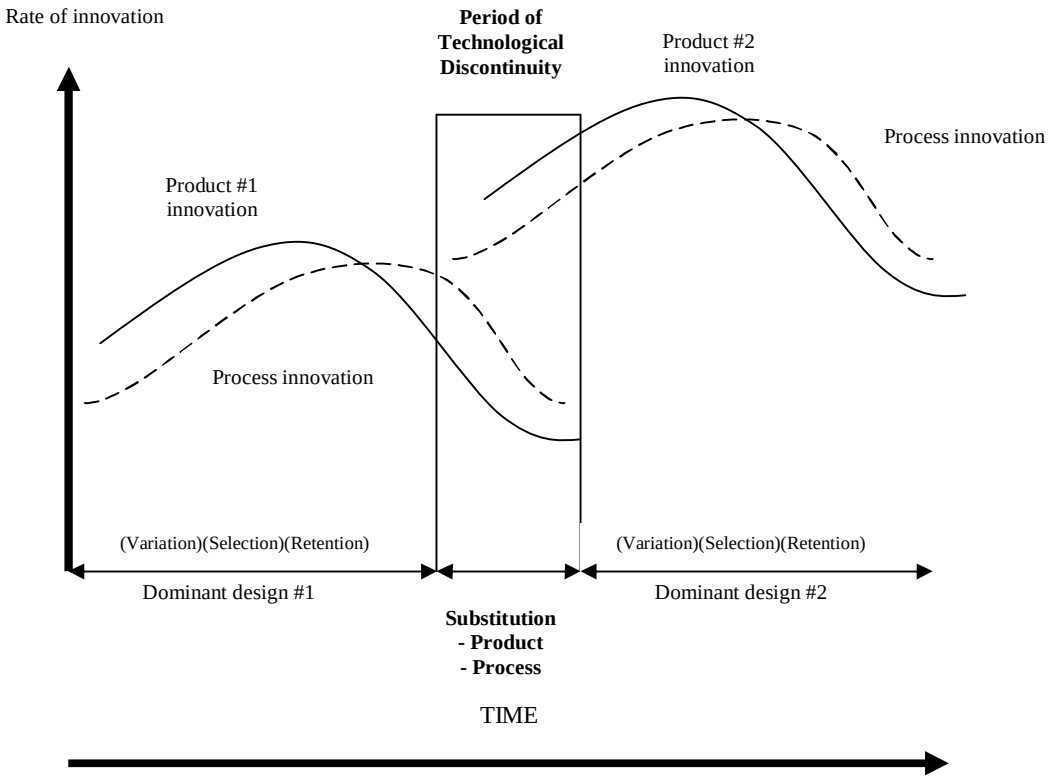


Figure 7: Technology cycles (Adapted from Tushman 1997)

When a dominant design is selected or an industry standard is established, variation ceases. Now the product enters the retention stage – a period of incremental change and architectural innovation. At the same time, process innovation begins with improvements in how the product is produced and delivered. Eventually, another technological discontinuity occurs and the cycles begin again. (Tushman 1997)

Swann (1998) argues that the pace of technological change is accelerating all the time. That also means that the product life cycles are becoming shorter. Both incremental and radical changes can be rapid. According to Swann (1998), rather than the rapidness of change, the difficulty that rapid technological change poses for planning is that its direction is usually unpredictable, because even given a full knowledge of the state of the art in a certain technology, one can not know which parts will enjoy market success in the future and which will not. But as will be discussed later, at least something, and actually quite a lot, can be done in order to predict the future. The future implications can not be ignored, but the organizations need actively strive to anticipate the future

states of their business. Understanding the dynamics of development in technology and their industry, the firms can become more prepared for the future.

3.2 The co-evolution of technology and industry

Technology's impact on industries has been known and studied many times by many researchers. In recent years, much of the research has been done to explore the "co-evolution" of technology and industry structure, with a focus on whether a natural industry "life cycle" exists. (Nelson & Winter 2002, Rosenbloom & Christensen 1998) E.g. Nelson (1998) discusses the concept of co-evolution of technology and industry structure. According to him, the basic proposition is as follows: During the early period of experimentation and unsteadiness, before a dominant design emerges (see chapter 3.1.2), there are no particular advantages to the incumbents. Market demand is fragmented across a number of variants. Firms producing particular designs tend to be small and model change may be frequent. There is a considerable amount of exit from and entry into the industry.

After a dominant design becomes established, firms that do not produce a variant of it tend to drop out of the industry or into small niche markets. With more stabilized product design, learning by incumbent firms becomes more cumulative and potential entrants are increasingly at a disadvantage. With the less fragmented and more predictable market, firms try to exploit latent economies of scale, and advances in process technology both reflect and enforce this. Generally scale intensive technology is as well capital intensive, and for that reason the cost of entry rises. There is "shake out" in the industry and structure becomes more concentrated with the surviving firms tending to be relatively large. (Nelson 1998)

Porter (1985) reminds that even though the theory can be generalized to concern many industries, there are also industries where the model does not fit as well as to others. There are also other theories which can be seen to fit the facts (see e.g. Klepper and Graddy 1990). Technology evolves differently in every industry, just as other industry

characteristics do. The pattern of technological evolution is the result of a number of characteristics of an industry, and must be understood in the context of overall industry structural evolution. Innovation is both a response to incentives created by the overall industry structure and a shaper of that structure. (Porter 1985)

Truly transformational industrial change takes time, usually decades, and unfolds its stages. If one does not focus on the long trajectory of change, one may be forced to take unnecessary risks by reacting quickly during unanticipated periods of transition. A better course is to understand the nature of change so that a firm can prepare for the inevitable challenges and opportunities that arise. (McGahan 2004a) The trajectories of technological change and the natures of industry structure evolution are discussed next.

3.3 Trajectories of change and evolution

It has to be remembered that firms are often "path dependent" which means that their strategies are strongly constrained by their current position and by the specific opportunities open to them in the future. Two sets of constraints make path-dependency in a firm innovation strategy inevitable: those of the present and likely future state of technological knowledge and those of the limits of competencies. Firms can not easily jump from one path to another, as competencies are rarely those of an individual but most often those of specialized, interdependent and coordinated groups where tacit technological and organizational knowledge through experience are of central importance. And even when competencies come from outside the firm, different practices and cognitive structures can make their assimilation costly or even impossible. (Tidd et al. 2005)

From the fact of path dependency has emerged the notion of *technological trajectories* which can be applied equally to a technology, constrained by knowledge limits, to a firm, constrained by limits in competence and also to countries which will often have more than one trajectory (Tidd et al. 2005). Dosi (1982) has introduced a model of *technological paradigm* – "an outlook, a set of procedures, a definition of the relevant

problems and of the specific knowledge related to their solution". From his point of view, continuous (incremental) changes are often related to progress along a technological trajectory within a certain technological paradigm. Discontinuous (radical) innovations are associated with the emergence of a new paradigm, i.e. jumping from one trajectory to another. According to du Preez and Pistorius (1999) industry-shattering and paradigm-shifting innovations very often come from an entirely different industry than the one they eventually have an impact on.

3.3.1 How industries evolve

McGahan (2004a, 2004b) uses trajectory thinking in her researches concerning industry evolution. She argues that every industry follows a certain trajectory of change. By understanding the trajectory of industry change, one can make faster decisions, avoid distractions and ultimately improve the firm's returns on investment. McGahan's framework is based on the idea that the key to achieving sustained superior performance (see e.g. Porter 1985) is not in trying to isolate a particular driver of change but rather to understand the rules of industry change in the environment. Developing a successful strategy depends on understanding the implications of change for industry structure regardless of the drivers. A firm's strategy can not succeed if it violates the rules of change in the industry, and a firm can not make intelligent investments unless it understands how the whole industry is changing.

According to McGahan (2004a, 2004b), threats in an industry can arise at two levels: to the core activities and core assets. Assets are defined as items with durable value that are a property of the firms in the industry and activities are defined as actions taken by firms to create profits. By "core" she means activities or assets which are central to the value created by the industry. Core activities and assets are threatened with obsolescence when some sort of new approach carries the potential to make them irrelevant to value creation. Each of the four trajectories of industry evolution (see figure 8) involves a different pattern in threats of obsolescence.

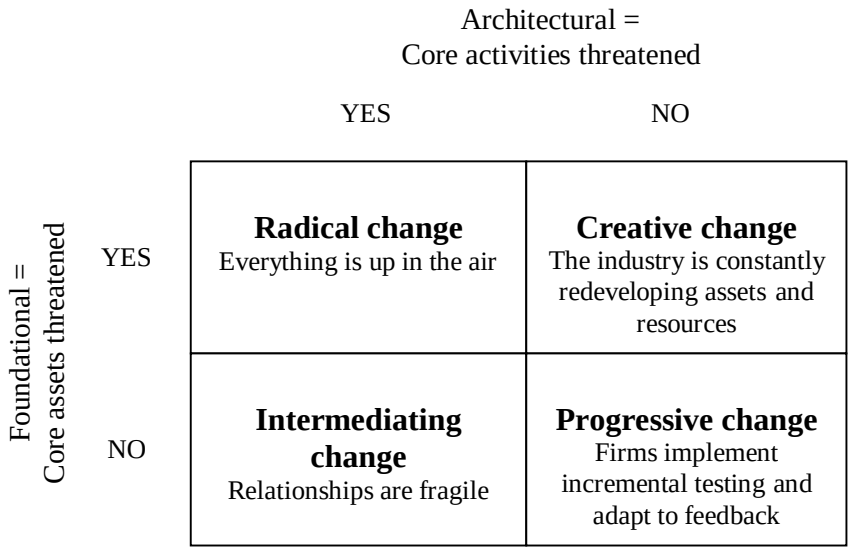


Figure 8: Nature of change and the trajectories of industry evolution (adapted from McGahan 2004a, McGahan 2004b)

Progressive change is the most common of the four types of industry evolution. On this trajectory, both core activities and assets are stable. Firms within the industry tend to build on their established capabilities over time rather than abandon old ways of doing things in favor of something new. Innovation tends to be relatively small in scale – firms innovate incrementally in ways that do not rock their core positions. Firms' performance depends on two primary capabilities: the development of a highly efficient set of interlocking activities and the ability to respond quickly to the feedback from buyers and suppliers. (McGahan 2004a)

Creative change involves major innovation but not a threat to core activities. That means that relationships with buyers and suppliers remain relatively stable and only the core assets are threatened with obsolescence. Threats usually do not come directly from buyers and suppliers but rather from competitors or new entrants. The creative path is the least common form of industry evolution. Firms' performance in creative evolution depends on several primary capabilities: project management skills that allow develop a new asset efficiently, risk assessment capabilities for managing across a portfolio of

projects, and the development of a network of relationships for commercializing new products effectively. (McGahan 2004a)

Intermediating evolution occurs when a new approach threatens an industry's core activities and thereby jeopardizes the firm's relationships with buyers and long-time suppliers. The core assets, however, are not threatened with obsolescence although their value depends on new buyer and supplier relationships. Intermediation typically involves massive changes in the structure of the information available to buyers and suppliers. Intermediating change is difficult to manage because executives must find ways to preserve old capital and at the same time develop entirely new sets of relationships. Performance depends on reconfiguring activities to create value in unprecedented ways. Usually so few of the old activities and assets retain their value that it may be easier to exit the business completely. (McGahan 2004a)

The fourth form of industry evolution, *radical change* occurs when a new approach threatens both the core activities and core assets within an industry. It is usually motivated by a massive technological or regulatory breakthrough. Buyer preferences shift dramatically, supplier capabilities become outdated and firms are jeopardized by locking into outdated ways of doing business. Success in radical evolution depends on developing a strategy that accounts for the transformation of the industry structure. The number of alternatives is greatest if the firm recognizes the radical change when it is just beginning. Performance depends on the ability to avoid redoubling investments in the business while continuing to extract value out of established assets and activities. (McGahan 2004a)

Each of the four trajectories of industry evolution is distinctive in its implications for successful innovation. One evolutionary environment may jeopardize profitability or even survival in another. Some of the rules of industry change are definitive while others are corollaries and guidelines. The rules can not tell exactly how to invest, how quickly to innovate or when to exit. The trajectories do not define a single strategy for success, but each trajectory is definitive in determining the general direction of innovation. It is seen that the pace of change in many industries is accelerating. However, the nature of change retains its character and the rules of change stay the

same through product and technology generations. The key is to consider the way in which breakthroughs in industries take hold rather than on the breakthroughs themselves. (McGahan 2004a, McGahan 2004b)

3.4 Types of competition

The theoretical discussion concerning firms' strategies more or less answers to the question, how firms generate above average returns to their owners. This requires success in growth and therefore in competition in the changing environment. The concept of competition is not as ambiguous as it is used in microeconomics. Different microeconomic research traditions use this concept in a little bit different and interdependent ways. (Barney 1986) In this chapter, three different concepts of competition introduced e.g. by Barney (1986), which reflect the three broad research traditions in microeconomics: Industrial organization (IO) economics (Bain 1968), Chamberlinian economics (Chamberlin 1933) and Schumpeterian economics (Schumpeter 1934, Nelson & Winter 2002), are discussed.

IO economics begins with a focus on industry structure and then moves to conduct and performance. In the model of IO economics competition, the returns of firms are determined by the structure of the industry within which they operate. (Barney 1986) The key attributes of and industry's structure include the existence and value of barriers to entry, the number and relative size of firms, the existence and degree of product differentiation in the industry and the overall elasticity of demand. (Porter 1985)

Chamberlinian economics examines the firm performance in a different way – it begins with a focus on the unique assets and capabilities of individual firms and then traces the impact of these organizational traits on the strategies firms implement. The differences between the skills and abilities controlled by firms can lead to differences in returns from implementing strategies, so it is implied that firms should seek to choose strategies that most completely exploit their individuality and uniqueness. Cited by Chamberlin (1933), some of the key differences between firms that can lead to differences in

performance include technical know-how, reputation, brand awareness and the ability of managers to work together. (Barney 1986, Barney 1996) The theory is later developed further towards valuable, rare, non-imitable and sustainable resources (see e.g. Barney 1991).

The view of competition developed by Chamberlinian does not necessarily contradict the views developed by IO economists. In many ways, indeed, these two models are strongly complementary. Industry structure has a strong impact in determining which of a firm's unique skills and assets can be exploited when choosing a strategy. It can be seen, that applying IO concepts to characterize industry structure, the categories of strategies a firm should consider (e.g. barriers to entry, product differentiation etc.), can be suggested, while Chamberlinian logic suggests which particular strategies within those broader categories firms should choose to implement, that is, strategies that exploit a firm's unique skills, competencies and resources. (Barney 1986)

Both the IO economics and the Chamberlinian competition models presume a level of stability in the competitive dynamics, whereas Schumpeterian competition is not so stable and predictable. In his researches Schumpeter focused on major revolutionary technological and product market shifts. (Barney 1996) This meant that in the long run price and other competitive actions of firms within a relatively stable industry become less important. That does not mean that competition would not exist, but rather that it was of secondary importance when describing the evolution of an economy through history. Revolutionary innovations in product, market or technology can only be partly anticipated by firms. When major innovations emerge, their ultimate impact may not be known, which means that it may be too late for older firms with older technologies and skills to compete in new requires, or on the other hand, guessing too early that a given innovation will become dominant may jeopardize a firm's long-term survival by trusting on a technology or market that runs out not to be dominant. (Barney 1986, Nelson & Winter 2002) The theme of dominant design in cyclical technology change is discussed more accurately in chapter 3.1.2.

3.4.1 An integrative framework of the concepts of competition

In reality, a firm may face all three types of competition simultaneously. The successful management of a firm thus requires balancing of all three competition models. Barney (1986) introduces a framework which suggests a developmental model which can be used to describe the different types of competition firms face within an industry over time.

Barney (1986) argues that industries begin as a result of Schumpeterian revolutions in markets, technologies or consumer demands etc., which can not be perfectly anticipated. The revolutionary change defines the character of competition in an industry by defining the technological and market bases of competition, the organizational resources and assets that are strategically valuable, and those which are strategically irrelevant. By defining which skills and abilities are valuable, the Schumpeterian revolution also defines which firms are likely to be successful early on, which firms must modify their resource base to become successful, and which firms are not likely to survive at all. An integrative framework of the types of competition, adapted from the views of Barney (1986) is shown in figure 9.

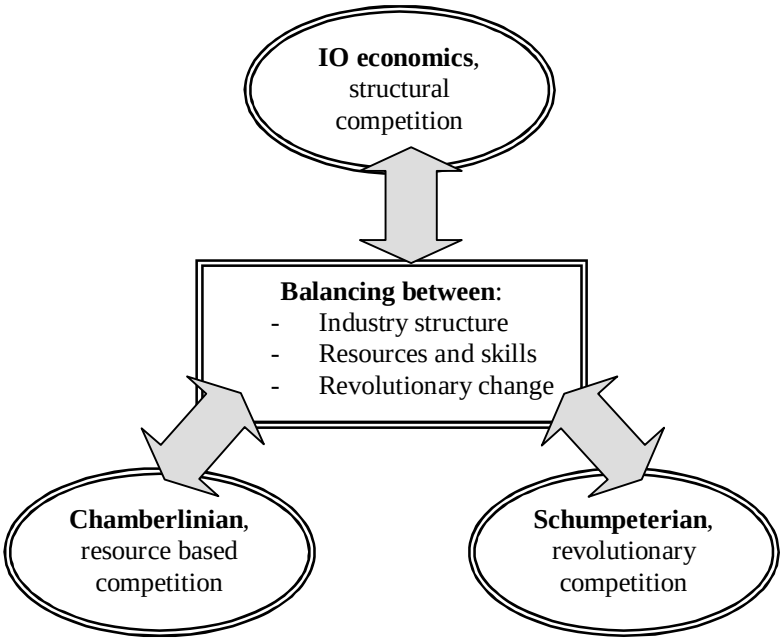


Figure 9: An integrative framework of the types of competition (adapted from Barney 1986)

After a Schumpeterian revolution has defined the competitive bases of a new industry, including which firms do control strategically valuable assets and abilities, IO and Chamberlinian competition become more relevant strategically. Interfirm rivalry (see Porter 1985) will continue within these industries. This will continue as long as the bases for competition originally defined by the Schumpeterian revolution either remain stable or evolve predictably.

In their recent study, McAfee and Brynjolfsson (2007) have studied competition in U.S. industries. According to their study, on the average, the whole U.S. economy has become more "Schumpeterian" since the mid-1990s. These changes have been greatest in the industries that buy the most IT software and computer hardware. Because every industry will become even more IT-intensive over the next decade, the competition is expected to become even more Schumpeterian. It seems likely that the results in the industries in other countries would seem much the same than the results from U.S. industries.

Managers might not want the competition in their industry to become more Schumpeterian, but possibly they do not have a choice. Firms are using IT to increase the speed of process innovation and replication. These firms drive the competitive dynamics of their industry leaving their rivals with a stark choice: adopt the Schumpeterian ethos of creative destruction or watch from the sidelines as others increasingly gain market shares and value. (McAfee & Brynjolfsson 2007)

3.5 Anticipating and adopting technological change

According to Preez and Pistorius (1999), technological change can be seen as a response to various forces that drive technological trends or global demands that cause technological change. These driving forces or demands may be e.g. political, social, economical or technological in nature. The assessment of these driving forces may enable technological change to be anticipated. In the empirical part of the study, the

anticipating of technological changes is also done based on the assessment of different driving forces.

Although the future can't be predicted with certainty, the ability to anticipate future technological developments and trends can be a significant competitive advantage as well from a company as a national point of view. Similarly, a lack of doing so may be very costly. Emerging technologies bring not only new opportunities, but also threaten to replace the old ones. It is no longer sufficient to be technically competent – organizations need to be able to anticipate technological change in order to take advantage of it. (du Preez & Pistorius 1999)

As Hamel and Välikangas (2003) state: "every business is successful until it's not". What's amazing is how often top management is surprised when 'not' happens". Even "unexpected" shocks can anyhow often be anticipated if one is paying close attention. Even though no technique can eliminate the unavoidable uncertainties inherent in any consideration of the future, a structured approach to the anticipation of the technological future and the assessment of emerging technologies can be a valuable aid to decision-making. However, the mere striving to the anticipation of technological changes is not enough. The next logical question becomes how the anticipation might be done. (du Preez & Pistorius 1999)

As is discussed earlier, the pace of technological change is accelerating. Because of that, many businesses need to make plans within ever shortening time horizons. A major issue for the management of technology in the future is how to ensure that shortening business horizons do not deter important long term strategic investments in new technologies. (Swann 1998)

In this study scenario method is used in order to anticipate technological changes and that way as an aiming tool for strategic planning. A scenario is an internally consistent view of what the future might turn out to be (Porter 1985). The scenario method will be introduced and discussed in the main chapter 4 and the use of scenario method in anticipating e-business' development in the forest industry will be introduced in the empirical part of the study.

3.5.1 Bounded rationality and organizational renewal

The ability to anticipate technological changes does not still mean that an organization would actively try to take advantage of the emerging technological changes. Much has to be done with the routines and attitudes of the firms. As Nelson and Winter (2002) state: “how can the same organizations be so impressively competent from one perspective and yet so strikingly ‘bounded’ in their rationality?” With this argument they refer especially to the traditional industries and firms where the willingness and ability to changes can be strongly limited by the routines they have employed in the past. From their point of view, real-life problems related to decision making are acknowledged as being too complex for full comprehension by an individual actor, and the routinization of activities in a firm is largely a response to the quantity of information, and the actors are not thus assumed to have accurate foresight of the future opportunities.

Firms are assumed to “satisfice” implying that relatively simple rules and routine operations determine most of the actions finally undertaken. A perfectly rational optimization of choices is therefore considered impossible. (Peneder 2001) According to Tushman (1997) the older an organization becomes, the more its people tend to develop a paradigm of the way work *should* be done and a certain pomposity and arrogance about the way they are doing. Much of research has been done concerning with understanding the behavior of business firms and their capabilities and limits for adaptation in an environment of change (see e.g. Nelson & Winter 2002).

Technology related decision are business decisions and have to be managed as such. From a management point of view it is therefore necessary to develop and deploy management tools that can account for the effect that technological changes can have on the organizations’ bottom line. Decision-makers are less interested in the future performance of a specific technology per se, but more interested in the impact that a given technology or trend will have on its business in the future. (du Preez & Pistorius 1999)

Organizations should adopt a perceptional approach that makes it possible to be flexible and agile in a changing and uncertain environment – i.e. they need to renew (Ellis & Sphielberg 2003). According to Hamel and Välikangas (2003) organizational ability to renewal is a natural consequence of its resilience in a changing environment. Strategic resilience is not responding to a one-time crisis or rebounding on a setback. It is about continuously anticipating and adjusting to trends that can permanently weaken the earning power of a core business. It is about having the capacity to change before the case for change becomes desperately obvious.

Organizations often invest too much in "what is" and too little in "what could be". But a noble past does not entitle to an illustrious future - a company that fails to adjust to its changing environment soon loses its relevance, its customers and, ultimately, the support from its stakeholders. Organizational renewal requires the organizational knowledge to keep pace with changes in the environment. (Hamel and Välikangas 2003)

Successful companies find it extraordinary difficult to reinvent their business models. But to thrive in turbulent times, companies must become as efficient at renewal as they are producing today's products and services. Renewal should be a natural consequence of an organization's innate resilience. The goal is a strategy that is forever conforming itself to emerging opportunities and trends. (Hamel & Välikangas 2003) Managing innovation streams (see chapter 3.1.1) requires an "ambidextrous" organization that can do two fundamentally different things simultaneously and well. It calls for managers who can maintain consistency and encourage continuous improvement in current offerings while at the same time allowing the flexibility and experimentation that help the firm to create or respond to radical shifts in the environment. (Tushman 1997)

3.6 Summary of the theoretical framework

Technological change's role as an incitement of the evolution of industries is strengthening as the pace of changes seems to accelerate (see Swann 1998). Managing technological change and that way doing the right strategic choices in firms which would prove to be successful in the future is not easy and presumes the executives to have the ability to anticipate the changes in the environment and the firms to be agile and also willing to develop continuously. Paradigms, i.e. mental models of the firms (see Tidd et al. 2005) need to change along the changes in technology.

The majority of technological innovations are incremental, but a radical innovation can quickly change the rules of the game and make the old ways to do things obsolete. Radical changes open up new opportunities but also challenge existing players to reframe what they are doing in the light of new conditions. (Rosenbloom & Christensen 1998) Understanding the basic evolutionary technology cycles can help an organization to predict the timing of radical change (Tushman 1997) and prepare for the changes on time.

It has to be remembered that every firm and industry can be seen to go along a certain trajectory. In firms it means that their technological competencies and knowledge are somewhat bounded, and jumping from one technological trajectory to another is always costly or even impossible (Tidd et al. 2005). According to McGahan (2004a, 2004b), there are four different kind of industry evolution trajectories, which all have their own rules of change. A firm's strategy can not succeed if it violates the rules of change in the industry, and a firm can not make intelligent investments unless it understands how the whole industry is changing. In other ways, all the changes in firms and industries may not be possible to adopt.

Another decisive factor concerning the strategy to be chosen by a firm is the type of competition in which the industry is. In reality, a firm may face all three types of competition simultaneously. The successful management of a firm thus requires balancing of all three competition models, i.e. balancing between industry structure, firm's resources and skills and revolutionary (radical) change. (Barney 1986)

In the empirical part of the study, these above introduced theories are utilized in the context of e-business solutions in the forest industry. As the history has pointed out, the adaptation of changes in forest firms is somewhat restricted and the forest industry is characterized as a rather traditional and also relatively conservative and rigid industry. Anyhow, remarkable changes may be expected to happen, and have already happened, via new technological innovations, e.g. ICT solutions.

If looking at the model of McGahan (2004a, 2004b), the forest industry appears to be in a trajectory of radical evolution as its core activities and core assets can be considered to be threatened by obsolescence. Especially in the pulp and paper industry the new fiber products, intelligent papers and packages, hybrid media etc. are already replacing the traditional end products. Along the renewal of products, also the relationships between the customers and suppliers are expected to change.

According to McAfee and Brynjolfsson (2007), in different industries there is a pervasive trend toward using IT to replicate not only goods and services but also business processes such as customer service and order management as well as support activities, e.g. accounting and human resources. While creating innovative business process is less visible than developing new products or investing in factories, it is actually more important to a firm's success. Intangible process capital is changing the way companies operate and the capabilities they possess. As a result, it also changes the way they compete.

It can be expected that the competition in the forest industry is becoming more Schumpeterian over the next decade. For forest firms it is necessary to be aware of the nature of change and follow the rules set by radical evolution. The forest industry has already faced many changes with relatively fast pace. Competition in the industry is strong and besides the technological changes, the forest firms are facing several cultural changes. The forest firms' willingness and agility to changes is extremely important in defining their success in the future. From the ICT industry's point of view, competition becoming more Schumpeterian probably means quick changes in authority relationships between the firms – a firm can quickly dominate the market and just as easily be dethroned by a rival with a new approach. On the whole, suppliers and buyers are

continuously expecting more active roles in the innovative process. Development and change is not a result of intra-industry rivalry but of the interaction between complementary actors and the integration of complementary technologies. (Lundgren 1991)

4 SCENARIO METHOD

The future is elaborate and several potential futures are possible. The path leading to this or that future is not necessarily unique. (Godet & Roubelat 1996) According to Kamppinen et al. (2003), the best way to predict the future is to make it oneself. This thought is familiar in our day-to-day lives – mainly no-one does expect things to happen by themselves, but we work and try to conduct our lives to some direction.

This chapter concentrates on the scenario method, one of the most widely used future studies methods. At first a short introduction to the future-oriented research in common is provided. Then a closer look at the scenario method is taken: its definition, purpose and background, scenario method's advantages and challenges, qualifications that a good scenario should fulfill, typical classifications of the scenarios, different ways to conduct a scenario process and the main stages that every scenario project includes.

4.1 Future-oriented research

In many organizations, strategic planning is organized on the premise that it is possible to plan for and forecast the future. However, this premise is no longer valid in most industries. (Ralston & Wilson 2006) Future means uncertainty. It includes more surprising new events than before. Trends are breaking and a lot of things happen around us – things which one can not have much influence on, one can only be prepared for them. Societal, economical and technological systems are becoming more complex and risky. The future and its uncertainties can not be ignored. (Coyle 1997, Ralston & Wilson 2006) According to Wilson (in Ralston & Wilson 2006), we can never be able to escape from the ultimate dilemma that all our knowledge is about the past, but all our decisions are about the future.

One can affect his or her own success in the changing world, but it comes up an active attitude towards future. It is useful to discuss and study the future, because at least

something in the future is predictable. The future is studied to get a better grip on it, intended to make more confident and hopefully also better decisions. (van der Heijden 2000, Mannermaa 1999)

Futures research has had a mixed reception over the last 30 years, and futures studies can be categorized in many ways. According to Coyle (1997), one can deal with the change by two ways. On the one hand, one might react passively, after the change has already occurred. In some cases it is appropriate to simply do nothing, in other cases one might model the changed situation to see what could be done, monitor matters to see how things go or ask the suggestions. On the other hand, one might react actively, before the event. To deal with the changes actively opens up two different strategies: defense and anticipation. In the defensive strategy the risks are shared with others by insuring or assuring. The group of anticipatory strategies includes a various number of "judgmental" and analytical future studies methods. Judgmental or subjective methods depend on the opinions and judgments of people. Analytical methods include mathematical, graphical and inductive methods.

Mannermaa (1999) introduces a three-dimensional classification of future studies methods. First, the methods can be classified by the nature of the used empirical data to *quantitative* or *qualitative*. Second, they can be classified by the process of forecasting and assessing the future to *mathematical, repeatable* and to *subjective, non-repeatable* methods. And third, they can be divided by the common attitude towards the future or the purpose of the study to *explorative* or *normative* methods.

One kind of a summary of future studies methods, adapted from Coyle (1997) and complemented by the views of Mannermaa (1999) and Gáspár and Nováky (2002) is introduced in figure 10.

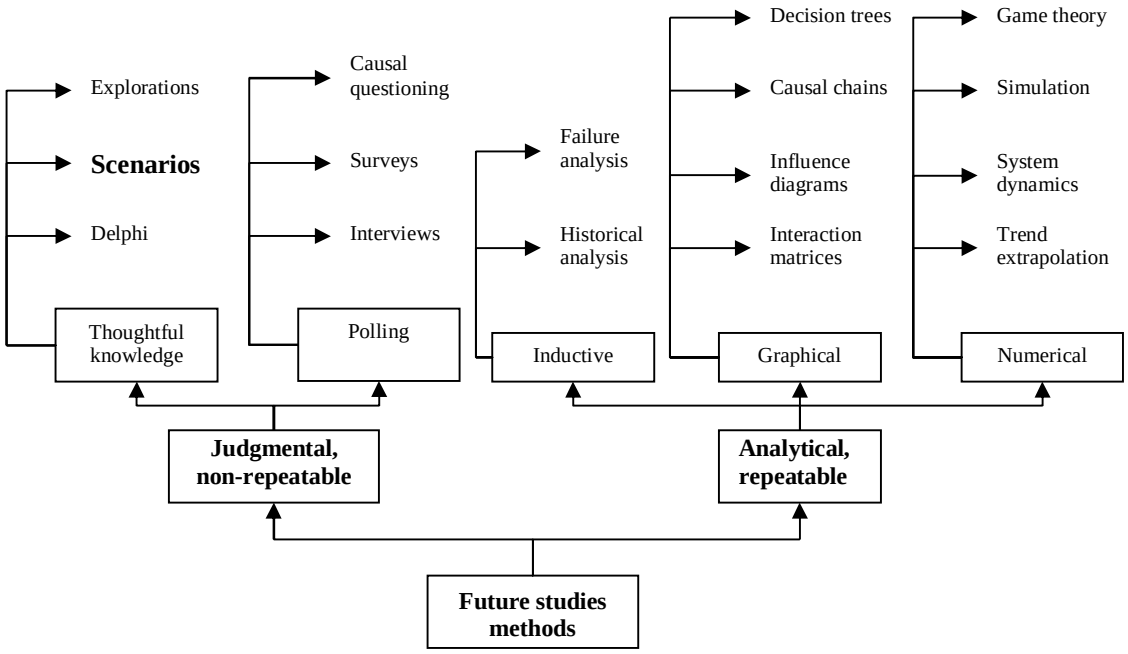


Figure 10: The future studies methodology tree (adapted from Coyle 1997, Mannermaa 1999, Gáspár & Novaky 2002)

On the grounds of these views, scenario method can be seen as a judgmental method which exploits mostly qualitative data and is subjective by its nature, which means that it can never be repeated exactly the same way (see the settling of scenario method in the future studies methodology tree from figure 10). The approach of scenarios can be either explorative or normative. These issues will be discussed later in more detail.

4.2 Scenarios – definitions and purpose

The description of a potential future and of the progression towards it comprises a scenario. A scenario thus is a description of a future situation and the course of events which allows one to move from the original situation to the future situation. (Godet & Roubelat 1996) Scenario-based planning does not attempt to predict what is unpredictable, but copes with uncertainty by considering multiple, equally plausible futures (van der Heijden 2005).

Most often, scenarios are used by organizations' top management to provide a better understanding of the range of possible business environments they might face up in the future (Millett 2003). The ultimate purpose of the scenario planner is to create a more adaptable organization, which first recognizes change and uncertainty, and then uses it creatively to its advantage (van der Heijden 2005, Schoemaker 1991). According to Schwartz (1998), the scenario process provides a context for thinking clearly about the complex array of factors that affect any decision. Core outcome of scenario planning is the improvement of organizational decision-making capabilities. (see e.g. van der Heijden 2005, Meristö 1991)

Scenario-based planning in organizations always ultimately aims for the invention of strategy. Even if scenarios are used in trying to understand ambiguous developments in the outside world, there will always be a point where the repercussions for thinking on organizational strategy are wanted to be considered. When the future isn't predictable, the organizations need futures studies to imagine what the future could, would and should be. In strategic planning this means the concept of multiple scenarios: the future will be described as different alternatives and the strategy will be crafted with the help of those different lines. (see e.g. van der Heijden 2005, Meristö 1991, Schwartz 1998)

According to Cornelius et al. (2005), scenarios serve five different functions. First, they present a background for the design and selection of strategies. Second, they help to make managers aware of environmental uncertainties by confronting them with fundamentally different future states. Third, they provide a tool to identify what might possibly happen and how an organization can act upon or react to future developments. Fourth, they offer the possibility to combine quantitative data with qualitative input, enabling scenario planners to incorporate results from other forecasting techniques and allow for soft and fuzzy variables. And finally, they can help stretch managers' mental models by explicitly confronting them with their own biased viewpoints.

Schoemaker (1991) lists some conditions, when the use of scenarios in an organization is favorable:

- Uncertainty is high (relative to one's ability to predict or adjust)
- Too many costly surprises have occurred in the past
- Insufficient new opportunities are perceived and generated
- The quality of strategic thinking is low (e.g. because strategic planning has become too routinized)
- The industry has experienced significant change or is about to do so
- A common language and framework is desired, without stifling diversity
- Strong differences of opinion exist, each of which has its merits
- Competitors are using scenario planning

Even though scenarios have become widely known as a strategic planning tool for companies, it is not the only context where the scenarios are effective. They are also used e.g. in hospitals, universities, non-profit organizations and governmental agencies. (Ralston & Wilson 2006) In short, scenario planning is applicable to any situation in which a decision maker would like to imagine how the future might unfold. (Schoemaker 1991, Schoemaker 1995)

Table 1, adapted from Ralston and Wilson (2006), clarifies how scenarios should and shouldn't be seen.

Table 1: Scenarios: what they are and are not (adapted from Ralston & Wilson 2006)

Scenarios are not…	**They are…**
Predictions	Descriptions of alternative plausible futures
Variations around a midpoint "base case"	Significantly different views of the future
"Snapshots" of endpoints	"Movies" of the evolving dynamics of the future
Generalized views of feared or desired futures	Specific decision-focused views of the future
Products of outside futurists	Results of management insight and perceptions

In conclusion, the scenario process has been developed to help to manage knowledge creation and sharing through interaction between individuals and organizations. The purpose of the scenarios is to help changing the view of reality – to match up more closely with reality as it is, and reality as it is going to be. Scenario is a tool for ordering perceptions about alternative future environments in which decisions might be played out. The end result is not an accurate picture of tomorrow, but better decisions about the future. (Schwartz 1998, van der Heijden 2005)

4.2.1 Background of scenario planning

The name of the scenario method comes from the theatrical term "scenario" – it is an outline of the plot of the dramatic work, giving particulars of the scenes, characters, etc. or the complete script for a film or a play. (Schwartz 1998, Coates 2000) Scenario planning has a long history. People have always been interested in the future and have used scenarios as a tool for indirectly exploring the future of society and its institutions. Scenarios' emergence as a strategic planning tool in the organizational world is preceded by their use by the military, and employed by military strategists. (Bradfield et al. 2005)

It was a combination of the development of computers, game theory and the US military need for war game simulation models, which provided a platform for the emergence of scenario techniques. Scenario planning developed significantly through the activities of the RAND Corporation (contraction of Research and Development), especially by Herman Kahn, during and after the World War Two. (van der Heijden 2005, Bradfield et al. 2005) After his resign from RAND and establishing Hudson Institute, Kahn began to apply his scenario methodology to social forecasting and public policy. He authored and co-authored numerous newspaper, magazine and journal articles and published books incorporating "futuristic" scenarios. The most controversial was Kahn and Wiener's "The Year 2000: A Framework for Speculation on the Next Thirty-Three Years", published in 1967. Because of his work, Kahn is often referred as the "father" of modern-day scenario planning. (Bradfield et al. 2005, Schwartz 1998)

Soon after Kahn's resign, Olaf Helmer and Ted Gordon also left RAND Corporation and founded the Institute of the Future. In the cooperation with Stanford research Institute (SRI) they began to experiment with scenarios as a planning tool and became the pioneers in the field of future studies in USA. In the 1960s, two geographical centers in the development of scenario techniques, USA and France, emerged. (Bradfield et al. 2005, Schoemaker 1995)

The breakthrough of scenarios in the business world happened in early 1970's, for example by the work of Ian Wilson at GE (General Electric), Pierre Wack at Shell and Peter Schwartz at SRI (Millett 2003). Maybe the most significant work was the one of Wack's. Wack was a planner in Royal Dutch/Shell, an international oil enterprise. Being familiar with Kahn's work, he decided to refine Kahn's method and experiment with the technique at his company in France. Wack and his colleagues were looking for events that might affect the price of oil, and succeeded to predict correctly how the oil markets would operate. (Bradfield et al. 2005, Schwartz 1998) After that, Shell has successfully produced and used scenarios over 30 years, and can be called as a kind of a "forerunner" in corporations' scenario planning. (Bradfield et al. 2005, Shell International Ltd. 2005) Since Wack's first scenario, which can be called as a landmark of the companies' scenario planning, the variety of scenario techniques and applications has substantially broadened, because every practitioner has a little bit different emphasis and views. (Schoemaker 1995, Bradfield et al. 2005)

4.3 Advantages and challenges of scenario method

"Imagine the competitive advantage resulting from moving two years earlier than one's competitors. Significant competitive advantage does not require perfect and total foresight and prescience. Enhancing the institutional skills of perception and adaptation to produce a more inventive and faster response to environmental change than one's competitors is all that is required" (van der Heijden 2005). A widely used example is the one of the oil crisis in 1973 – it took about eight years for the oil refining industry to work out the real impact of the oil crisis on demand. That's one of the clearest

illustrations of how long it can take for organizations to react to the changes in environment. (van der Heijden 2005, Schwartz 1998) Van der Heijden (2005) argues that the costs could have been significantly lower if the organizations in the oil refinery industry were somehow prepared and able to react faster to the changes.

Forecasts are usually constructed on the assumption, that tomorrow's world will be much like today's. However, sooner or later the world changes in a major way. Scenario planning accepts the uncertainty, tries to understand it and makes it a part of the reasoning. Whereas forecasting techniques try to abandon any uncertainty by providing managers with only one forecast, multiple scenario analysis deliberately confronts decision makers with environmental uncertainties by presenting several, fundamentally different outlooks of the future. (Cornelius et al. 2005, Schoemaker 1991) Instead of speculating about just "the future", by using scenarios it is possible to speculate about a range of possible futures that might arise from the uncertain course of the forces of change (Ralston & Wilson 2006). Thinking through different future stories, and talking in depth about their implications, brings unspoken assumptions about the future to the surface (van der Heijden 2005, Meristö 1991).

Schoemaker (1995) presents one essential advantage that scenarios have compared to other planning methods. According to him, scenario planning attempts to capture the richness and range of possibilities, stimulating decision makers to consider changes they would otherwise ignore. At the same time, it organizes those possibilities into narratives that are easier to understand and use than great volumes of data. As a tool for imagining alternative futures, scenario projects have helped many leaders to gain perspectives to guide their search for competitive advantage (Millett 2003).

Scenarios are powerful vehicles for challenging the "mental models" about the world and lifting the "blinders" that limit creativity. (Schwartz 1998) Also Masini and Vasquez (2000) emphasize the creative and social effect of the scenario planning process – scenarios make it possible to broaden mental frontiers and to develop a greater open-mindedness towards new knowledge. They are multidimensional in various ways, so they necessarily bring together different experiences and personalities.

Many writers see the scenario process itself as a major advantage in the scenario making. A scenario process' communicative and learning effects are stressed and they are expected to lead to better decisions. (see e.g. Schoemaker 1991, Masini & Vasquez 2000) E.g. Godet (2000) and Meristö (1991) stress the action-oriented nature of a scenario process, which means that on the basis of the scenarios, concrete decisions and actions are made.

As to any research method, critics can be found also to scenario planning. E.g. Hamel (2001) introduces quite searing criticism to scenario planning by arguing that it is not naturally proactively working action. He sees that scenario working can easily become defensive, as scenario planners concentrate on finding out how "the big bad future" can affect existing business.

Bradfield et al. (2005) argue that there appears to be virtually no area in scenarios which there is a wide-spread consensus – the literature reveals a large number of different definitions, characteristics, principles and methodological ideas about scenarios and that can sometimes be a little bit confusing. But as can be seen later in this study, it is also an enrichment of the scenario method, as different kind of ideas can in many cases be successfully combined. However, the confusion over the definitions and methods need to be resolved and more precision in the terminology for describing the methods is needed (Millett 2003).

Millett (2003) reminds that scenario development and research can be quite expensive and time-taking. Scenarios often require a lot of team effort and professional facilitation. Scenario project also requires commitment of the participants, and that can be hard to attain (Ralston & Wilson 2006).

Table 2: The experienced advantages and challenges of scenario method

Advantages	Challenges
Presents several different outlooks of the future	Is not seen naturally proactively working action
Offers a common language for talking about the factors affecting the decision making	Can easily become defensive, as the planners concentrate to find out how the "big bad future" affects the business
Stimulates the managers to consider changes they would otherwise ignore	No area of wide-spread consensus - different definitions, characteristics, principles and methods used
Organizes the possibilities into narratives that are easy to understand	Expensive and time-taking process
Powerful vehicle for challenging mental models	Requires participants' commitment which can be hard to attain
Brings together different experiences and personalities	

As can be seen, the scenario method has its good and worse sides. Scenario method can be an effective tool, if it is used properly. Next the factors that make the scenarios good tools for anticipating the future states are discussed.

4.4 What makes a good scenario?

There are some qualities which in literature are seen as preferable to achieve in a scenario process. “Good scenarios are thinking and perception devices. They are not about forecasting highs and lows but about making a new reframed perspective visible” (van der Heijden 2005).

According to Godet and Roubelat (see Godet 2000; Godet & Roubelat 1996), the word “scenario” is often misused and serves to qualify any set of hypotheses. They recall that a scenario approach can only be credible and useful if it complies with five prerequisites:

- *Relevance* – each scenario should contribute specific insights into the future that help to make decisions
- *Consistence* – the scenarios must be logical and ensure that there is no built-in internal inconsistency that would undermine their credibility
- *Importance* – the written scenarios should have a clear meaning
- *Likelihood* or plausibility – the selected scenarios must be capable to happen
- *Transparency* – the concept of a scenario must always be stated clearly

E.g. van der Heijden (2005) and Schwartz (1998) see that scenario-based planning is non-prescriptive – it recognizes that successful competitive strategies must be original inventions made by organizations, and therefore employs processes that enhance the capability of the organization to mobilize resources towards greater inventiveness and innovation. Scenarios must always be focused on a strategically relevant area and relevant to the issues of concern to the client, if they are supposed to be productive. The other dimension of relevance in their opinion is that all relevant drivers and events should be included in the scenarios.

Van der Heijden (2005) concludes that effective scenarios should have enough hooks into the current organizational mental models to make them plausible to the "critical mass" in the organization. But they should also contain an element of novelty and surprise in directions where the vision of the organization needs to be aimed.

Selin (2006) sees scenarios as agents of trust or distrust. She reminds that the subjective trust of the intended audience is what makes or breaks the final result. She presents five basis of credibility, which make a scenario trustworthy. These are:

- *Trust in sources* - who is involved in the construction of the scenarios
- *Trust in content* - strength and reliability of the data and information that make up the scenarios
- *Methodological credibility* - trust on the process or method itself
- *Trust in narrative* - persuasiveness and the metaphors which the scenarios create in readers' minds
- *Trust in dissemination* - the range of distribution as well as the context in which scenarios are presented.

With scenarios, ‘more detailed’ does not necessarily mean ‘better’. More important thing is that scenarios must be comprehensible and manageable. Scenarios must provide useful, comprehensive and challenging idea generators and test conditions, against which the client can consider future business plans, strategies and direction. (van der Heijden 2005)

The one essential thing is also that the scenario maker knows what he or she is doing. As Masini and Vasquez (2000) express: “scenarios are like a tool, for example, a hammer. However, this hammer is not used in the same way by a carpenter to make furniture, by an artist to shape a sculpture, or a madman who uses it to bang people over the head with!” That means that certain experiences and know-how to carry out the job and understand different contexts to use the tool correctly are required. “It is necessary to master the exercise” (Masini & Vasquez 2000).

4.5 Scenario typology

Scenario types can be classified and categorized in many different ways. The most usual categorizations are based on the time perspective (explorative-normative) or on the nature of scenarios (optimistic, pessimistic, probable, desirable etc.). In this chapter, a comprehensive typology, created by van Notten et al. (2003), is presented. After that, a couple of more detailed categorizations, which are perceived interesting and essential for this study, are introduced.

Van Notten et al. (2003) argue that there is a large number of diversity in the scenarios, and establishing an overview of them is useful. That’s why they’ve created a many-sided typology of scenarios, which creditably manages to combine many different classifications of scenarios. The typology is presented below in figure 11.

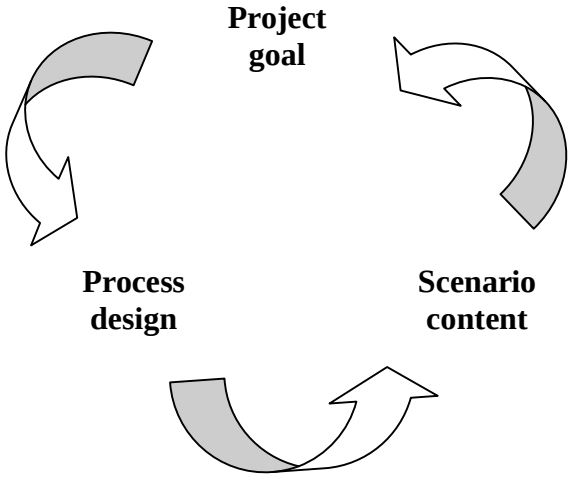


Figure 11: A scenario typology (adapted from van Notten et al. 2003)

The first theme, *project goal*, describes a scenario analysis' objectives. The objective can in the one end be exploration: awareness rising, stimulation of creative thinking or gaining insight into the way how societal processes influence one another. In the other end, the objective can be decision support. This theme includes characteristics as subject, time scale, spatial scale and vantage point. (van Notten et al. 2003)

The second theme, *process design*, addresses aspects such as the degree of qualitative and quantitative data and used methods of data collection. On the one end of this theme is intuitive and on the other end formal design. The intuitive scenario process leans strongly on qualitative knowledge and insights, and quite creative techniques are used in the process. Formal process is quite a rational and analytical exercise. (van Notten et al. 2003) These approaches will be discussed in more detail in chapter 4.6.1.

The third theme, *scenario content*, looks at the composition of the developed scenarios: the nature of variables and dynamics of a scenario, and how they interconnect. The scenario content can be distinguished to complex or, in the other end, simple. (van Notten et al. 2003)

These above mentioned themes and their characteristics are presented more detailed in the following table.

Table 3: The scenario typology in detail (adapted from van Notten et al. 2003)

Theme	Characteristics
PROJECT GOAL Exploration vs. decision support	*Inclusion of norms:* descriptive vs. normative *Vantage point:* forecasting vs. backcasting *Subject:* issue-/area-/institution-based *Time scale:* long term vs. short term *Spatial scale:* global vs. national/local
PROCESS DESIGN Intuitive vs. formal	*Data:* qualitative vs. quantitative *Method of data collection:* participatory vs. desk research *Resources:* extensive vs. limited *Institutional conditions:* open vs. constrained
SCENARIO CONTENT Complex vs. simple	*Temporal nature:* claim vs. snapshot *Variables:* heterogeneous vs. homogenous *Dynamics:* peripheral vs. trend *Level of deviation:* alternative vs. conventional *Level of integration:* high vs. low

Coates (2000) also introduces an interesting approach to the categorization of scenarios. He sees scenarios falling into two broad categories. One is scenarios that tell about some future state or condition in which the organization is embedded. That scenario is then used to stimulate users to develop and clarify practical choices, policies and alternative actions that may be taken to deal with the consequences of the scenario. The second form assumes that the policy has already been established. The policy and its consequences are integrated into a story about some future state. Rather than stimulating the discussion of policy choices, this type of scenario displays the consequences of a particular choice or a set of choices. The first category of scenario tries to stimulate thinking and the second category is used as a tool for explaining or exploring the consequences of some policy decisions.

Close to this thinking is the categorization into exploratory and normative scenarios (see e.g. Godet and Roubelat 1996). Scenarios are divided into these above mentioned groups based on the way they proceed – from this moment to the future or backwards. Exploratory scenarios are built starting from past and present trends and leading to a likely future. Normative (or anticipatory) scenarios are built on the basis of different visions of the future which may be either desired or, on the contrary, feared. Normative scenarios are retrospective: they are built proceeding from the future to this moment.

This logic is also on part of the typology of van Notten et al. (2003), named “the vantage point” of a scenario.

4.6 Scenario building

Chermack (2004) emphasizes that there is a clear distinction between the concepts of “scenario planning” and “scenario building”. He sees scenario planning as the overreaching process of positing plausible alternative future environments and using these environments for learning, changing thinking or for testing or “wind-tunneling” (see van der Heijden 2005) executive decisions, as scenario building is taken to mean the process of constructing the stories themselves, as a component of the larger scenario planning process. In this study scenario building and different approaches to it are handled a little bit wider, but also considered as a separate part belonging to the whole scenario planning process.

There are many different ways of developing and using scenarios. It’s important to realize, that there are not general-purpose scenarios or general-purpose scenario approaches, no “one size fits all” -scenario projects that can be bought off the self. Each project has to be designed based on the specific objectives and needs. No single way of scenarios exists and the same method can’t be used in exactly the same way in all cases. (van der Heijden 2005, Masini & Vasquez 2000) There is not one scenario method, but rather a variety of methods of construction (Godet & Roubelat 1996). Porter et al. (1991) remind that the focus of the scenario process must always be related to the needs and interests of the user.

Views about the preferred number of scenarios vary. There are no strict limits how many scenarios one should have and appropriate number varies along the writer. E.g. van der Heijden (2005) sees 2-4 scenarios adequate, Schwartz (1998) is certain that more than three would be waste, Coates (2000) argues that the minimum number should be four and Schoemaker (1995) introduces that one should first develop 7-9 preliminary scenarios and then choose or combine the needed amount of scenarios out of them.

Whatever the number of scenarios used, the essential idea of the scenario planning is that more than one possible vision about the future is created in order to capture those driving forces and their different values which will have the biggest impact on the future. (Porter et al. 1991)

There are also many different views about the used time frame and the scope of scenarios. They are tightly dependent on the handled situation and a number of factors, e.g. rate of technology change, product life cycles, political elections, competitors' planning horizons and so on. (Schoemaker 1995) At the beginning of the scenario building history, the time span of scenarios could be up to forty years and the scope was usually at the state or global level. But the modern uses include innovation management and technology selection, organizational strategy formulation and operational strategizing, and the time lines can be as short as a few years. (see e.g. Bradfield et al. 2002, Schoemaker 1993)

4.6.1 Different approaches to scenario building

As there are many types of scenarios, there are also a number of approaches for scenario process itself, since scenario writing was established (e.g. Gausemeier et al. 1998). Even when a common thought structure of the problem and of the strategies of the actors, identification of the trends and uncertainties and the building of coherent scenarios is shared, the practices of processing scenarios and putting them into action differ to the relative importance ascribed to the different methodological ingredients (Masini & Vasquez 2000).

According to Masini and Vasquez (2000), scenario building approaches can be classified into two opposite groups. These are statistical (or formal) and intuitive logic approaches. One of the best known representatives of *statistical* methods is Michel Godet, a French scenario specialist, with his *la prospective* approach. This approach is powerfully influenced by the calculation of probabilities and operational research. (see e.g. Godet 2000) Godet also makes a big effort to combine quantitative and qualitative elements (Söderlund 2003). The main aspect of statistical approach is the identification

of a process that brings together different, frequently formalized, techniques. A great deal of time is also used to the identification of probable futures. (Masini & Vasquez 2000)

Intuitive logic is primarily developed by Ian Wilson and the Stanford Research Institute and thereafter applied by the Planning Group of the Shell Oil Company, led by Pierre Wack. Lately it is successfully applied by Peter Schwartz. Intuitive logic emphasizes pragmatism – the scenarios are story-liked narratives and the writing takes a form of a literary practice for which no single definitive method exists. It is usually oriented towards specific decisions, and does not dwell on the analysis of the probability of specific events occurring. (Masini & Vasquez 2000)

Between these views are heuristic methods, conducted successfully e.g. by Kees van der Heijden and Peter Schoemaker (see van der Heijden 2005, Schoemaker 1991). The practitioners of heuristic approach consider that no single standardized methodology for the development of scenarios exists, and that they are rather a process that draws on the knowledge and creativity of the participants to constructively work out alternatives, expressing and analyzing ideas in a free and creative environment. (Masini & Vasquez 2000) Schoemaker (1995) argues that the “extremes” in the methodology can be risky – in intuitive approach the results may be too creative in order to win trust, and on the other hand, statistical approach can be too mechanical and doesn’t encourage innovativeness.

These different approaches include a various number of procedural steps (see Schwartz 1996, Burt & van der Heijden 2003, Schoemaker 1995 and Godet 2000). In his doctoral thesis Bergman (2005) has creditably pulled together this presented classification of the approaches by Masini & Vasquez in a table, which clearly illustrates the basic steps of different scenario approaches. This table, slightly adapted with the writer’s own views of the concerned literature, is presented in table 4.

Table 4: Different scenario building approaches with their guiding steps (Adapted from Bergman 2005)

<table>
<tr><th></th><th>Intuitive approach</th><th colspan="2">Heuristic approaches</th><th>Statistical approach</th></tr>
<tr><th></th><th>Schwartz</th><th>van der Heijden</th><th>Schoemaker</th><th>Godet</th></tr>
<tr><td rowspan="2">Defining the process and its focus</td><td rowspan="2">1. Exploration of a strategic issue or decision</td><td rowspan="2">1. Structuring of the scenario process</td><td>1. Definition of the issues</td><td>1. Delimitation of the system</td></tr>
<tr><td>2. Identification of the major stakeholders or actors</td><td>2. Diagnosis of the actor</td></tr>
<tr><td rowspan="3">Analyzing the context and key elements</td><td>2. Identification of local key forces</td><td rowspan="3">2. Exploring the context of the issue</td><td>3. Exploration of the trends or predetermined elements</td><td>3. Analysis of internal and external key variables</td></tr>
<tr><td>3. Exploring the driving forces</td><td rowspan="2">4. Identification of key uncertainties</td><td rowspan="2">4. Analysis of the interaction between the actor and the environment</td></tr>
<tr><td>4. Ranking the forces by Importance and Uncertainty</td></tr>
<tr><td rowspan="4">Building the scenarios</td><td>5. Selection of the scenario logic</td><td>3. Developing the scenarios</td><td>5. Construction of two forced initial scenarios</td><td>5. Drawing out the most likely environmental scenarios</td></tr>
<tr><td rowspan="3">6. Fleshing out the scenarios</td><td>4. Stakeholder analysis</td><td>6. Assessment of internal consistency and plausibility of initial scenarios</td><td rowspan="3">6. Building the final scenarios</td></tr>
<tr><td rowspan="2">5. System check, evaluation</td><td>7. Creation of final scenarios</td></tr>
<tr><td>8. Evaluation of the stakeholders</td></tr>
<tr><td rowspan="2">Implications</td><td>7. Implications for the decision-making</td><td rowspan="2">6. Action planning</td><td>9. Reassessment of the scenarios and decision-making</td><td>7. Evaluation of strategic alternatives</td></tr>
<tr><td>8. Follow-up research</td><td>10. Action planning</td><td>8. Action planning</td></tr>
</table>

4.6.2 A scenario building process

As discussed earlier, even though every scenario process is unique, there are, however, common elements and certain structure to all approaches. All the scenario processes

share the same basic fundamentals in their structure. (Masini & Vasquez 2000) Börjeson et al. (2006) describe the scenario process in quite a simple and understandable way. According to them, first there is an element consisting of the generation of ideas and gathering of data. Second, there is an element of integration of data, where parts are combined into wholes. And third, there is an element of checking the consistency of scenarios.

Usually a scenario process is seen to be comprised of four fundamental steps. Phelps et al. (2001) see that a scenario process can be conceptualized in four stages: 1) defining the scope, 2) database construction, 3) building the scenarios and 4) choosing strategic options. Ralston and Wilson (2006) define the basic steps as follows: 1) getting started, 2) laying the environmental-analysis foundation, 3) creating the scenarios and 4) moving from scenarios to a decision. The basic elements, quite similar to the definitions above are also shown in the left column in table 4. The principles of each stage are introduced below.

4.6.2.1 Defining the process

First, it is essential to deal with certain issues when initiating any scenario planning process – issues of defining the scope and objectives of the scenarios, changes in staffing and culture and revisions in planning procedures. Defining the scope of the process delimits the planning by listing all the variables which should be taken into consideration. These variables include e.g. time frame, an industry or market segment and stakeholders. Unfortunately, these issues are often a little bit neglected in the process when they should be central to the thinking and the design in addition to make the scenarios successful. (Phelps et al. 2001, Ralston & Wilson 2006)

At the stage of process definition, it is essential to find the answers to the question why the scenario building process on the whole will be conducted, to define the decision focus, to get the people involved to understand and commit to the process and to define the guidelines according to which the process will be organized. (Ralston & Wilson 2006)

4.6.2.2 Analyzing the context and key elements

Every scenario field consists of a large amount of influencing factors. At the context analyzing stage the scenario builders identify the key elements in external environment and try to fill the gap in the knowledge and understanding of key issues. The new signals of change and new models for how the environment could work in the future are looked for and the key external uncertainties and the forces and drivers that could be important and affect the decisions are tried to identify. (Gausemeier et al. 1998, Ralston & Wilson 2006)

Some writers (see e.g. Schwartz 1998) give quite accurate definitions to the different forces and drivers in the environment. However, the categories can't necessarily always be separated and it is more useful to not to focus on definitions but to focus on how to perceive the elements in various situations. Gausemeier et al. (1998) argue that the factors can be found from three environment areas: industry, industrial environment and global environment. A kind of "checklist" of social, political, economic, environmental and technological forces and drivers is useful in trying to analyze the context and variables as accurately as possible. (Ralston & Wilson 2006, Schwartz 1998)

4.6.2.3 Building the scenarios

After working out the relevant forces and drivers, it is usually needed to determine the most significant ones of them. After the most important forces and drivers are found, the next stage is to build some initial or preliminary scenarios based on the determined logics – how the drivers and forces are seen to play out in the future and how they are linked to each other. Outlines of possible scenarios are then suggested: the scenario builders select a few scenarios that best cover the range and will be challenging to the decision makers. As discussed above, the views about the preferred number of scenarios vary. The final scenarios, the stories around the outlines are finally fleshed based on the chosen storylines. (Ralston & Wilson 2006, Schwartz 1998, Phelps et al. 2001)

There are many ways to sort and categorize the drivers and a wide array of possibilities to work out the preliminary scenarios. (see e.g. Phelps et al. 2001, van der Heijden 2005) The methods used in this study are introduced in main chapters 5 and 6. Building the alternative, initial scenarios, i.e. writing the storylines, is seen as the most challenging part of the process (Ralston & Wilson 2006). The scenario builder should manage to flesh out a set of scenarios which fulfill the needs of trust and relevance (see chapter 4.4), understandability and accuracy of their prediction (Schwartz 1998).

4.6.2.4 Implications

When the scenarios are built, it is time to get them into action. One needs to return to the focal issue or decision focus identified at the first step of the process and think how the decision looks in each scenario. The choice of strategic actions results from an in-depth analysis of the scenarios and thinking through the organization's best actions and responses in each possible future. (Schwartz 1998, Phelps et al. 2001)

There are many different techniques, which can be used in each stage of a scenario process. (Börjeson et al. 2006, Gausemeier et al. 1998) It is also possible, and in many cases preferable, to use a combination of techniques. (Börjeson et al. 2006, van der Heijden 2005) As discussed above, these techniques can be tightly statistical or mathematical, or on the other way, more qualitative and free-formed. E.g. Gausemeier et al. (1998), Börjeson et al. (2006) and Mannermaa (1999) present a large amount of different techniques applicable to different stages of a scenario process, which aren't introduced more deeply in this study. But the methods and techniques used in the stages of the scenario process conducted in this study will be introduced later in chapter 6.

4.7 Scenario method in analyzing future opportunities of e-business in the forest industry

In this study, scenario method is used to anticipate the future states of e-business in the forest industry. ICT technology offers many possibilities but also requires the forest firms to be ready for the changes and able to exploit ICT technology's opportunities as well as possible. E-business is more and more becoming an everyday way to do business in every industry. Along the changes in the end products and that way also the customers of the forest firms, e-business can and will become a natural part of everyday business in the forest firms too. But to be able to do business effectively in the future, the firms need to be prepared for the changes – i.e. the future has to be anticipated.

The scenario method offers a good tool for thinking over the possible futures. As discussed earlier, one of the greatest advantages of the scenario method is that it does not try to define "the future" but deals with multiple alternative future states. The forest industry is at the phase of many changes which may occur considerably fast. By being able to define the driving forces in the industry, which is an essential part of a scenario process, the forest firms can at least at some degree anticipate the events and changes to happen in the future and shape their actions according to them.

E-business as a phenomenon is rapidly developing. The solutions made today will possibly not be usable after a couple of years, so it is essential to be aware of the future. Because a lot in the future is dependent on the actions the firms will make, it is useful to think over multiple possibilities - which might be the consequences of certain events or activities, and try to aim to a future which is seen the most successful. The advantages of the scenario method for decision making are obvious but the use of the method requires an active role of the managers and the willingness to "create" the future.

5 THE SUPPORTING METHODS USED AT THE SCENARIO PROCESS

In this chapter, the methods and techniques used at the phases of the conducted scenario process are introduced. Every method, its principle, and the way and the reasons why the particular method has been used in a particular phase of the process are shortly discussed. The results extracted by the used methods are introduced in connection with the conducted scenario process in chapter 6.

5.1 GroupSystems in driver and event generation

The generation and assessment of drivers and events was conducted in GDSS laboratory at the Department of Industrial Management at Lappeenranta University of Technology. The laboratory is designed to support electronic meetings with computers for up to ten participants (see Piippo et al. 1999). The main group support system (GSS) used in the laboratory is GroupSystems, which was also used for the driver and event generation and prioritization at the conducted scenario workshop in the study.

GroupSystems is developed in the University of Arizona and Ventana Corporation. It contains all the general characteristics of GSS – it empowers face-to-face and asynchronous work sessions including tools for idea generation, prioritization, commenting and discussion. A remarkable advantage of the system is anonymity – the ideas and comments can not be connected to the users. The system gives the workgroups a supporting environment to quickly generate lots of ideas to solve problems or to find opportunities, distill those ideas to the very best, clarify exactly what is meant, organize the ideas, evaluate and prioritize them, build consensus among the team, and finally, produce deliverables that help the group to take action. (Turban et al. 2005, GroupSystems 2007)

The same kind of idea generation sessions are relatively widely used to gather information in the same kind of contexts in Lappeenranta University of Technology (see e.g. Piippo et al. 1999, Bergman 2005). In the scenario workshop, using the GDSS laboratory and GroupSystems as a support tool was perceived to be an effective and productive way. The scenario workshop participants' opinions about the fitness of GSS in the process are shortly introduced in chapter 6.

5.2 Clustering in arranging the events to the scenario sets

After the drivers and events were generated, commented and prioritized by the participants of the scenario workshop conducted at the process, it was time to look at the preliminary scenarios, i.e. form logical sets and that way the storylines of the scenarios from the generated events. The method chosen to be used to form the scenario sets in this study was clustering. There are many other methods which could also be used in that phase of scenario process, but these methods are not introduced in this context. Clustering was chosen mostly because of its former examined appropriateness for scenario set forming (see Piirainen et al. 2007b) and also because of its familiarity for the writer.

Clustering is an appropriate method exactly in situations where the grouping of variables is wanted to be done without necessarily having pre-knowledge about the basis of classification, which was the case in this scenario study. Clustering techniques thus apply when there is no class to be predicted but rather when the instances or variables are to be divided into natural groups. The clusters presumably reflect some mechanism that causes some instances to bear a stronger similarity to each other than they do to the remaining instances. Clustering rather explores the data or material than aims to strengthen some former-placed theory. (Metsämuuronen 2001, Witten & Frank 2005)

The clustering was done by Weka Machine Learning Workbench which is a collection of machine learning algorithms and data preprocessing tools developed at the University

of Waikato in New Zealand. Weka's graphical interface used in this study is called *Explorer*. The algorithm used to the calculation of parameter equations was *EM-algorithm* (Expectation-Maximization). EM alternates between performing an expectation (E) step, which computes an expectation of the likelihood by including the variables as if they were observed, and a maximization (M) step, which computes the maximum likelihood estimates of the parameters by maximizing the expected likelihood found on the E step. The parameters found on the M step are then used to begin another E step, and the process is repeated. (Witten & Frank 2005)

5.3 Mapping in illustrating the relationships between the drivers and events

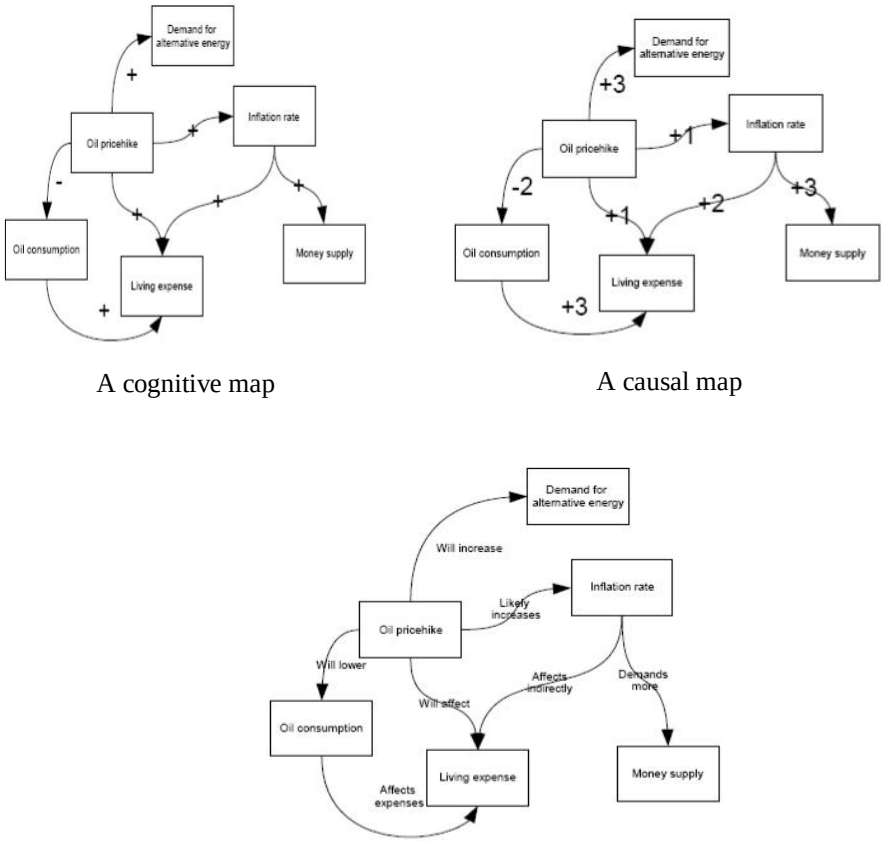
After the ideation and forming the scenario frames, i.e. clusters, the sets of drivers and events needed to be looked at more deeply and arranged to meaningful and reasonable entities. Therefore, thinking about and forming the links and causality first between the drivers and then, based on the drivers, between the events in the chosen clusters were the next tasks to do. Maps were experienced to be an effective way to illustrate the relations and links of different drivers and event sets in a comprehensive and all-inclusive way. The drawing of maps was done by a program called CmapTools.

The most widely featured types of maps are mind map, concept map, cognitive map and causal map. The main difference between these types is, that a mind map pictures a central concept and the branches of relating matters, as the other map types can be used to describe multiple concepts with intertwining relations and causalities. (Piirainen et al. 2007b) Because of its different nature compared to other mapping techniques and its relatively weak appropriateness to the uses of this study, mind mapping is not introduced more deeply here but the three other methods are next presented a little bit more accurately.

Concept, cognitive and causal mapping are methods for modeling interactions which take place in a complex situation. The maps consist of nodes and the connections, e.g. arrows between the nodes. The nodes represent variable concepts associated with some

attribute of the problem. An arrow or edge connecting two nodes indicates the presence of a cause-effect –relationship usually with the direction of the edge indicating which node is the cause and which is the effect. The main objective of building a map around a problem is to be able to predict the outcome by letting the relevant issues interact with one another. (Khan & Quaddus 2004, Perusich & McNeese 2006)

The principle of all three above mentioned map types is quite similar and they do not necessarily differ much from each other, but they all have their own special characteristics. In a causal map, the nodes are seen to have causal relationships of different strengths of positive or negative loading, depicted by a number – for example 1 can mean weak relationship and 3 can mean strong relationship between the nodes (Markóczy & Goldberg 1995). In a cognitive map the relationships between the nodes do not have specified strength, but they do have a sign which can be positive (a promoting effect) or negative (an inhibitory effect) (Perusich & McNeese 2006, Khan & Quaddus 2004). In a concept map, in turn, the connectors have written descriptions, "linking statements", instead of numerical strengths or polarity marks (Hay & Kinchin 2006). The examples of the three types of maps are introduced in figure 12.



A cognitive map

A causal map

A concept map

Figure 12: Cognitive, causal and concept maps (adapted from Piirainen et al. 2007b)

As in the case of any research method, the mapping techniques have also developed and had many varieties over time. However, the basics have remained the same. The decision about which mapping technique to use depends on the explored subject, as the modeled information can vary a lot by case. Because knowing the strength of affection between the drivers or events was seen as quite challenging by the writer and thus much of the deduction about the strength of the relationships would have to been done quite intuitively, causal mapping was not used in this study. The most extensive and comprehensible view of the relationships between the drivers and the logics and links between the events inside the scenario storylines was seen to be attained by combining cognitive and concept mapping techniques.

6 SCENARIO PROCESS

This chapter concentrates on describing the scenario process conducted in this study. An overview of the scenario workshop and the actions before and after the workshop are introduced. The principles of the methods and techniques used in the phases of the scenario building process are more deeply introduced in the main chapter 5, but the results and conclusions of every phase are discussed next. The scenario process as a whole can be seen as a heuristic one, as it includes some formality as the data was collected via a structured scenario workshop but as it is not tightly constrained to certain statistical methods or formalized techniques when forming the scenario sets and storylines. The creative environment emphasized by Masini & Vasquez (2000) was also supported all the way of the process.

In figure 13, the framework of the conducted scenario process is introduced. The process adapts mainly the basic steps of the scenario process introduced in chapter 4.6.2. The first stage was to define the process and its focus. The second step was to identify and assess the drivers of change and uncertainty. After the generation of the drivers and events, the preliminary scenario sets were created. As seen in figure 13, the scenario workshop dealt mostly with phases of driver identification and preliminary scenario set creation. The write up work was done to finish off the preliminary scenarios, revision and forming the final scenarios. The evaluation was done a little bit during the workshop and more accurately by the writer and by the participants of the workshop and some colleagues after the preliminary scenarios were fleshed out. The scenario storylines were revised and the final scenarios were created according to the proposals of the participants and some colleagues. The implications of the scenarios are left to be seen in the future.

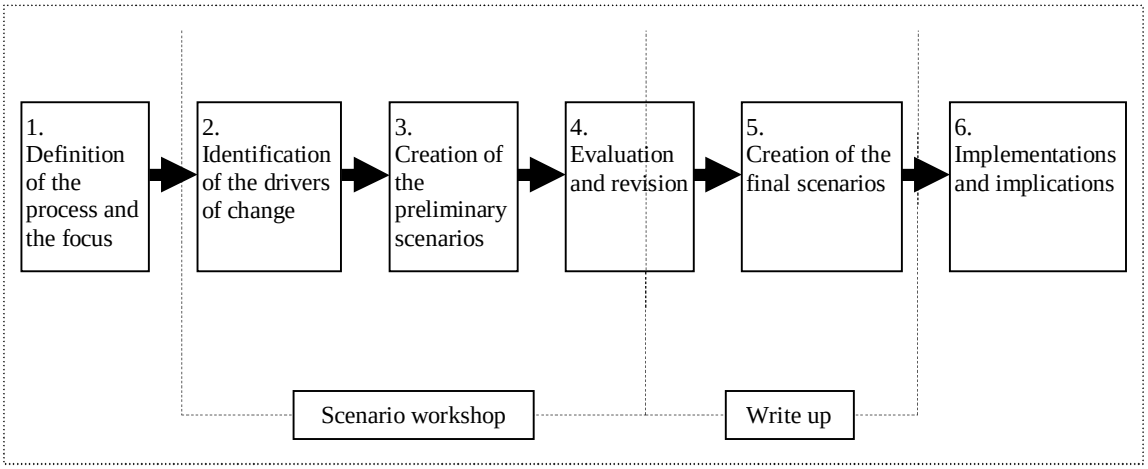


Figure 13: The scenario process

The scenario process started with defining the scope of the scenarios. The subject was chosen together with the Talikko project's leader and some researchers of the project. As discussed in the introduction in chapter 1, the chosen subject, e-business, is one of the four intersection areas explored in the Talikko project. E-business future solutions were experienced as an interesting and favorable area to be examined by scenario method. In the Talikko project, e-business is a shared interface for all three industries under scope – i.e. electricity networks and generation, forest and ICT. Nonetheless, because of the absence of representatives from the energy cluster, in this study the future solutions of e-business were explored concerning especially the forest industry. The chosen timeframe, 10 years can be considered as quite a long time to anticipate the development of e-business solutions, because changes in ICT technology happen relatively fast. Anyhow, the forest industry can not be seen as a quickly developing field but rather a little bit conservative and slow-moving, and for that reason the chosen timeframe for this scenario study is seen reasonable.

Because all the participants of the workshop were Finnish and thus mainly have experience of Finnish forest and ICT industries, the scenarios can be seen to concern especially e-business solutions in the Finnish forest industry. Anyhow, because the Finnish forest industry is very important actor in European and also in global scope, (see e.g. Finnish Forest Industries Federation 2000) the main findings can, from the writer's point of view, partly be generalized to cover European and global development of the forest industry. It must anyhow be remembered that Finland is a forerunner in

many information technology solutions (see e.g. Academy of Finland & Tekes 2006), so the changes in e-business solutions can possibly occur faster in Finland than in some other countries where the knowledge level of ICT is not as highly set despite the fact that the "hype" of ICT in Finland is gradually fading (see Meristö et al. 2002).

6.1 Scenario workshop - E-business in the forest industry in 2017

The scenario workshop was conducted in 30th March 2007 in the GDSS laboratory at the Department of Industrial Management at Lappeenranta University of Technology. As a whole, including a lunch break, the workshop lasted for five hours.

The group of the workshop participants consisted of representatives from ICT and forest industries and researchers and other specialists representing three different views of expertise in the e-business field: 1) the views of users (forest industry) and their customers, 2) the views of system planning and integration and 3) the views of networks and the cooperation of companies. The progress of the workshop is introduced in figure 14.

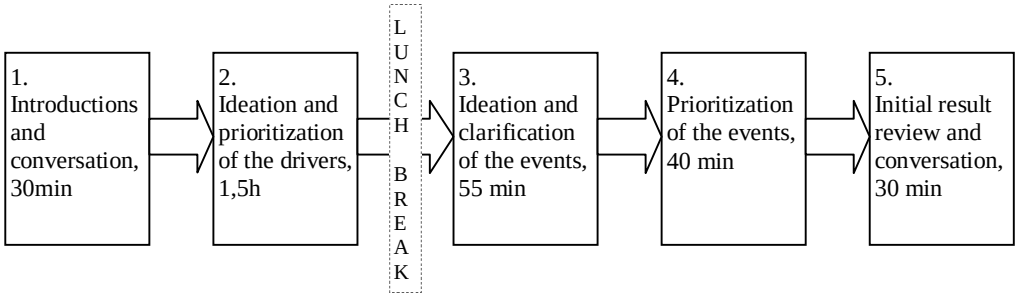


Figure 14: The progress of the scenario workshop

The day started with short introductions of Talikko project, the purpose of the workshop and this master's thesis and a short presentation of the scenario method and the ways it would be used in the workshop. The participants' first task to do was to ideate and generate drivers of change in the context of e-business according to PESTEL model (see e.g. Johnson et al. 2006) The divisions of PESTEL (Political, Economical, Social,

Technological, Ecological and Legal) were set to the categories under which the participants generated their views. After that, the drivers were discussed and prioritized with a vote to find the most important drivers. 20 most important drivers were chosen to more accurate examination afterwards.

The next task was to ideate events based on the generated drivers. The participants had a list of the drivers, by which they first generated events to a piece of paper for a while and after that they continued ideating with the electronic GroupSystems. The questions to aid the event recognition were “What kind of business opportunities the identified trends can open in ten years time?” and “What events these opportunities will create?” After the ideation the events were also prioritized, according to three different aspects: their probability of occurrence, impact to user’s business and technological impact. A ten-point Likert-scale was used, so that in the probability vote 10 is read as 100% and 1 is read as 10% and in the impact votes 10 was seen as highly positive and 1 as highly negative impact. These three aspects; probability, business impact and technological impact were the factors according to which the initial scenarios were created afterwards. The initial scenarios will be further discussed in chapter 6.3.

At the end of the day, the participants were shown a short look at the initial results and a short discussion of the day was held. The participants also filled a questionnaire to review the workshop and the GSS system. The questions dealt with the challenges of scenario process and the characteristics of GSS. The results of the questionnaire were mainly positive, as can be seen in table 5 where a short review of the results is taken. All the questionnaire items are not introduced in this context, but the most relevant for this study are shown by the average and standard deviation of the answers. The results are introduced more accurately in the study of Piirainen et al. (2007a).

Table 5: A review of the questionnaire results (adapted from Piirainen et al. 2007a)

Questionnaire items	Avg.	St. dev.
The brainstorming process (1 completely disagree - completely agree 10)		
The goals of the session were clear	8,57	1,40
The goals were reached	8,14	1,21
Do you feel that the process provides useful results	8,50	1,22
Do you consider the results as realistic and relevant to your company	7,86	1,35
The session was confusing and relevant steps were skipped	2,43	0,79
The results are trustworthy because of the process	4,71	2,29
The results are trustworthy because of the used work methods	7,29	1,38
Work methods (1 completely disagree - completely agree 10)		
The process helped in getting and outline ideas	7,71	1,25
Evaluation was a useful and relevant phase	8,43	1,51
The process was logical and proceeded fluently	8,29	1,5
I did have time to apply my mind to the evaluation and the results were reliable	6,86	2,43
GSS-environment in the process (1 completely disagree - completely agree 10)		
GSS fitted naturally with scenario process	8,86	1,21
GSS helped in observing different perspectives	7,57	2,64
GSS helped in creating trustworthy results	7,43	1,27

6.2 Mapping the drivers

Because the causality between the drivers or events was not voted in the workshop, this job was first done by the writer and the maps were afterwards assessed by the participants of the workshop and a few colleagues, and shaped and revised according to their proposals. Some guidelines of the causality between the drivers and events arose from the discussion and comments of the participants during the workshop, but a majority of the deduction work was done by the writer herself. As discussed in chapter

5, cognitive and concept maps were used to form the frameworks for drivers and the scenario storylines.

First, the 20 most important drivers voted in the workshop were explored and the links and connections between them were tried to deduce. Among the 20 most important drivers there were drivers from every division of PESTEL. The biggest group was economical drivers – among the 20 selected drivers there were six economical drivers as from the other divisions of PESTEL there were only two or three. The reason for the large amount of economical drivers is partly explained by the comments of the participants. One participant argues that economical drivers are the most impacting ones, technological drivers are those which restrict and "dictate" what kind of solutions are possible, and the role of other drivers (political, social, ecological and legal) is rather to "disturb" the development. Another participant agrees and assesses the impact of economical drivers to be 95% of the all drivers of change in the e-business context. The drivers and the divisions they are belonging to are introduced in table 6.

Table 6: 20 most important drivers of change

Driver	Avg.	Division of PESTEL
Common global standards	9,38	**T**echnological
Continuing usability of infrastructure	9,00	**P**olitical
Implementation of integration standards	8,75	**T**echnological
Economy's dependence of 24/7 -technology	8,50	**E**conomical
Tightening competition	8,13	**E**conomical
Availability regulations of electronic services	8,00	**L**egal
Traceability of cases in states of exception	7,88	**E**cological
Legal claims to more ecological production	7,88	**E**cological
Cost savings	7,88	**E**conomical
Increasing information technology preparedness of people	7,75	**S**ocial
SOX-CEO requirements for reporting	7,75	**L**egal
Network economy	7,63	**E**conomical
Global competitive environment	7,63	**E**conomical
Outsourcing/off-shoring	7,50	**T**echnological
Filing responsibility and readability of information	7,50	**L**egal
Actual advantage to the paying customer	7,50	**E**conomical
Common international ways of action	7,25	**S**ocial
Efforts to influence to the competitiveness of own country, continent or coalition	7,25	**P**olitical
Easy information transmission between different systems	7,25	**P**olitical
Supportiveness to remote working in purpose to avoid ecological harms	7,25	**E**cological

To get a more logical overview of the drivers and their causality to each other, one of the 20 most important drivers was left out from the cognitive map and two drivers - data security and information overload which were also ranked relatively high in the vote and seen important by the writer for the entireness were taken on. The cognitive map will be introduced and discussed more accurately in chapter 7.1.

6.3 Creating the initial scenarios

As discussed earlier in chapter 4, there are many possibilities how the initial or preliminary scenarios can be created. A method used for the creation of the initial scenario sets which was experienced to fit best to the context of this study by the writer was clustering. The method of clustering is shortly introduced in chapter 5, so in this chapter only the principles and the results of clustering are introduced.

The phase of forming the scenario logics inside the three scenario sets can be characterized as quite a complex but extremely interesting phase of the process, as it included everything from plastering Post-it notes at the wall to raw writing and literature reading work. The initial number of clusters was four, but because the fourth cluster included only three events, the events of this cluster were included to scenario number 3 for their best appropriateness to the cluster's scenario set logic. The eventual number of formed scenarios thus was three.

To attain the scenario logics as well as possible, and that way to get credible and logical scenario storylines, a couple of modifications were done to the borders of the initial clusters, which means that some events were moved between the clusters. Most of them were situated in the intersections of two scenario clusters, so they could be naturally moved from one cluster to another. A couple of events were quite far away from the borders of the clusters they were moved to, but the removals can be explained by the logicality of the entity. The re-situation of some events is also shown in figure 15 and 16, as the borders of the scenarios 1 and 2 intersect. In the intersection area between the clusters 1 and 2 there are a few events which were possibly seen to be used in both scenarios. During the writing process that was not anyhow seen to be necessary or even useful.

The clusters were formed by all three factors: probability, business impact and technological impact. Because a picture showing events according to all three factors set as axes would have not been very informative, the clusters are introduced in two separate figures (see figure 15 and 16) – one with the probability and business impact axes and one with the probability and technological impact axes.

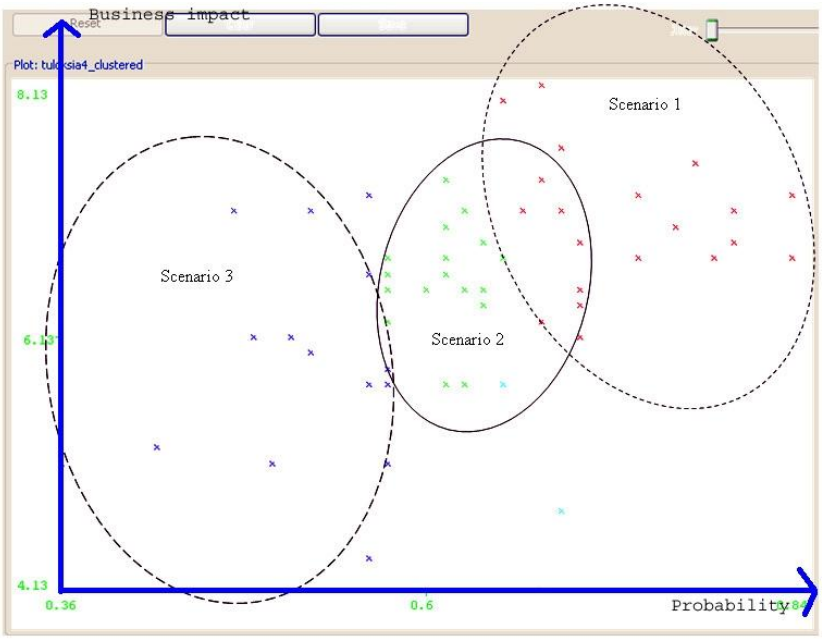


Figure 15: Clustering of scenario sets by probability (x-axis) and business impact (y-axis)

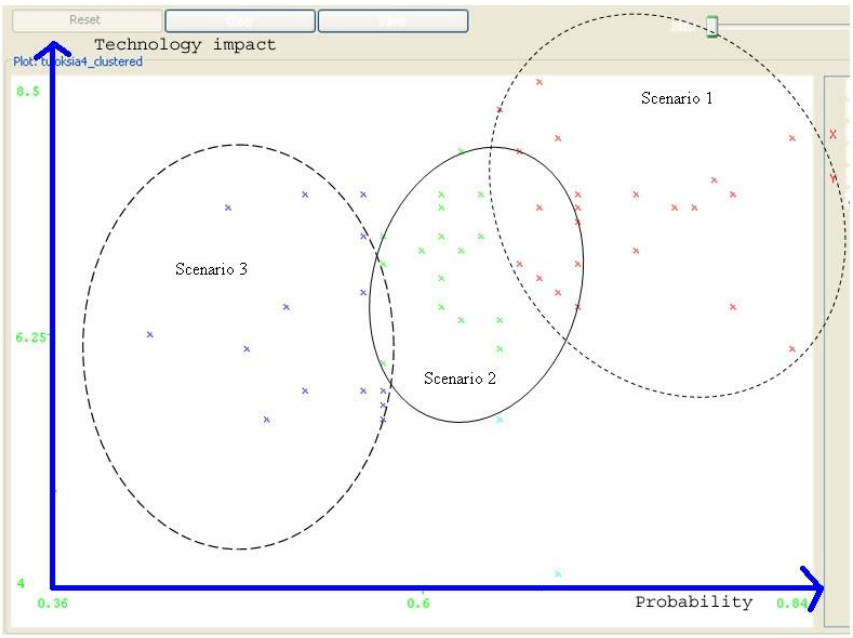


Figure 16: Clustering of scenario sets by probability (x-axis) and technological impact (y-axis)

As can be seen from the figures 15 and 16, the events which are seen to have most impact on business and technology and which also are experienced to be quite probable to happen, are situated in scenario 1. Scenario 2 is formed by the events which are seen

to have smaller impact on business and technology and which are seen to be quite probable to happen. The events of scenario 3 are not seen as probable to happen as the events of the other scenarios, and the impacts on business and technology are not seen very strong. The reason for that can be the nature of the events which is rather more societal and legal based which is not necessarily the case in the scenarios 1 and 2. The events thus could be seen to have a stronger impact on other dimensions (e.g. society and ecology) than the assessed ones in the vote.

The events were also examined to find out if there were some events which could have a lot of impact on user's business but which do not have a lot of technological impact or impact on the producer's earning logic – and vice versa. The events were situated in co-ordinates, where business impact forms the x-axis and technological impact forms the y-axis. As can be seen from figure 17, that kind of events were not actually found. This can also be noticed from pictures 15 and 16 about the scenario sets as the event points are situated very same way in both pictures and the event sets circles are very much same kind. On the grounds of the figure 17, it can be said that events which seem to have a lot of impact on user's business has also relatively strong technological impact, and the events which do not hold a lot of business impact, neither hold a notable amount of technological impact.

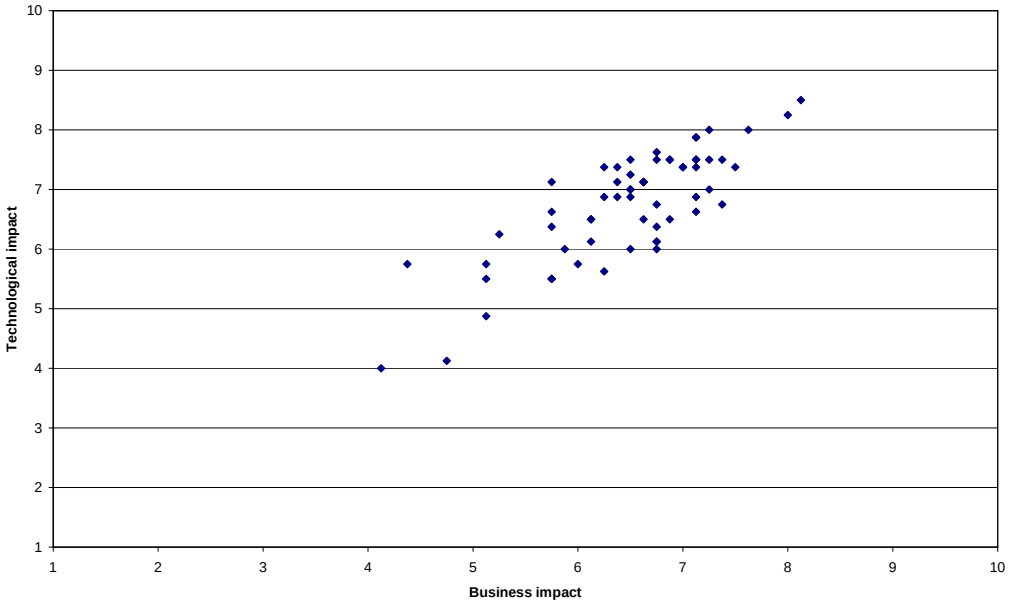


Figure 17: The events situated in a co-ordinates of business and technological impact

Even though the industry area in which the e-business solutions are thought about and researched in this process is the forest industry, from the writer's point of view the results can at many parts be generalized to other traditional industries, where the changing pace has also been relatively slow but the fastening pace of changes poses needs for new supporting tools to make the business actions more effective. This is the case for example in the energy industry, which has been characterized as quite a conservative industry but which is at the moment facing a fast development and the needs for more efficient ways of action. The most notable change in the demand conditions in the industry has been the opening of the electricity market, which has given the customers a possibility to change the electricity supplier freely. (Hernesniemi & Viitamo 1999, Finnish Energy Industries 2005) The energy industry is also strongly related to the forest industry, which probably means that many of the e-business solutions mobilized in the forest industry may also have influence on the actions in the energy firms.

7 SCENARIOS: E-BUSINESS IN THE FOREST INDUSTRY IN 2017

In this chapter the three formed scenarios are discussed. First, a cognitive map of the drivers of change which were voted as most important among the scenario workshop participants is introduced and the drivers are discussed. After that, the scenario stories around the events are told. Because of the large size of the scenario maps, the whole scenario maps are shown in the appendices I-III and only the simplified pictures presenting the main themes of the maps are introduced at the beginning of each scenario story. In the maps in the appendixes the events are put in the boxes and between them along the arrows some comments, so called linking phrases concerning the events are given. These comments are not shown in the simplified pictures.

The linking phrases in the maps are partly taken from the comments and drivers written by the workshop's participants to the system, partly from the discussion along the workshop, some of the linking phrases are written based on the literature about the field, and also the results from the Talikko project's Delphi research are utilized to complement and enrich the phrases. The linking phrases and the events' relations to each other are thus mainly consequences of the deduction work done by the writer. That is usually the case when building scenarios as some space of imagination is always left to the shoulders of the scenario story writer(s). As in the words of Schwartz (1996) "scenario building is art, not science" and the fact that two completely similar scenario processes can never exist, because the process is always dependent on the context and the persons participating the process, makes scenario planning an extremely interesting way to anticipate the future. That has also been noticed by the writer during the process.

As will be seen from the scenarios, the drivers of change are used in different contexts in different scenarios. The events and their relations to each other in the concept maps are not tightly time-dependent, even though a timeline is drawn in the simplified pictures at the beginning of each scenario story. A more decisive thing is the logic of the scenarios, i.e. that the events of a scenario can naturally be seen to fit together.

7.1 The drivers of change

The most important drivers and their relations to each other are shown in figure 18.

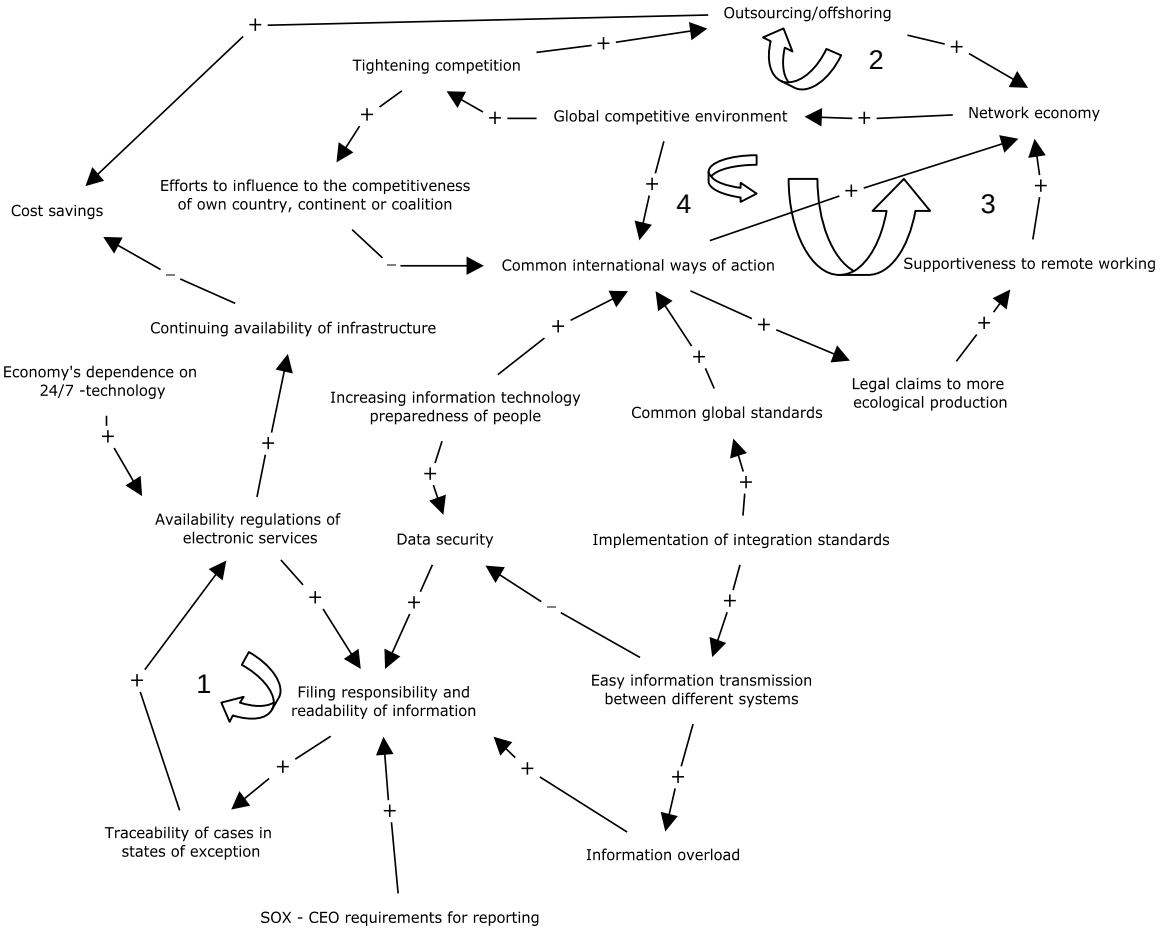


Figure 18: A cognitive map of the drivers of change

Although data security was not voted among the 20 most important drivers, it was seen highly important factor in the development of e-business solutions and for that reason picked to a further examination by the writer. One of the workshop participants estimates that over 100 000 attack efforts to e-mail can occur in every second so the systems must be highly secure. Availability of information and easy transmission from one system to another create new possibilities but also remarkable challenges to data security, so easy information transmission is seen to have negative impact on data security in the map. The filing responsibility and the readability of information are seen to cause challenges to equipment – the participants argue that much of the former

archived data is produced by equipment which might not be in use anymore, and the new hardware may not be able to handle the information, which can in that case become useless.

Data security requirements together with information (over)load and legal requirements for reporting are seen to increase the need for filing and readability of information. In the loop 1, the increased filing responsibility increase the possibility to trace the cases in the states of exceptions, which was seen mainly as an ecological driver in the workshop, but from the writer's point of view can as well belong to other categories of PESTEL and for that reason situated most naturally in the loop 1 in the map. The needs to traceability of cases naturally increase the need for availability regulations for electronic services which again is seen to increase the filing responsibility but also to improve the continuing usability of infrastructure. The claims for the availability for the infrastructure is seen to have a negative effect to cost savings, as the guaranteed availability of electronic infrastructure often causes new costs for the organizations.

Only two social drivers were seen to belong among the 20 most important ones. Much of the conversation was engaged on the graduating heterogeneity and internationalization of population. That was seen to cause both possibilities and problems. The internationalization of population and this way also the firms operating in the forest industry can open new gates to global networking, but it also causes problems, because the level of civilization varies a lot between the countries. The aging of workforce was seen to have positive effects as the younger workforce was seen to be more used to work with computers and information systems. Nevertheless, the retiring workforce has a huge amount of knowledge, especially tacit kind, which has to be successfully transformed to the next generations. In this task, effective information systems were seen indispensable.

Technological drivers were seen to be merely restricting ones; the participants see technological drivers as factors which dictate what kinds of changes are possible to follow through. A lot of conversation was engaged of the divergence of operations and ownership of knowledge. Much of the operations of bigger organizations have already been outsourced, but the ownership still remains tightly in the hands of original

organizations, as in Nokia which has outsourced nearly everything in its supply chains. From the writer's point of view, this has a strong connection to the network economy and this way also to global commerce.

This leads to the loop 2, where network economy is seen to influence the formation of global competition environment which causes tightening competition as the amount of the players in the field increases. The tightening competition spurs and also obligates the outsourcing or even off-shoring of actions which leads back to network economy and global competitive environment and that way to intentions to common international ways of action. It should be notable, that the efforts to influence the competitiveness of own country, continent or coalition can nevertheless weaken the willingness to follow the common international ways of actions. The workshop participants bring out the possibility of using political ways to affect the business of the other side's organizations in one's own markets.

The loop number 3 starts from the grounds of the loop 2. Common international ways of action can be seen to increase the needs for legal claims to more ecological production. The legal claims can draw the firms to support remote working in intention to decrease ecological harms. Remote working can be seen to have a link back to the network economy and so on. One remarkable thing is that in the driver set remote working was seen to reduce ecological damages. Nevertheless, the impacts of remote working were also seen to be the opposite - it can also increase pollution, as the distances can be long and cause a lot of traveling. Inside the loop 3 there is also a smaller loop 4, which forms a natural connection between the network economy, global competitive environment and common ways of action.

As seen from the cognitive map, the influences between the drivers are mainly positive. The impacts of the drivers were seen as rather increasing the possibilities of the development of e-business solutions in the forest industry than decreasing them. That is strongly linked with the results of event prioritization vote, where the most of the events were seen as quite probable and events with weak impact on business or technology were relatively rare.

7.2 Scenario 1 – "24/7 functionality"

The first scenario consists of 19 events with their linking drivers and other linking factors. In the figure 19, a simplified framework of the scenario is shown. The whole scenario with its events and the linking phrases between them are shown in appendix I.

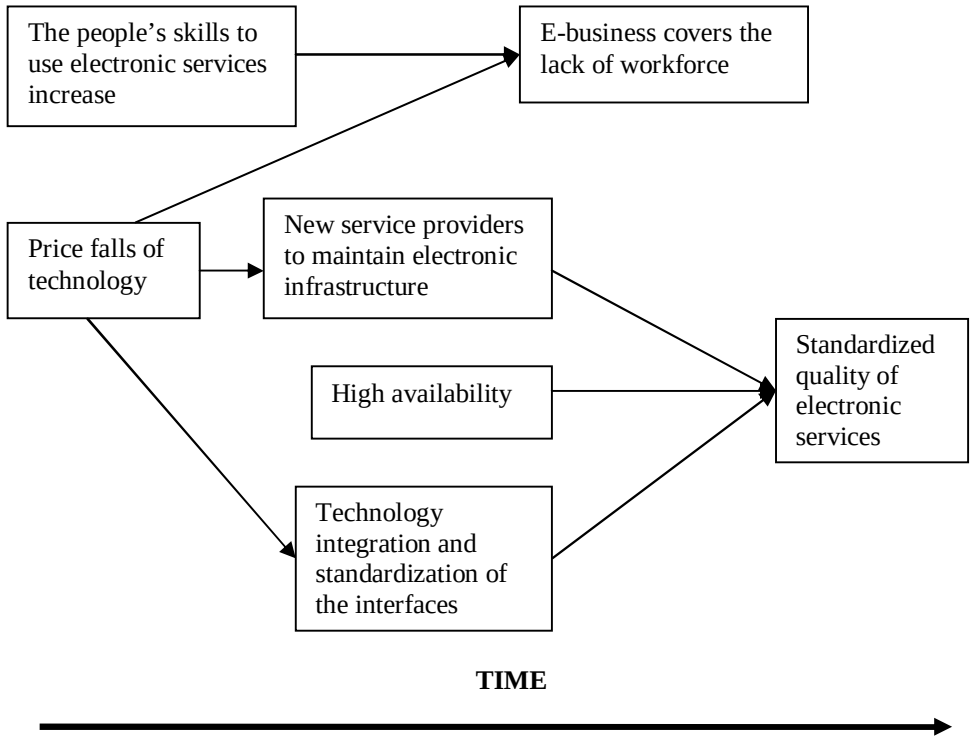


Figure 19: A simplified picture of the 1st scenario

As seen in figures 15 and 16 in chapter 6.3, the events forming the first scenario are seen as quite probable to happen and also having relatively lot of impact as well on forest firms' business as on technology. The scenario has two different ending points which are seen to be reached along different paths.

The widely known fact is that new generations are more used to work with computers and do business electronically, so the people's skills to use electronic services increases little by little making e-business a part of people's everyday life. That is the beginning of the first storyline of the scenario. As discussed earlier in chapter 2.2.1, the Finnish

forest industry is facing the lack of high-educated and talented workforce as the structural lack of workforce is expected to happen in Finland in the near future. That lack can be supposed to increase by the year 2017, even though development in educational structure and education programs happens all the time. The lack of workforce can cause the need to hire workforce from abroad. Besides of the lack of workforce, the Finnish forest industry needs expertise and new innovations from abroad as the companies are operating more and more globally. The workforce hiring from abroad generates more heterogeneous, usually relatively highly educated people working in the forest industry. The increased computer skills of more heterogeneous workforce are seen to have an impact on the emergence of high level of use of electronic applications which have relatively high usability. The increased use of electronic business solutions can finally partly ease the need for workforce and thus cover the forest industry's structural lack of workforce.

As long as the lack of workforce is emerging in the forest industry, this kind of development path can be seen as highly positive. However, the participants of the scenario workshop remind in their comments, that as the e-business solutions will develop all the time and that way can also go "too far", they can also have a negative effect for the need of human labor. Anyhow, in this scenario that kind of development is not seen to happen by the year 2017.

The next beginning of storylines are the price falls of technology which are seen to bring wherewithal to small actors. As discussed in chapter 2.2, the Finnish forest companies have concentrated forcefully into large groups of companies for the last 15 years. Anyhow, smaller actors still exist in the forest industry, especially if the business actions are considered to cover all the parts in the supply chains and though including actors from the supporting industries around the "core" of the forest industry. As in this case as the whole forest cluster can be processed, small actors can exist in many phases of the product supply chains. One of the main entry barriers for smaller actors in the usage of electronic business solutions has seen to be the relatively high prices of ICT technology. Along the price falls of technology, these solutions become economically available also for smaller firms. That has an impact on the increasing usage of the

solutions and that way again finally on a possibility to cover the structural lack of workforce by e-business as the ways to work become notably more effective.

In the next branch, the small actors naturally intent to cost savings and efficiency and try to create different networks, especially regionally. The costs savings are certainly not the only reason for networking - in the network the exploitation of know-how eases up and the competitiveness of a region probably increases by more effective know-how exploitation and knowledge transformation. And as the knowledge and know-how moves in the network, so the requirements for data security tighten. The tightened data security may lead to the abandonment of old equipment, software and ways to work, and to more standardized quality and higher level of used electronic services.

At the same time, the ongoing outsourcing of electronic infrastructure is expected to continue. That leads to the emergence of new service providers to maintain the infrastructure. That event can be seen as very essential to the scenario as it leads to four different development paths. First, the development of learning data mining and the needs for data prioritization from the large amount of data generate the need for expertise of analytical customer relationship management (CRM). Along the emergence of new service providers the report generators specialized to tighten up the data are born.

Along with the emergence of new service providers, the economy becomes more and more dependent on 24/7 –technology, which emphasizes the role of quality assurance and testing services. Faster data transmissions make the measuring of performance more real-time which leads again to the standardized quality and high level of electronic services as does the high quality software production which is also consequence of the emphasized role of quality assurance and testing services. The economy’s dependence of 24/7 –technology also leads to the emergence of availability services whose role is to guarantee a certain availability of the infrastructure for certain customers. The needs for the systems to operate trustworthily every time generate the increase in demand and supply of high availability solution providers by whom the continuing availability of electronic infrastructure is tried to attain. That can again lead to standardized quality and higher level of electronic services.

The emergence of new service providers can also be seen to increase the need for technology integration between different firms. At the same time, the attempts to process and project management integration and the needs for more intensive standardization of electronic processes in the forest firms increase. The needs for technology integration and "mapping" between different standards, for example integrating papiNet invoice to UBL invoice, increase the amount and use of data integrators. The implementation of integration standards by which the different technologies and applications can better be fitted to work together, leads again to the standardized quality and higher level of electronic services.

Along the emergence of new service providers and the forest firms' attempts to attain a good price and quality ratio of their capacity, the forest firms may end up to use rental services of computational capacity. The computational capacity needed usually varies a lot, and the occasions when notable large amount of capacity is needed are rare. That is why the forest firms might not need own mainframe computers but it is more reasonable to rent the computing services from elsewhere when needed.

As can be seen, the storylines of this scenario are strongly connected to a group of the providers of different services, as availability, standard mapping, capacity rental and data processing services. This is partly the case also today in e-business in the forest industry firms. However, the compatibility of the systems and the effectiveness and capacities are notably more developed in the scenario. In the scenario e-business can be characterized as a natural, effective and also predominant way to do business. As the companies' globalization is expected to continue, the standardization of the e-business systems is a prerequisite for the forest companies to survive in the competition. High quality has been a "trademark" for the Finnish forest industry, and it is important to follow that guideline as the systems and services become more and more electronic.

This scenario can be seen quite probable, because the majority of the changes are possible to implement with the existing technology. From the scenario workshop participants' point of view, the bottom line of the development is rather the attitudes and willingness to change. Some kind of "settler spirit" is needed, if the changes are wished to come into action completely. The competition in the forest industry is hard, and

creates increasing pressure to more effective ways to work. The increasing needs for cost savings run the actors in the supply chain to tighter cooperation as the actors of the supply chains usually work quite separately today. That is why it is probable that the individual systems will decrease and the integration of the software and applications becomes predominant. In the scenario, however, the emphasis is rather on the integration of internal systems and the electronic functionality of the customer relationships, although the electronic cooperation between the firms is expected to develop all the time. The increasing skills of the workforce to use electronic systems give a good basis for the objective of the scenario, standardized quality and high level solutions which are effectively used in the firms' business actions – "24/7 functionality".

7.3 Scenario 2 – ”Outsourced systems and active networks”

The second scenario is formed by 20 different events with the linking drivers and factors. A simplified picture of the scenario is shown in figure 20, and the whole scenario with its events and the linking phrases between them is shown in appendix II.

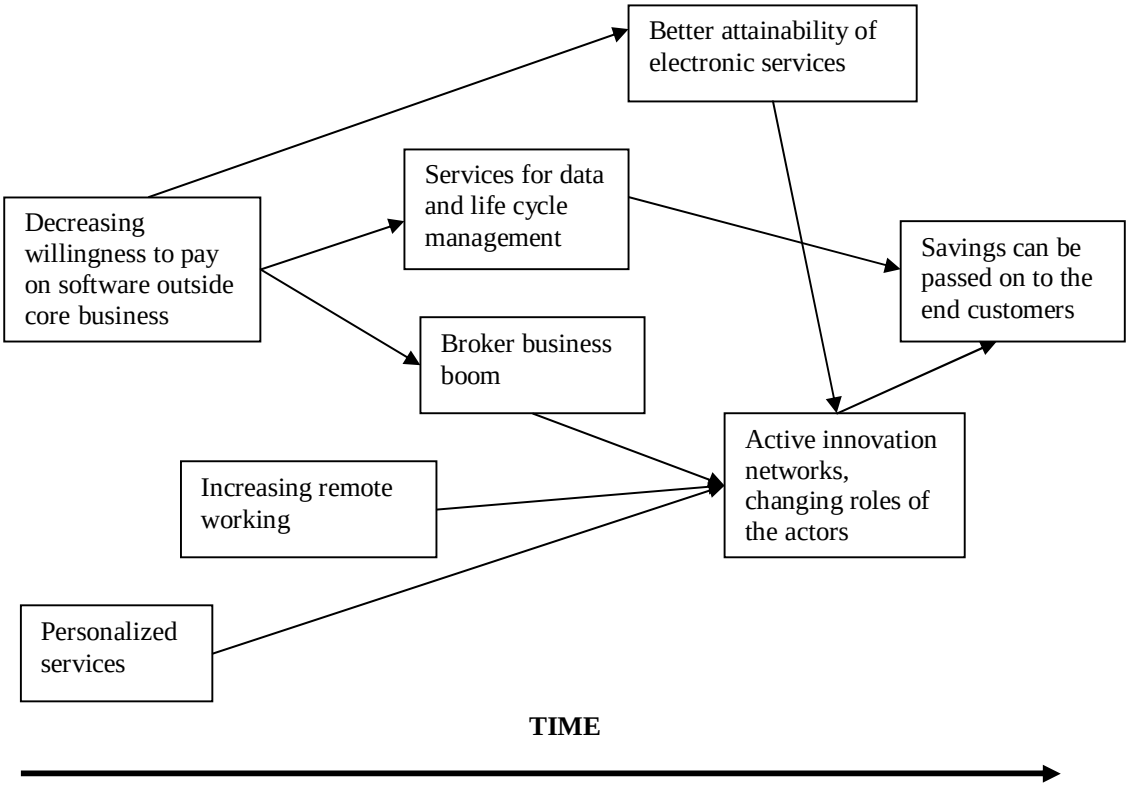


Figure 20: A simplified picture of the 2nd scenario

The events of the second scenario do not differ much from the events of the first scenario by their business and technological impact. They are seen to be quite probable to happen, even though not as probable as the events belonging to 1st scenario (see figures 15 and 16 in chapter 6.3). The emphasis of the scenario is anyhow a little bit different.

The scenario concentrates at the same time on highly developed IT business solutions inside the firms and on building innovative and active networks of actors along the

supply chain. As discussed in chapter 2.3.1, the trend in today's development of e-business solutions in the forest sector is to make as well the internal as the external processes effective. However, the all supply chain covering integration is just at its beginning today. So the objective of the scenario can be seen to be relatively ambitious but not impossible at all. As in the case of the first scenario, the most decisive factor is the firms' willingness to cooperate and the "settler spirit" to make things done.

The core idea of the scenario is, that along effective IT solutions and developing cooperation and openness along the whole supple chain, electronic systems become better available for everyone, even for the smallest actors in the networks, and the savings of the utilization of e-business solutions can partly be passed on to the customers by which it is possible to increase the companies' revenue and competitiveness. The brokers have a notable role in matching the needs of the firms and they are seen to become a trusted third party in the electronic business actions.

´The scenario begins with the decrease of the forest firms' and other supply chain actors' willingness to pay on the software outside their core business areas, which lead to as well more open software development as to the increasing outsourcing of data processing systems. In the first branch of development, the implementation of integration standards, which in the scenario workshop participants' opinion is a remarkable driver of change in the forest industry's e-business field, leads to the increasing openness and standardization of application interfaces which from its part starts up a competition in application architecture. At the same time, the open source supporting service business is growing. These events have an increasing impact on the software quality. Model-based software development becomes more predominant and new services to business/IT –interface to enable faster system implementations are born. By these services, the electronic systems can be seen to become more attainable for the heterogeneous actors in the networks.

At the same time, the division of data exploitation and data ownership continues which has been the progression in many companies in recent years. That kind of development is natural also for forest companies, as they usually do not own sufficient ICT expertise by their own. Many of the new service concepts are born to manage the usually quite

fragmented data of the business processes, e.g. securing, storing and renewal services to offer real-time and exploitable data archive to the use of the firms, business concepts for the maintenance of a business field's metadata and service providers specialized to the management of life cycle information.

The needs for creating a modifiable, effective model for the maintenance of the ICT solutions of a firm's business processes, called "enterprise architecture -thinking" increases the use of business portals which offer comprehensive solutions to the management of electronic business data. That again leads to the emergence of services in business/ICT –interface to enable faster implementations of the systems and that way to the attainability of electronic services for the network actors. As the needs for tightened control emerge, the centralized control systems to IT solutions can be naturally included in the business portals.

As discussed before, the decreasing willingness to pay on the software outside the core business leads to the outsourcing of data processing systems. The amount of "thin" client systems of long life cycle and slight maintenance increases. The purpose of a thin client system is to enlighten the business processes and make them more effective, i.e. the overlapping and time-taking processes, software and equipment are tried to cut down, and all the firm's business processes can be easily managed by a light and effective system. (see e.g. HP 2007) As the trend to combine all the systems and data needed in the business processes is expected to increase, the use of thin client systems can lead again to the enterprise architecture –thinking and that way to the use of business portals and so on.

The outsourcing of data processing systems also lead to the usage of brokers, and the broker business, i.e. intermediaries between the producers and customers is expected to boom. Service broking in the supply chains is seen remarkable as the volume and automation of electronic operations models increases all the time. So, the booming of broker business can be seen again to lead to the attainability of electronic systems to the heterogeneous actors in the networks. On the other hand, the "social networking", i.e. the forming and maintaining the relationships, gives a possibility to move away from

pure production-subcontracting –networks to active innovation networks which can change the roles of the actors.

The thin client systems discussed before also offer great relieves for remote working, which is becoming more and more a common way to work. Already today, remote working is a daily way to work for many people. Many new remote working management applications are and will be developed and along with the thin client systems new effective tools for remote working can be found. At the same time, because of the increasing requirements from the customers, the personalizing services are developing. By the effective tools for remote working, the supply providers of personalized remote working services can be seen as a natural way to the development. Along with the moving from email to more structured information transmission which is easier to follow-up afterwards, the personalized remote working solutions can lead to new, innovative ways to work and probably, again, to active innovation networks and the changing role of the actors.

At the same time of the development of personalizing services, also the electronic signature is strengthening its position. The boom of electronic business transactions can be seen to continue and the development is going towards a one trusted electronic profile instead of multiple application specific ones. Electronic identification is seen to become an easy and natural way to identify people electronically without a need for social contact, and that brings many new opportunities to the e-business solutions. That path leads again to a possibility to move away from traditional networks to active innovation networks and the changing role of the actors.

At the end, the attainability of electronic systems along with the increased economic availability of technology, which can be seen to be caused by common development in the e-business field, lead to the active innovation networks. The growth of business actions and the attained value added finally lead to the situation where the savings of the utilization of e-business solutions can partly be passed on to the customers and that way the firms' revenues and competitiveness can be seen to increase.

In the second scenario, the utilizing of e-business can be seen highly effective and also cost-saving. Anyhow, many of the solutions, e.g. business portals are still relatively costly, and can thus restrict the opportunities of the smallest actors in the field to get the complete benefit out of the systems. Along the more effective networks and cooperation the smallest actors can anyhow be connected to the electronic value chains and at the same time the larger actors can successfully develop their internal systems and architectures. The second scenario goes a step further than the first scenario as the objective is not just to make the systems work together but also make the whole supply chain, including the smallest actors, work as well electronically as socially effectively and trustworthily from the producer to the end consumers.

7.4 Scenario 3 – "Global and local control"

The third scenario includes 16 events with their links. A simplified picture is shown in figure 21. The whole scenario with its events and the linking phrases between them is shown in appendix III.

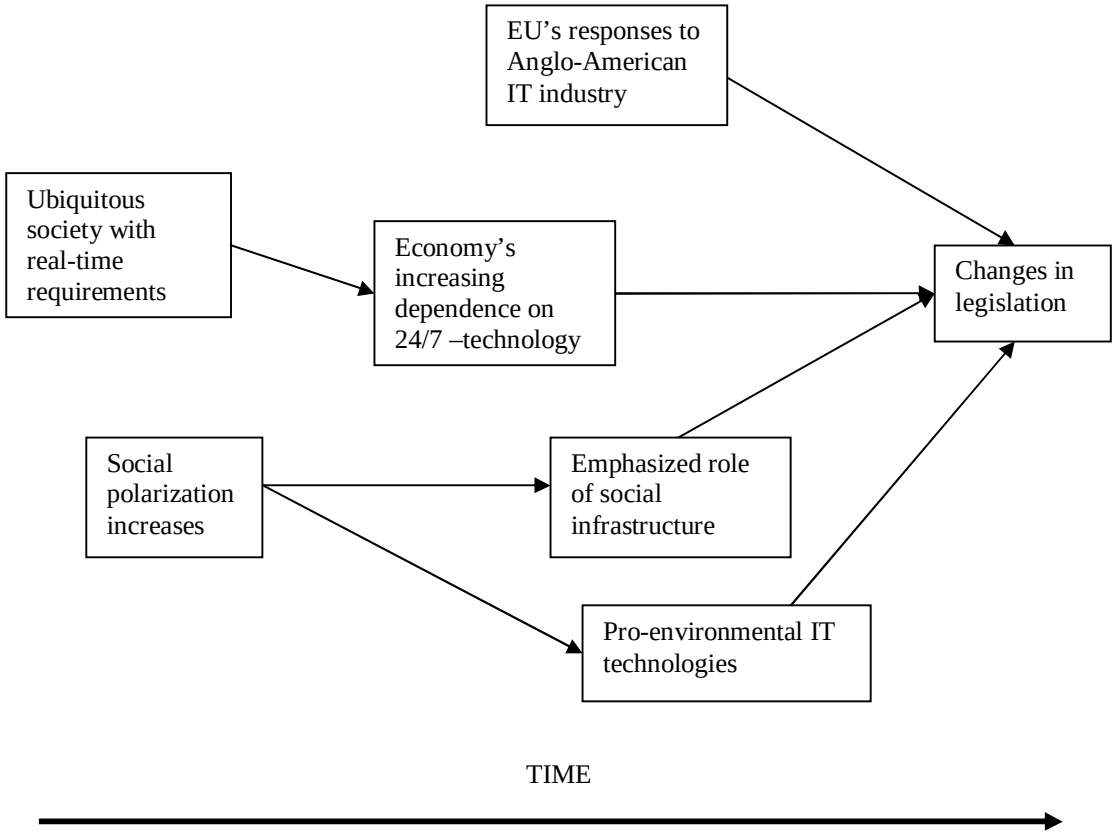


Figure 21: A simplified picture of the 3rd scenario

The events of the third scenario are not seen as probable to happen by the workshop participants and a majority of them do not have as much impact on business and technology as the events of the two former scenarios (see figures 15 and 16).

The events of the third scenario can be characterized as more "societal" by their nature, and it can be seen that their impact is not headed as directly to the business actions of the users or to the used technology even though the changes themselves can be quite impressive. The events and changes can be seen to relate the e-business' development

widely and do not necessarily have to be strictly related to the forest industry field but also can be seen to happen in other industries.

At the beginning of the first three storylines, USA is seen to stand more tightly behind its own IT industry. That event does not expectedly have a huge impact on the users' business or the technology as the impact of the event can rather be related to the efforts to influence to the competitiveness of own country or coalition. For the European Union (EU), anyhow, this is a challenge to which it tries to respond. As a respond to Anglo-American software industry, EU is seen to develop open solutions and the quality of software development is expected to increase. The demands for more transparent reporting are seen to increase as well in Finland as in EU in common. These demands lead the Finnish government to move on to open file formats by the principles of the law of publicity. The increasing needs to get out of the immatureness of the legislation to serve the global economy finally lead to the extensive changes in legislation.

The efforts to influence the competitiveness of own country or coalition turns the looks to the forest industry's own education programs. Forest industrial education programs exist in numeral educational establishments also today (see e.g. Finnish Forest Industry Federation 2000), but the changing and globalizing competitive environment poses new requirements which are not necessarily fulfilled by the existing education programs. Naturally the technological change and the structural lack of workforce, which was discussed in the first scenario, are notable factors affecting the change of the educational needs. The education and the industry's needs thus can be seen partly divided. That leads to the establishment of integrator business of education and educational needs.

The next storylines start from the all-easing intercourse of the people and machines which can be seen to be a consequence as well of the falling prices and the development of technology as of the increasing skills of people to use computers and electronic services. Continuing development of wireless ICT technologies leads to a more and more ubiquitous society which offers many new possibilities but also requires everything to function real-time. The requirements of the society also lead to fastening development of artificial intelligence applications.

At the same time the economy becomes more and more dependent on 24/7 –technology. As technological infrastructure becomes more critical so does the social infrastructure which is emphasized in interactive real-time systems. That again fastens the demand and that way the development of high quality artificial intelligence applications. At the same time remote working is strengthening its position as a common way to work. However, the remote workers also need social contacts and the needs for social networking are tried to fulfill with remote working cafeterias.

In the last storyline, social polarization is expected to continue. That along with the globalization of the companies naturally causes increasing environmental harm. The firms will implement new, pro-environmental technologies and that way data-processing is expected to become more pro-environmental. Remote working is also more and more supported in purpose to diminish ecological harm. These actions, however, are not enough, as the pro-environmental technologies and processes are not utilized in the same scale in every country and company. So, extensive changes in legislation are still needed.

The clear “ending point” of the scenario is difficult to find and that is why the scenario includes a few, quite separate storylines. However the “big picture” is clear – extensive changes based on high-technology solutions, increasing skills and know-how of people to work with the computers and strong polarization and globalization which lead to the needs for renewals in ecological thinking and social network supporting. From the Finnish forest industry’s point of view, the decisions made in the European Union have a relatively strong impact on the development of e-business solutions in the forest firms as the Finnish forest companies are important actors in whole Europe. Differing from the first two scenarios, the efforts are not headed to the functionality and integration of the systems but the whole controlling of global and local e-business environments.

7.5 Summary of the scenarios

Every one of the three scenarios has its special character – the first scenario concentrates on the compatibility of the systems and standardized quality and high level of the systems used in and between the firms. The second scenario goes a step further, as the total integration and the possibilities of e-business are seen as important to reach the whole supply chain and innovative and active networks are seen to be prerequisites for effective e-business. The end customers are seen powerful and it is seen that by utilizing e-business solutions effectively in the whole value chain, the cost savings can partly be passed on to them. The third scenario is quite different by its nature, as it rather concentrates on the societal and political factors in the e-business field. The system integration is seen partly a matter-of-course and the decisions made by the firms are strongly influenced by social, environmental and political issues. The scenarios' features with relation to some general factors concerning the studied field are shown in table 7.

Table 7: The characteristics of the scenarios

	SCENARIO 1 - 24/7 FUNCTIONALITY	**SCENARIO 2** - OUTSOURCED SYSTEMS AND ACTIVE NETWORKS	**SCENARIO 3** - GLOBAL AND LOCAL CONTROL
Probability	High	Relatively high	Moderate
Impact on business	High	High	Moderate
Impact on technology	High	High	Moderate
Internal systems	Well integrated	Outsourced	Integration a matter-of-course
Systems between the firms	Technology integrations Standard mapping	Active networking	Integration a matter-of-course
Customer interface	High availability pursued	Well integrated	Not in examination
Software development	Varies	Increasing openness Model-based development	Open
Environmental values	Not in examination	Not in examination	Highly important
Social networking	Not in examination	Relatively strong	Strong

As can be seen from the scenarios, a lot of changes are expected to happen in the e-business field in the forest industry during the next ten years. Most of the events generated at the scenario workshop are seen quite probable to happen in the set ten years' time span. From the scenario workshop participants' point of view, one of the most decisive things is the willingness to changes and to cooperate to form all-covering supply chains in which all of the actors have a possibility to utilize electronic solutions effectively. The forest industry is already in a good way, as the integration and the system development of the internal processes and also processes between the firms are being done all the time. As the majority of the events are seen quite probable to happen by the workshop participants, it can be seen that the forest firms have a lot of opportunities in the field of e-business by which they can strengthen their position in all-globalizing and tightening competition.

8 CONCLUSIONS AND DISCUSSION

In this chapter, the conclusions and limitations of the study are discussed and suggestions for future research are made.

As the pace of change in many industries is seen to accelerate (McGahan 2004a), also the forest industry is facing many changes, which create new challenges but also many new possibilities for the firms. Even more important than the pace of change are the direction and nature of changes (Swann 1998). The forest industry can be seen on a radical trajectory of evolution, which means that its core assets and activities are both threatened by obsolescence (see McGahan 2004a, McGahan 2004b). One remarkable reason for that is the fast and surprising development of ICT technology which breaks the traditional ways of doing business. In this study, the focus was on electronic business and its possible future solutions in the forest industry. It is seen that by utilizing the solutions that e-business offers, the forest firms can achieve remarkable cost savings and whole new business opportunities (Seppä et al. 2005). But it also means that the traditional ways to operate and think over the business may have to change.

Changes do not happen by their selves, but the firms have to take an active and innovative attitude towards the development. As Kamppinen et al. (2003) state, the desirable future does not happen by itself, but it has to be done. Even though future is uncertain, it is useful to discuss and study the future, because at least something in the future is predictable (van der Heijden 2000). The chosen method for predicting the future in this study was scenario method.

8.1 Scenario method in analyzing new technology opportunities

Scenario method offers an extensive way to think over plausible possible futures (van der Heijden 2005). That is why it was also seen an appropriate method for the

conducted study. A great deal of uncertainty and novelty related to the changes of ICT technology and the field of e-business supported the selection. It was seen that thinking over multiple futures, e-business' characteristics could be better taken into account. The future development of e-business is almost impossible to study leaning on the past or current knowledge about the field. So, new innovative visions and ideas about the future of e-business were needed, and they were seen to be best reached by a scenario process. By writing the ideas and visions into stories and describing the paths along which the future states can be reached, the communication about the subject was experienced to be facilitated. As an answer to the posed research question (see figure 2 in chapter 1), the scenario method was experienced to suit relatively well in anticipating the development of e-business, even though the method includes its own restrictions. These restrictions were discussed in chapter 4.3 and the restrictions concerning the conducted process will be discussed in chapter 8.3.

Cornelius et al.'s (2005) five different functions of the scenario method can be seen to become materialized relatively well in the study (see chapter 4.2 about the different functions of the scenario method). First, the background for the design and selection of strategies concerning e-business solutions was thought over during the scenario workshop. Second, the awareness of the uncertainties in the environment was increased by thinking over the driving forces by a PESTEL-framework based on which the possible events were ideated. Third, the things what might possibly happen and the possible chains of actions and reactions of the firms were depicted in the scenario stories. The most of the data collected was qualitative by its nature, but quantitative and qualitative data were combined when assessing the importance of the drivers and the probabilities and impact of the events, by which the scenario sets were formed. Finally, the mental models of the participants, and also that way of the instances they represented, were tried to stretch by inviting persons from different instances holding different kind of knowledge on the research field.

The conducted scenario process can be characterized as a heuristic one (see chapter 4.6.1 about the different scenario building approaches). The practitioners of the heuristic model, e.g. van der Heijden (2005) and Schoemaker (1991), state that no single standardized methodology for the development of scenarios exists but the

creativity of the participants must be supported. Anyhow, some structure in a heuristic process is required, as too much creativity in the process is not seen to win trust (Schoemaker 1995). These principles were realized in the conducted process, as the participants were given a free hand to ideate the drivers and events but the workshop and the whole process had a pre-defined structure along which it was conducted and certain quantitative methodology was used to refine the material ideated in the workshop. There would have been multiple possibilities how the initial and final scenarios were formed, but the writer took a free hand to choose the methods and techniques which she experienced to be most applicable for the study. That, of course, opens up some questions about the reliability and validity of the used methodology which are discussed later in this chapter.

8.2 The scenario stories

Three different scenarios of e-business's future in the forest industry were created. The contents of the scenarios were built based on the views of different experts from the studied field, i.e. scenario workshop participants. The majority of the events generated in the workshop were experienced relatively probable to happen and having at least a moderate amount of impact on business and technology. However, every scenario has its special character. In addition to pure written stories, the scenarios were tried to visualize by concept maps, simplified pictures and a table about the main characteristics. The scenario maps in the appendices I-III are recommended to look at delicately at the same time when reading the scenario stories.

The timeframe of the scenarios was set to ten years which can be experienced a relatively long time span if thinking the all-fastening pace of change of ICT technologies. However, as came out from the literature and the views of the workshop participants, the forest industry is rather a bit conservative industry and needs time to change – from the forest firms' point of view, a ten years' time span might seem rather a short one.

The first scenario, “24/7 functionality” is seen the most probable to happen and also having a lot of impact on the user firms’ business and on technology. Essential themes of the scenario, integration and standardization are already going on in the industry, but there is a lot to do to make the systems inside and between the firms work effectively and trustworthily together. However, the posed objectives of the scenario can be reached in the posed ten years’ time scale, if the firms are active in the development.

The second scenario, “Outsourced systems and active networks” goes a step further. The emphasis of the scenario is on building innovative and active networks and balancing roles of the actors. To attain the “networked economy”, the electronic systems need to be available for all the actors in the network. That is tried to achieve by increasing openness and new innovative ways to work. The objective of the scenario is challenging, but not impossible to reach. The probability of the events is seen relatively high and the impacts on business and technology are pretty much at the same level than in the first scenario.

The third scenario, “Global and local control” is rather different by its character. The events of the scenario do not concentrate on the integration or standardization of the systems, but they are rather seen as a matter-of-course. The emphasis is on environmental, social and political factors, which control the development of e-business solutions. The events of the scenario are not seen as probable to happen and the impacts on business and technology are seen lower than in the two other scenarios.

The desirability of the scenarios is not easy to define accurately, but some conclusions can anyhow be done based on the conducted votes and the experienced sound of the workshop and the generated events. On the whole, the nature of the process was rather positive and opportunity seeking and events which would have highly negative impact on business or technology were not found.

In the light of the results, the first scenario is seen as the most positive one by its impacts. As discussed earlier, the most of the changes depicted in the first scenario can be implemented by existing technology. That might be one reason for the desirability of the scenario, as the firms do not have to take an extremely long step to a new, unknown

world. On the other side, the radical nature of the third scenario might be the reason for taking the changes with a grain. Anyhow, in the writer's opinion, the more decisive thing for the vote results is the different nature of the events their selves – the political, social and environmental changes are not as tightly connected to the business actions of the firms, even though they should not be ignored.

8.3 Reliability and validity of the study

One of the scenario method's characteristics is that it can never be repeated exactly the same way again (Mannermaa 1999), because the end result depends on the participants of the process, the writer of the scenario stories and the context in which the process is conducted. One can not avoid the fact that the current issues concerning the field always have impact on people's thinking. As in the case of the scenario workshop, the big changes which have happened in the forest sector during the last years are supposed to affect the driver and event generation. Thus, if one is sticking tightly out for the definition of the *reliability* of a method, the scenario method could not be seen totally reliable as the reliability means that the study with the same material can be repeated and the results will not differ remarkably from each other (see e.g. Hirsjärvi et al. 2004). However, even though a scenario process can not be totally repeatable, the reliability of the study was tried to ensure during the different parts of the conducted process.

The clustering of the event sets was initially done by two different clustering tools, Weka clustering and SPSS (Statistical Package for Social Sciences) clustering to check the logic of the sets. The formed event sets by the two tools did not differ notably, and either of the clustering tools could have been chosen. Because of its better usability and the former positive experiences of the usage, Weka clustering was finally chosen. The clustering was done two times to ensure the reliability of the scenario set forming.

The participants of the workshop were asked how they experienced the used working method, an interactive scenario workshop in the GDSS laboratory. The questions dealt with the challenges of the scenario process and the characteristics of GSS system. The

results were primarily positive, which indicates that the workshop as a working method filled the posed expectations and the creativity and cooperation of the participants were supported. GSS system can thus be seen relatively valid for the conduction of the ideation and preliminary scenario building parts of the process. Anyhow, one should be aware of the people's tendency to set the scores a little bit higher than they actually mean in this kind of assessments – the environment always has some impact on the respondents' views. For example, the respondents may be relieved that a hard day in the laboratory is over, or they may be willing to agree with the other participants about the utility of the system. The widely known fact of avoiding social risks among the respondents in this kind of assessments (see e.g. Alkula et al. 1999) poses some limitations for the interpretations of the results.

For attaining reliability and validity of the results, after the initial scenario stories were written and the maps of the storylines were drawn, they were sent to the participants and some colleagues from LUT to ensure that the event sets and storylines were understandable, the stories had a meant logic and that the terms were used correctly. The stories were then revised according to their proposals. Because of the low degree of comments from the workshop participants, much of the check-up work was left on the shoulders of the colleagues. That decreases the validity of the study a little, as it could not be perfectly ensured that the events and comments ideated in the workshop were correctly understood by the writer. Among the people who read the stories, the storylines and linking phrases were anyhow experienced logical.

The probability of events and their impact on technology and users' business were relatively high on average and very improbable events or events having highly negative impact did not appear in the process. That makes the future a bit too rosy, as it is unlikely that all the changes that e-business brings to the business actions of the forest firms would be positive by their nature. As is discussed, the forest industry can be characterized as rather a little bit conservative industry and it is not probably ready for all the emerging changes in technologies. The fast emergence of e-business solutions can be seen to have its negative sides, especially concerning the smaller firms in the value chains. The absence of negative views of the future can be seen to have some diminishing impact on the reliability and validity of the results.

As the scenario method tries to influence on decision making today, the actual use of created scenarios is important. The implications of the formed scenarios in strategy decisions in the firms can not be known accurately by the writer, but the process offers a good tool for supporting the firms' decision making. The process as a whole can be seen to succeed relatively well in its objective: creating different views about the future of e-business in the forest industry. It must be remembered that the created scenarios are only alternative plausible futures, and only time will tell what really will happen in the forest industry's e-business field.

8.4 Discussion and suggestions for further research

As the study has pointed out, the future of e-business can be seen plausible. The changes can not be predicted perfectly, but it is useful to think over possible future states, because the forest firms need to be prepared for the changes in their business environment. By scenario method, it is possible to create different visions about the future. However, it must be remembered that the scenario method has its own restrictions and it is not the only method for studying the future. The most reliable and covering results may be attained by combining different future studies methods.

Along the changes in ICT technology, forest industry's traditional paper and paperboard products are becoming more and more threatened by obsolescence. But new communication paper, intellectual and hybrid media end products, which are capturing market area from the traditional products, do not have to be only a thread for the industry, but they may be for example a new channel to exploit the advantages that e-business can offer. In the writer's opinion, the utilization of e-business in the value chains of new kind of products is worth more studying, because forest industry's future may be expected to be based on these products in some part. E-business is not considered as a core future studies area in every forest company, but it should be a natural part of the development. The great majority of the forest industry's business has usually been business-to-business actions, but because of the changes in the customer base to considering also more and more end customers in specific markets (see Nyrud &

Devine 2005), the role of e-business becomes even more important. The changes are strongest in the pulp and paper industry which still remains strong, but can not afford to lie on the old knowledge and know-how for too long.

As is discussed earlier, many of the changes of e-business examined in the study can well be seen to fit into other industries. One good example might be the energy industry, which is also characterized as a bit conservative industry field. One interesting way to redefine the scenario process would thus be to conduct a same kind of scenario workshop concerning e-business' future in the energy industry. The actual future of e-business remains to be seen, but by the scenario process conducted in the study the understanding of the dynamics of change was tried to increase concerning the e-business' future in the forest industry. The knowledge collected from the study may possibly be utilized in the further studies concerning the e-business field.

9 SUMMARY

The study has examined the future solutions of e-business in the forest industry. The future states of e-business were studied by the scenario method by which it was possible to form different views about the future.

In the theoretical part of the study technological change and industry evolution were explored. It was stated that technological change has a strong impact on industry evolution and that new technologies have even given rise to entire new industries. That is why it is necessary for the firms in an industry to be aware of technological changes. As is the case with ICT technology, the changes usually happen relatively fast. The pace of change is even seen to fasten. The direction and the characteristics of change are also essential to think over.

It was noticed that technological and industrial change both can be seen to go along a certain trajectory. For the firms in an industry it is essential to know which kind of trajectory they are on, because going along a certain trajectory requires certain managerial actions. It is also vital to recognize the nature of technological change – most technological change is incremental but there are also radical innovations which can rapidly change the whole rules of the game. As the forest industry can be seen to go along a radical trajectory, the forest firms need to follow the rules of radical evolution and find the ways to survive in Schumpeterian competition. Changes in technology need to be anticipated and the firms can not lie on the old ways of doing business – they need to be open and agile for the changes.

The method used for the anticipation in the study, scenario method was also introduced in the theoretical part of the study - the characteristics, purpose, advantages and challenges of the scenario method were discussed and different ways to conduct a scenario process were presented. In the empirical part, a heuristic scenario process was conducted via a scenario workshop which consisted of eight experts from the e-business field. In the workshop, future events were ideated based on the drivers of change. Three different scenarios were formed based on the material collected in the workshop - “24/7

functionality", "Outsourced systems and active networks" and "Global and local control". The scenario stories were told and a concept map of every scenario was drawn.

The three formed scenarios indicate that the forest firms have a lot of possibilities to utilize e-business solutions in their business actions in the future. The scenario method was noticed as a good tool for supporting the strategic decision making concerning the future solutions in the firms. One can not deny that future brings changes, but one should find the ways to take the full advantage of them.

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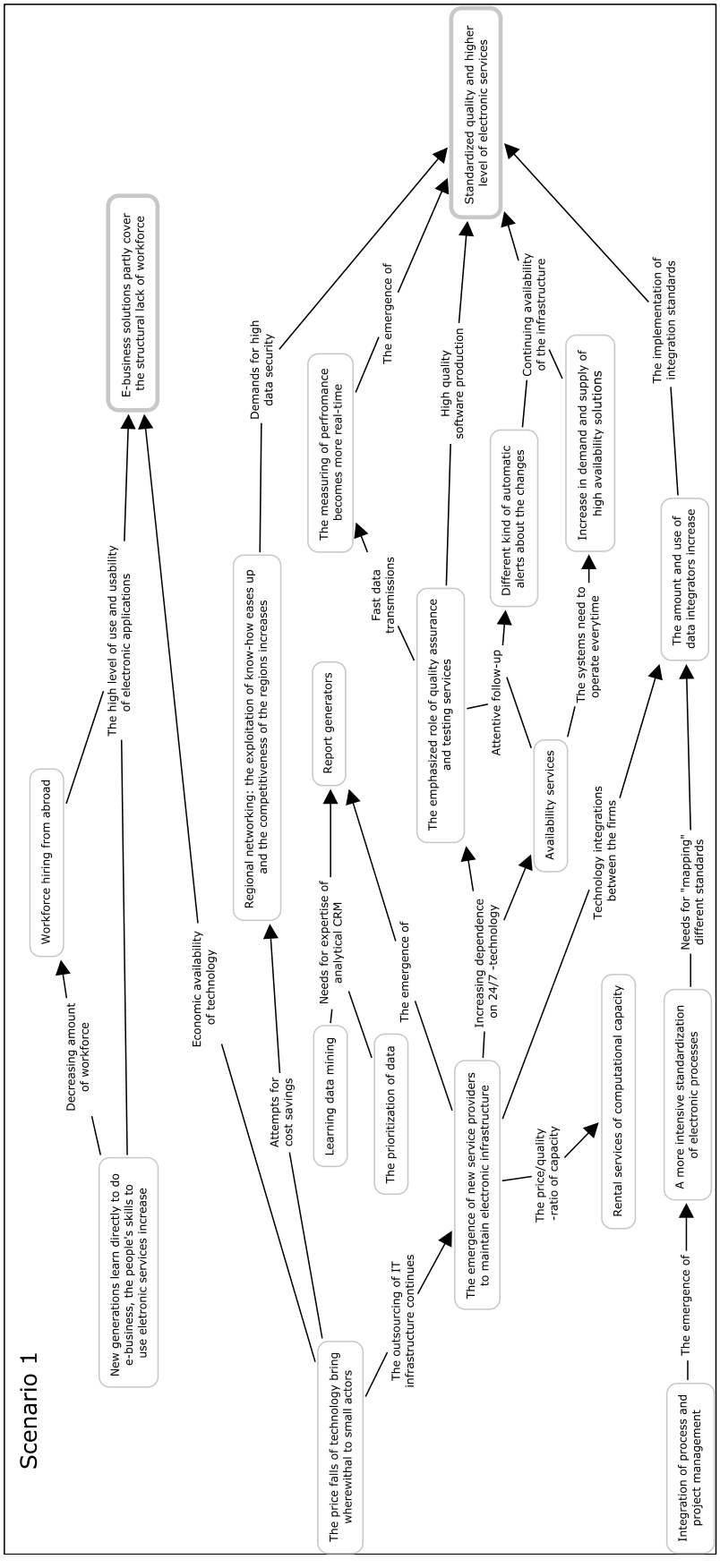
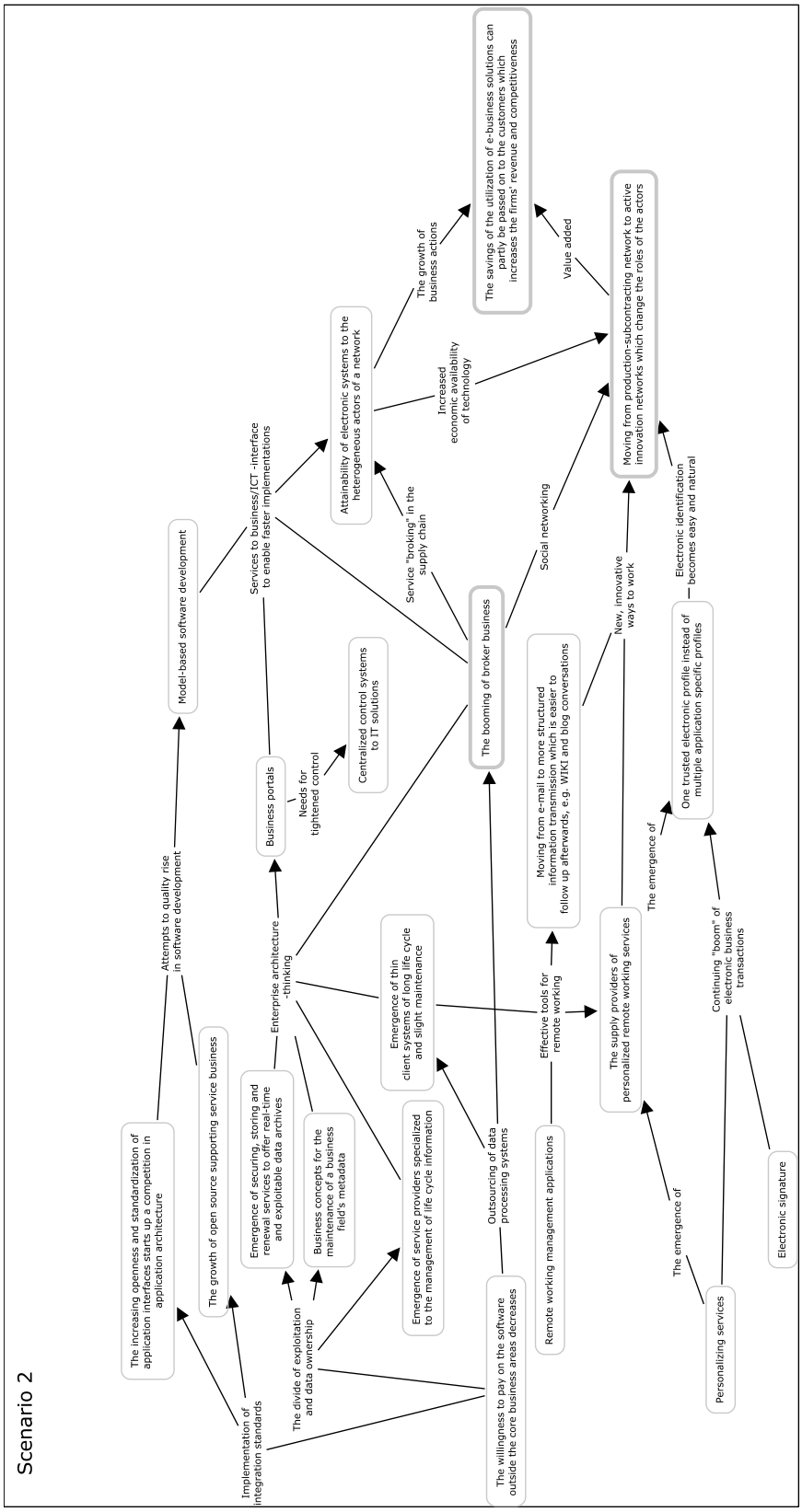
Appendix I: Scenario 1 – 24/7 functionality



Appendix II: Scenario 2- Outsourced systems and active networks



Appendix III: Scenario 3 – Global and local control