

**SCHOOL OF ECONOMICS
AND MANAGEMENT**
Lund University

Time efficiency in a product development process

Lund University

School of Economics and Management

FEC 591 Master's Thesis

June 2007

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Foreword

Over the past 4 years we have learnt and experienced a lot while studying. We have found that hard work is rewarding and that there is no such thing as giving up. This master thesis is our final assignment and it will put an end to our education. It will also symbolize a semester of ups and downs with a lot of cooperation.

We would like to thank our tutor, Per-Hugo Skärvad, for his great knowledge and his way of sharing it. His guidance has been valuable for us. Troed Troedsson and Camilla Hending at Paradigmmäklarna also deserve a great thank you. A special thanks to our interview persons. Without their participation, this dissertation could not have been written. Finally, we would like to thank our families and friends for their support.

Lund, June 2007

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Summary

Title: Time efficiency in a product development process

Subject: Master's Thesis, FEK 591, Strategic Management

Authors: Sanja Ondelj, Serap Sögütlü and Anna Utter-Laurell

Tutor: Per- Hugo Skärvad

Key words: Product Development Process, Rapidly Changing Markets, Time

Purpose: We wish to gain a deep knowledge about product development processes in relation to the aspect of time in companies in highly technological and rapidly changing markets. The purpose is to establish how organizations better can employ time as a resource to make the product development process more efficient.

Methodology: The dissertation has an abductive research approach. The research purpose of the dissertation is mainly exploratory but also has descriptive characteristics.

Theoretical perspectives: The theory part is divided into three parts and the first part contains product development process. The second part is about changing markets and the last part includes time and time management.

Empirical foundation: The empirical part includes the results from the primary data collection from Sony Ericsson and Paradigmmäklarna.

Conclusions: Information we gathered from theory and primary data show that information flow, synchronization and time profit when seeing time in three dimensions are factors which should be reflected in the architecture of a product development process. To illustrate our findings, we decided to create a model.

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Chapter 1 - Introduction

This first chapter begins with a background description of the subject that the dissertation addresses. Further, the purpose and research question are emphasized and the limitations are presented. To conclude the chapter, definitions of the most relevant terms are provided as well as an outline of the following chapters.

1.1 Background

Today we live in a rapidly changing environment and the high pace is evident in all parts of society. Companies which act in contemporary markets are especially affected by this. Since product life cycles have become shorter companies have to put more effort into increasing the production efficiency. For example, previously a car manufacturer could launch a new car model every seventh year. Today, a new car model is usually developed in intervals of two to three years. Competition has intensified, customer demands are higher and the global economy creates more options for consumers. (Lind & Skärvad, 2004) The conditions mentioned above require an efficient product development process from idea to finalized product. Consequently time as a resource plays an important role in that process. Companies in all industries have to be aware of and manage time in their daily business activities as well as in their long term strategic planning. Research made by Lars H. Bruzelius and Per-Hugo Skärvad (Speed Management, 1992) brings up time as a resource in organizations and how they can use it in an efficient way. Furthermore, they also enlighten the benefits of short development processes and an insight is made about the so called sequential and overlapping development process. This caught our attention and inspired us to conduct research about time efficiency in the context of product development.

According to Bruzelius and Skärvad (1992) *time* has a number of features. It cannot be recovered or stored and it is impossible to

substitute it. The value of time becomes unmistakable, especially in contemporary and rapidly changing business environment. A company that creates and predicts the future is possible to set the *pace* of change. Another fact is that good *timing* is more important than making fast decisions. Timing is about knowing exactly when to perform a particular action to be able to get the best possible outcome out of it. Additionally, time as resource cannot be preserved and due to that it is necessary to manage time and sharpen the “time feeling” in an organization and thereby in the product development process as well. (Bruzelius & Skärvad, 1992)

1.2 Purpose

We wish to gain a deep knowledge about product development processes in relation to the aspect of time in companies in highly technological and rapidly changing markets. The purpose is to establish how organizations better can employ time as a resource to make the product development process more efficient.

1.3 Research question

For contemporary companies acting in rapidly changing markets, time is of the essence seeing that the pace on those markets is especially high. The business environment requires them to constantly come up with new products and solutions. It is in most cases also characterized by intense competition. We are interested in looking at a product development process in a high-tech company and how time is employed within it. To have a shorter product development process has advantages but whether or not that makes the process more efficient can be discussed. Consequently, the question this dissertation endeavours to answer is the following:

How can an organization better employ time as a resource to make the product development process more efficient?

1.4 Limitations

The time constraint of ten weeks does not allow us to investigate all parts of a product development process in relation to time. Neither do we have the possibility to allow the dissertation to cover different types of organizations. Therefore we choose to focus on a global, contemporary and high-tech company in a rapidly changing market in which the importance of time management within the product development process is evident.

1.5 Definitions

To assist the reader, we wish to present a short definition of the terms commonly used in our dissertation. The definitions are based on the descriptions of well-known researches as well as how we ourselves define certain terms used in the text.

A company in a rapidly changing market

A company acting in a high-tech, rapidly changing business environment that requires constant innovation and change.

Product development process

The process from idea to finalized product.

Overlapping product development process

Different sections work parallel with each other and overlap throughout the product development process.

Sequential product development process

Different sections work in chronological order throughout the product development process.

Time as a resource

The time resource is the available time period which sets the time frame of a company's business activities

1.6 Outline

The dissertation has the following outline:

Chapter 2: Basic Methodology

Chapter 3: Operative Method

Chapter 4: Theoretical Framework

Chapter 5: Compilation of primary data

Chapter 6: Analysis and results

Chapter 7: Conclusion

Chapter 2 - Basic Methodology

The second chapter presents the methodology used in this dissertation. Initially, the choice of methodology is discussed and followed by a model displaying the theoretical research process. Finally, various research philosophies and research approaches are briefly explained.

2.1 Choice of methodology

To be able to write a research report there are a number of things to consider before the writing process begins. One of them is the choice of methodology. It is influenced by the dissertation's research purpose and research questions. (Saunders *et al.* 2003)

Our purpose with the dissertation is to study how an organization better can employ time as a resource to make the product development process more efficient. To examine this, we decided to collect available information in relation to the topic. The theoretical information was critically reviewed and a selection of the most relevant information was made.

To us, the research question is interesting and deals with an important aspect for contemporary, modern and highly technological companies. The creation of the theoretical part of the process gave us a deeper and more substantial knowledge about the research area. That allowed us to continue the process by gathering more specific information from a company, in this case Sony Ericsson, in order to answer our research question. A description of the company will be given in chapter 5. Accordingly, four semi structured interviews were conducted with persons positioned within Sony Ericsson that could provide us with relevant information related to our study. We also conducted an interview

with two society analysts from Paradigmmäklarna (see chapter 5) to get an external perspective on our area of research.

To illustrate the research process figure 2.1 below depicts what is called a “research process onion”. Each layer of the “onion” represents a decision or step in the research process itself that has to be peeled away, starting from the outer layer, to reach the next layer. Each approach in the different layers is connected to an approach in the underlying layer and assists us to build up the methodology of the dissertation in a structured way.

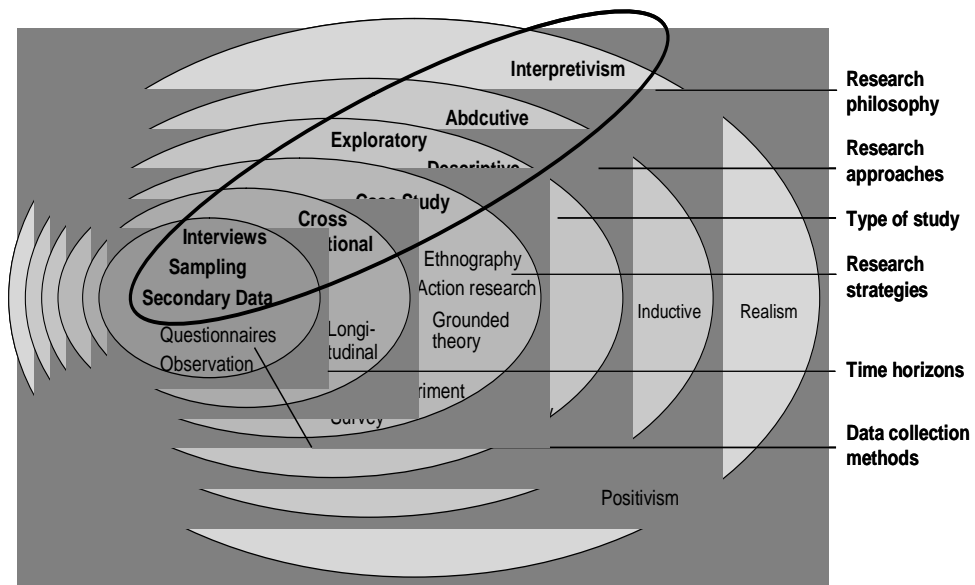


Figure 2. 1 The research process onion
Source: Saunders et al. 2003, 83

2.2 Research process

2.2.1 Research philosophy

A research philosophy can be described as the way the researcher thinks about the development of knowledge. According to Saunders *et al.* (2003) there are three main views about the philosophy of a research process. These three views, namely: *positivism*, *realism* and *interpretivism*, are illustrated in the outer layer of the “research process onion” in figure 2.1. Neither of the three research

approaches is better than the other but the different approaches are more suitable for different contexts.

Positivism is the approach that best illustrates the philosophical standpoint of a natural scientist. The *realistic* research philosophy is to some extent based on the same grounds as positivism as it is based on the belief that there is such a thing as an objective reality independent of human thoughts and beliefs (Saunders *et al.* 2003,). The *interpretivistic* research approach is based on the idea that the world is too complex to be described in law-like generalisations and such generalisations are neither as important (Saunders *et al.* 2003). The researcher can only study the subjective reality of the research object and thereby be able to understand the situation. Consequently, reality is seen as something that is not constant but instead is evolving. The researcher realized that he/she is a part of the research process and therefore also influences and affects it (Ibid.).

This dissertation bears the characteristics of interpretivism. We acknowledge that the social business world is complex and our research cannot be used to generate any law-like generalisations. The results will most likely be coloured by our own interpretations, values and perceptions. Consequently the conclusions of the research will also be subjectively interpreted. To gain further data more specifically connected to the research question, we wish to collect our data from a large, contemporary and high-tech company that acts in a rapidly changing market where the pace in the product development plays an important part. The choice fell upon the mobile communication company Sony Ericsson. The performed study only includes information from Sony Ericsson and society analysts at Paradigmmäklarna. The results derived from it are hence not possible to generalise for the entire mobile communication industry.

2.2.2 Research approach

According to Saunders *et al.* (2003) there are two possible research approaches that can be applied when performing a research project, namely the deductive or the inductive approach. When using a *deductive* research approach a theory together with a hypothesis is developed and then a research strategy is designed to test the hypothesis (Saunders *et al.* 2003). An *inductive* approach is quite the opposite where the researcher instead gathers the data from the research and then develops theory as a result of the analysed data. (Saunders *et. al.*, 2003)

When attempting to categorise the research approach of this paper we found that we could not clearly place it in either of the two approaches above. The general opinion was that the deductive approach would be too scientifically rigorous to achieve the purpose of the dissertation. A deductive approach also requires the researcher to remain objective to what is being observed (Eriksson & Wiedersheim-Paul, 1997). When taking the research philosophy of the dissertation into consideration as well, we concluded that a purely deductive approach would not be ideal to achieve the intended aim. Nor would an inductive approach be ideal seeing that we did not start the process of the dissertation without any prior knowledge about the subject at hand. Knowledge linked to product development, time management, and rapidly changing markets had been gained during previous studies. Neither did we feel that the collection of data without first having a theoretical framework to support the collection process would be appropriate in this case.

Consequently, we continued to search for other possible research approaches and eventually identified *abduction* as the most suitable approach for this dissertation. Alvesson and Sköldbberg (1998) describe abduction as being a combination of deduction and induction. With an abductive approach the researcher has an understanding of relevant empirical theory which can help the

researcher to avoid making unrealistic assumptions. The acknowledgement of empirical theoretical knowledge when initiating the research process supports the researcher and does not require him/her to start without any previous knowledge as assumed with a purely inductive approach. It also allows the researcher to view reality in a more subjective light during the research process. The abductive approach is therefore well suited for the research that will be conducted in connection to the relevant research question.

2.2.3 Type of study

Research studies are classified according to their purpose and there are three possible classification categories (Robson, 2000 in Saunders *et al.* 2003). The first category is the *exploratory studies* and is useful when the researcher strives to clarify his/her understanding of a problem (Eriksson & Wiedersheim-Paul, 1997). The second category is the *descriptive studies* that focus on the description of something (Lundahl & Skärvad, 1999) and it is a good way of answering primary questions. The third category is the *explanatory studies* where the aim is to “study a situation or a problem to explain the relationship between variables” (Saunders *et al.* 2003, 98).

This dissertation fits the characteristics of both an *exploratory and a descriptive* study. It aims to explain how an organization better can employ time as a resource to make the product development process more efficient which to some extent positions it as a descriptive study. However, it also has many characteristics of an exploratory study seeing that it aspires to clarify the particular phenomenon relating to time efficiency in the product development process. We wish to provide new insights into the addressed research subject.

2.3 Summary

In this chapter we discussed different research philosophies, approaches and purposes and explained our choices for this dissertation. The research process is characterized by an interpretivistic philosophy. Complete objectivity cannot be guaranteed; instead we are aware of the subjective reality that we will study. The abductive research approach is well suited for this dissertation seeing that the study is performed with our understanding of relevant theories linked to the research area. Furthermore, the research purpose of the dissertation is mainly exploratory but also has descriptive characteristics. We wish to provide new insights into the research subject which we address in the dissertation.

Chapter 3 - Operative Method

The third chapter begins with an explanation of the research strategy of our research process. It includes the approach taken to answer the research question and the time horizon for this research process. The chapter continues with a brief introduction of the conducted study and the collection of empirical data for this dissertation is described. Further, the reliability, validity and delimitations of the material are discussed. Finally, we briefly explain the processing of the collected data.

3.1 Research Strategy

To reach the aim of this dissertation we discussed what would be an appropriate way of answering the research question. The research strategy is the general plan of how you will go about answering the research question you have set (Saunders *et al.* 2003, 90).

The choice became to perform a study principally based on primary data from interviews conducted with employees at Sony Ericsson and Paradigmmäklarna. Two out of the four respondents at Sony Ericsson wish to remain anonymous. Therefore, we will not describe the positions of the participants within Sony Ericsson in any detail. However, all four participants work with or within the company's product development process, where two of them hold a more prominent role in that process whilst the other two hold less prominent roles. Semi structured interviews that revolved around the themes, as well as direct questions about product development processes and time were conducted. To get an external and thereby different perspective on these themes, we conducted yet another interview with two society analysts at Paradigmmäklarna. Relevant and qualitative interviews in combination with an applicable theoretical framework were thought to be the best way to reach the

intended aim of this dissertation. The decision was based on the previously selected research philosophy, research approach, type of study as well as our own opinion of the most suitable research strategy in this particular case. The research performed by us will be of a qualitative character and the way we perform our study is according to us an appropriate way to collect data.

We are aware of that our study cannot be clearly classified into a specific category of research studies. We feel that there are some resemblances and links to a case study. However, we would not go as far as to define our study as a case study. Instead we prefer to see it as a less extensive study aiming to see *how an organization better can employ time as a resource to make the product development process more efficient*. Jacobsen (2000) states that a case study can be further divided into less extensive studies, classified by the number of units studied and the focus level. These research studies maintain many of the characteristics of a case study. We assume that many of the advantages as well as disadvantages of a case study are also applicable to our type of study. Therefore we discuss these in this chapter and believe them to be significant in relation to our study. A case study is performed on one or a few number of case objects, which are studied in more detail (Lundahl & Skärvad, 1999). Another description provided by Yin (1989 in Lundahl & Skärvad, 1999) explains a case study being an empirical investigation which deals with a contemporary phenomenon in its real environment, where the boundaries between the studied phenomenon and its context is not clearly defined and where multiple sources of data are being used. Case studies are often a good way of proceeding if the research question is a “how” or “why” - question in exploratory studies (Christensen *et al.* 2001).

Although we consider our study to be a suitable approach for this dissertation, we are aware of that it also has certain disadvantages resembling those of a case study. It does not allow the researcher to

generalise the results. Neither is it possible to apply the findings to another situation than the one studied. However, assumptions about possible generalizations can be made. Its semi structured form is an advantage, but can at the same time cause problems. Seeing that there are no given rules it is easy to make mistakes or to get caught up in too much data (Jacobsen, 2000). Although the intention with the study is to gain a deep and profound knowledge, there is always a risk that the result does not become an accurate reflection of the studied situation. Furthermore, case studies and our study can also be criticized for lack of precision, reliability and validity (Ibid.). We did our best to avoid this lack of structure and improve reliability and validity by following a systematic research procedure within the frames.

3.2 Time Horizon

The study is performed as a cross-sectional “ad hoc”-study which studies a situation at a certain point in time (Christensen et. al., 2001). The study is meant to enlighten and understand how an organization better can employ time as a resource to make the product development process more efficient. The intention was not to study a product development process in the company over a time period, for which a longitudinal study might have been more appropriate.

3.3 Data Collection Process

The inner layer of the “research process onion”, illustrated in section 2.1, shows the various data collection methods that can be applied during a research process. The collected data will consist of both secondary and primary data. *Secondary data* is data that has been previously collected and put together in another context and with another purpose than for the current study (Christensen *et al.* 2001). Secondary information is useful when you want to gain fundamental knowledge about the area which you are studying. It

also helps the researcher to develop an understanding of the situation and to confirm the reliability in his/her own findings (Ibid.). *Primary data* is data collected by the researcher himself/herself and which has been especially collected for that particular research project. With primary data you collect information that is adapted to your specific research project. However, to retrieve primary data is more costly than to use secondary data and it takes more time to do so (Ibid.).

3.3.1 Secondary Data Collection

Once an interesting research area and a research question had been established we discussed the various theoretical parts that needed to be studied in order to gain a deeper insight into the subject. The area of interest would require us to study theoretical material in relation to product development, rapidly changing markets as well as theories relating to complex and intrinsic systems, time and time management. Other material, before the primary data collection would take place, was related to the companies Sony Ericsson and Paradigmmäklarna gathered from websites and similar sources. We also took advantage of previous knowledge gained through our studies. With the help of the gathered empirical secondary information we could broaden our knowledge platform about the research area and use theory as a support in the continuing process.

3.3.2 Primary Data Collection

According to Saunders *et al.* (2003) there are three categories in which interviews can be categorised, namely; structured interviews, semi-structured interviews and unstructured interviews. During a *structured interview* the interviewee is asked a number of predetermined and standardised questions and the interviewer marks the answers which are then usually pre-coded. A *semi-structured* interview is based around a list of themes and maybe also a number of questions that the interviewer wishes to cover

during the interview. This means that the interviewer can add or even take away some questions or discussion areas. There is more flexibility in a semi-structured interview that allows for variations during the interview. Finally, there is the *unstructured interview*, or the in-depth interview, that more resembles a conversation between two parties. There are no predetermined questions that need to be addressed but the area of interest which the interview should cover must naturally be ready in advance. (Saunders et. al., 2003) The different interview categories have both strengths and weaknesses. The less structured interviews are better to get more in depth into the research area but the lack of structure may cause problems concerning the research quality of the analysed data from the interview. The more structured interviews can guarantee the research quality of the analysed information. However, the lack of flexibility can cause the research to only “scratch the surface” of the intended research problem. The more structured interviews are usually suitable to use when conducting quantitative research and the less structured interview types are therefore more commonly used for qualitative research. (Saunders *et al.* 2003)

Our interviews are conducted as *semi-structured interviews* with a number of questions and themes which the interviews evolve around. However, we believe we have a larger amount of direct questions than might be expected in a semi-structured interview. Nevertheless, we feel that the flexibility of the interviews is still maintained seeing that the respondent is still allowed to speak relatively freely. The interviews were conducted as *personal interviews* and all three group members of the dissertation were present during the interviews. We contacted the respondents on beforehand to provide them with the questions and themes which the interview would evolve around. The interviews were also tape-recorded after the consent of the respondents. This was done in order to ensure that any later misinterpretations or incorrect notations of the answers would be reduced and therefore not affect

the analysis of the data. However, although the interviews were recorded we also took notes throughout the interviews to further insure the correctness and interpretation of the data. We are aware of that the usage of a tape-recorder has certain disadvantages. The respondent might feel inhibited to answer when being recorded, there is a risk of technical problems and it can also affect the relationship between the interviewer and the respondent. However, we feel that the advantages outweighed the disadvantages in this case and we did our best to reduce the possible negative impacts.

3.4 Quality Evaluation

The reliability and validity of research findings determine the credibility of the research and are important to consider. The two concepts will be explained in the following sections and the reliability and validity for the conducted research in this dissertation is determined.

3.4.1 Reliability

Reliability can be expressed as the absence of random errors in the research. A well conducted research process presents findings that have not been affected by the circumstances around the research process or by the persons conducting it. (Lundahl & Skärvad, 1999) It should be possible to carry out the research on additional occasions and to receive the same results, even if the research is conducted by different researchers.

The study in this dissertation collects a substantial amount of material from the semi-structured interviews conducted with four employees at Sony Ericsson and two analysts at Paradigmmäklarna. The flexibility of the conducted semi-structured interviews allows for additional questions to be added or the order of the discussed topics to be altered from interview to interview depending on the situation. The lower degree of structure makes it difficult to

replicate the interview and therefore also the findings derived from it. It is also highly unlikely to get the same findings at a later point in time. Collected information from a semi-structured interview only reflects a situation during a certain point in time that probably will be the subject of future changes. (Saunders et. al., 2003)

Robson (2002 in Saunders *et. al.*, 2003) points out a number of threats to the reliability of a research project, those being *subject or participant error*, *subject or participant bias*, *observer error* and *observer bias*.

Subject or participant error can cause the respondent to understand a question or situation incorrectly and therefore give an incorrect answer. Likewise can the interviewer do an error that affect the interview (Saunders *et al.* 2003). We realize that a semi-structured interview or other parts of the study can generate different results at different point in time. Factors such as stress, work load or simply the mood of the respondent or interviewer can affect the result. Attempts were made to avoid subject or participant error by allowing the respondents to decide the time and date of the interview. By this, we could be relatively certain about that they really did have the time and possibility to participate. *Subject or participant bias* may cause the respondent to respond in a false or incorrect way. It might be because they are influenced of what their bosses expect them to say or that they want the situation to appear differently from what it really is. We are aware of that we cannot avoid subject or participant bias seeing that the interviews were performed during single individual occasions. The respondents' answers could also have been under higher management influence. However, the respondents were given the possibility to be anonymous. There is also a possibility of *observer error* during the interviews with the employees at Sony Ericsson and Paradigmmäklarna. Seeing that we were three members that conducted the interviews there is a risk of us extracting the

collected information in three different ways. An increased structure frame can reduce this threat but this was not possible in our case, seeing that we conducted semi-structured interviews with a higher degree of direct questions, characterised by a looser structure and flexibility within the available frames (Saunders *et al.* 2003). However, we believe the higher number of direct questions to increase the structure slightly. Yet, the possibility of us extracting the information in three different ways can also be viewed as an advantage. Three different perspectives on the information can allow for the interviewers to compare their interpretations of the information. The final threat to the reliability of the research is the *observer bias*. The interviewers can be affected by the respondent and therefore not interpret the answers objectively. Seeing that all three group members conducted the interviews there is always a risk of three different ways of interpreting the answers.

We are aware of that the *low level of reliability* of our research findings was to be expected since they are the result of a non-standardized research method. Increased structure could have increased the degree of reliability. However, it would also have limited the opportunity to gain a deep insight into the present situation and understand the complexity of the subjective reality which is the intention of the research. We considered a qualitative, non-standardized research to be the best way to reach the aim of our dissertation (Saunders *et al.* 2003).

3.4.2 Validity

The validity of a performed research can be explained as whether or not the research measures what it is intended to measure, or how truthful they are (Lundahl & Skärvad, 1999). There are two aspects of the validity concept, *internal validity and external validity*.

Internal validity addresses to what degree the research instrument measures what it is thought to measure (Lundahl & Skärvad, 1999). One important aspect of internal validity is therefore to define what it is you want to investigate. We recognize that we cannot guarantee that our research generated the exact information intended. Despite that, we consider the *truthfulness or inner validity* of our research to be relatively high. The research displays the influence of four relevant interview sources at Sony Ericsson as well as two external interview sources at Paradigmmäklarna. Attempts to include different viewpoints and show different perspectives on the research where made. The semi-structured interviews that were used to collect much of the primary data allowed for flexibility but also helped us to conduct the interviews in a satisfactory way. The interview guides summarised the topics and questions we wanted to cover in the interviews. At the same time it provided us with the possibility to extend interesting discussions during the interviews. All interviews were tape recorded, after the consent of the respondent, to avoid later misinterpretations during the analysis of the material. We attempted to let the respondent speak freely around the topics and questions and at the same time ensuring that they covered the relevant areas. Through this approach we reduced our own influence on the respondent and still managed to keep a red line through the interview. Brief but regular summaries of the respondent's responses were made, giving him/her the opportunity to add, correct or reverse his/her answers. Later contact through mail with respondents could also be used to clarify answers given during the initial interview.

External validity or the generalisability addresses to what degree the research findings can be generalised to a larger population (Saunders *et al*, 2003). The findings from this type of qualitative, non-standardized research we perform are not possible to generalize and quantify to a larger population, and as previously mentioned, this is not the intention of our research. They might be used as a

base for general suggestions about how something might be but not used as structured and valid facts. (Saunders *et al.* 2003) Our intention was to gain a deep insight into the present situation and understand the complexity of the subjective reality and not to produce quantifiable results used to make law like conclusions.

3.5 Delimitations

We chose to conduct a study on the product development process in relation to the aspect of time. Apart from the external interview with Paradigmmäklarna, the information is only taken from one high-tech company. This is partly due to time and financial constraints, which does not make the results and conclusions drawn from it possible to generalize. They can only be used to make suggestions of possible assumptions. The company Sony Ericsson, serving as an example of the setting in which we studied possible improvement of the employment of time in the product development process, was considered as a suitable company to gather information from. It is a contemporary organization acting on a high-tech and rapidly changing industry and in which the time of the product development process is important. The selection of the company from which to extract information was also influenced by the fact that we have connections at Sony Ericsson. That made it easier for us to obtain relevant information and get possibilities to perform interviews. Therefore we are aware of that the choice of company from which we extract information is the subject of researcher bias. (Saunders *et al.*, 2003)

3.6 Processing of collected data

Through interviews with employees that work with or within the product development process at Sony Ericsson, as well an external interview with analysts at Paradigmmäklarna, relevant primary information had been gathered. All the gathered information was

then reviewed based on its relevance to the aim of our study; *how an organization better can employ time as a resource to make the product development process more efficient*. The second step was to structure it in accordance with the overlooking themes of the interviews. The structured information is found in chapter 5 of the dissertation. The third step was to analyse the information from the employees at Sony Ericsson and Paradigmmäklarna. Furthermore, the information, together with the theoretical framework, was used to find an answer to our research question. The analysis along with the result of our study, partly illustrated by our new model, is presented in chapter 6.

3.7 Summary

The third chapter presents the empirical method of the report and the data collection process of our secondary and primary data is explained. The secondary data collection of the study is the collection and critical review of empirical material related to the research area. Secondary information about Sony Ericsson, the company from which we gather information related to the product development process and the time aspects, and Paradigmmäklarna was collected from the companies' websites.

The primary data collection in the study is performed as a cross-sectional "ad-hoc" study since it is considered to be a good way to reach the aim of this dissertation. The interviews are of a semi-structured character containing more direct questions than usual. The material from the five interviews will be analysed in a qualitative way. A discussion about the dissertation's reliability and validity followed by a description of the processing of the material ends the chapter.

Chapter 4 - Theoretical Framework

The fourth chapter presents our selected theoretical framework and an explanation concerning its relevance is provided.

4.1 Introduction

The purpose with this dissertation is to identify how organizations better can employ time as a resource to make the product development process more efficient. Our main focus is based on the process and the usage of time within it. An efficient product development process is especially important from a competitive point of view. There are also studies declaring that companies in high-tech and rapidly changing markets are greatly dependent of time. Our material in the theoretical framework covers research that gives us knowledge of our area of research. Furthermore, it will be a support in our attempt to answer our research question.

The theoretical part will *first* begin with information about the product development process within a company. It gives a general overview of the process and continues to presents alternative approaches of making the product development process more efficient and time saving. The *second* section revolves around theories regarding rapidly changing and highly competitive industries, those being the theory of competing on the edge by Eisenhardt and Brown (1998) and the theory of hypercompetition by D’Aveni (1994). After that we present theories about dynamic and intricate systems with the help of complexity theory, chaos theory and evolutionary theory. These theories are used to comprehend the conditions of dynamic and intricate systems as well as to see how they are structured and may evolve. They help us comprehend the complex and dynamic environment for a high-tech company in a rapidly changing market. Furthermore we

describe how a company's vision is linked to its past and future. The *third* and final section in the theoretical framework deals with time based management in organizations. A general introduction to time is given. Studies about time and its role in organizations, based on research done by Lars H. Bruzelius and Per-Hugo Skärvad (1992), concludes the chapter.

4.2 Product development process

The product development process is an important part of our dissertation. The description of it in this section will observe the most important factors and give an overall understanding of it. The product development process is in turn a part of the product realization which is about producing and developing products that are attractive for customers. In this sense product realization covers all the activities that help develop solutions for identifying customer needs, and activities that will make these solutions to become real physical products (Säfsten & Johansson in Bellgran & Säfsten, 2005). As we also can see in figure 4.1 below, the product realization is a combination of the product development process and the production development process. These two processes are dependent of each other to achieve an effective development and realization process. The integration between product development and production development is however not always smooth. Product realization is in turn a part of the innovation process which is a part of the product lifecycle. (Bellgran & Säfsten, 2005) Instead of owning and operating the whole product realization process, now majority of the companies focus more on the parts of the process, because they have a stronger value proposition (Aytac et. al., 2006).

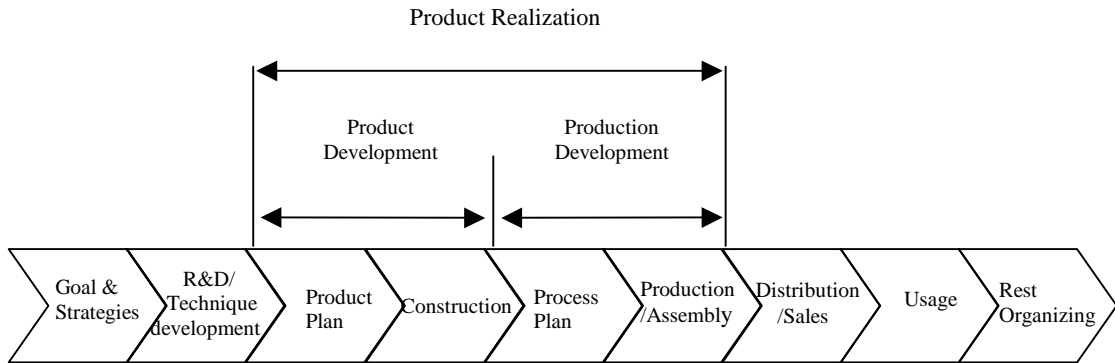


Figure 4. 1Product realization process
 Source: Bellgran & Säfssten, 2005, 7

Companies usually have structured product development processes which in turn contain descriptions of the activities performed within them (Beskow in Bellgran & Säfssten, 2005). A well described product development process is helpful in many ways and among others it gives a good base for the company (Ulrich & Eppinger in Bellgran & Säfssten, 2005). Furthermore it facilitates the coordination of activities and management and makes the plan clear. It also makes it easier to discover the parts that should be improved (Bellgran & Säfssten, 2005).

To just have a competitive price in comparison to your competitors today is not enough if you want to stay and compete on the market. There should also be room for quality, delivery capability, flexibility and much more, in other words everything that will satisfy the customer. A successful production activity requires consideration and choice of strategic, tactical and operative resources. They should be connected with each other and support the resources available for the product. In turn, those are the resources which the organization will compete with on the market. (Ibid.)

4.2.1 Sequential and overlapping product development process

The product development process can be constructed as a sequential or overlapping process. Time usage in particular is what most clearly

distinct the two processes alternatives. There is much effort done to shorten the time within the product development process. Previously, a sequential product development process was more applicable because the markets were generally more stable than they are today. Now there is more focus on the overlapping product development process (see figure 4.8) and integrated activities with increased participation. This integrated product development process involves activities performed parallel to each other such as planning, conceptual development, design of system level, specific design, test and refinement. To be able to work in an overlapping way with different activities it is important within a development process to have correct information and a relevant decision base. The sooner, new information is gained for the upcoming activity, the sooner those activities can be started. When activities are overlapping instead of sequential it is important to be updated with the change and progress that occurs in the sections. (Bellgran & Säfsten, 2005)

4.2.2 Time and the product development process

As mentioned earlier, the aspect of time is crucial in rapidly changing environments and consequently also in the product development process. This section gives a deeper insight of how time and product development processes are linked to each other. For a producing company, time in different forms in a company, has always been one of the most important competitive factors. For many products the product life can be very short and in some cases even be shorter than the time period it takes to develop it. For a company in such a situation the development of the next product generation must start before the previous one has reached the market. One important disadvantage of this is in relation to the competitors. Competitors' that have a shorter product development time can start later. That makes it possible for them to await new technology or market information that they can use to improve their product additionally. The shorter development time allow them to launch their improved product on the

market at the same time or even faster than your company. It also makes it impossible for the company to use feedback gained throughout the current product development, during the next product generation. Still there are strong economic reasons for a company to do their best to shorten the development time. Companies can through intense product launches defend its market share and thanks to a first mover advantage set the price on the market. The margins are bigger in the introductory phase than when the product's life cycle has matured. It is important to stress that a fast development of a product is not always advantageous. Time should be used in other effective producing ways; it should also be linked to costs and quality. Thus a short development time is only good when it is a matter of competitive capability. Further Bellgran and Säfsten (2005) takes up a study done by Lindberg *et al.* (1993) that shows that reduced development time leads to increased revenues, but at the same time it creates increased development costs. (Bellgran & Säfsten, 2005)

A company in a high-tech market is constantly innovating technology and new products. High-tech companies grew rapidly in the beginning of late 1990s and companies concentrated more on internal integration to be able to reduce costs and shorten the life cycle of their products. Companies in those markets are primarily driven by time based competition, thus time is a vital factor in this market. Customers demand in a high-tech market is considered to always be volatile and challenging to achieve for a company. Due to the rapid innovation, short product life-cycles are created and firms must provide the customers with innovative products to be able to retain their position and gain new revenues. Product life-cycle in these markets is referred as technology life-cycle. They start with an early growth and continue with a period of stability and later the sales decline when a new product is introduced. This life cycle is driven by market competition and technological innovation. It is ineffective to forecast a high-tech product since they have short product life cycles; it is not possible to expect that the demand trend will remain the same for any longer period

of time. (Aytac *et al.* 2006) Products that are sold for a short period of time are referred to have a short life cycle; furthermore they are characterized to be different from the other products existing in the market. (Kamath *et al.* 2006)

4.2.3 Complexity and the product development process

We will present the complexity theory later on (see section 4.3.5) and explain how a set of relationships together affects behaviour and the direction of development. In this section we show how complexity occurs in a product development process. Product complexity and production complexity are two relevant things to look at in the production system. Product complexity is mostly an integration of different components, operations and also the technical level and the line between them. The number of product structures, product design, variations, materials, size and weight are just a few of the things that a complex product can consist of. The complexity of different sections depends on which solutions the sections have come to choose, in other words how the complexity is handled. In the same way as the production processes in an industry, the product development process also has many interacting parts and is complex. This creates different problems within the product development process. Therefore, it is preferable to try and eliminate the complexity and encourage simplicity. (Bellgran & Säfsten, 2005) During the whole development process it is important to always think of how to deal with and reduce the complexity (Säfsten & Johansson in Bellgran & Säfsten, 2005). Furthermore complex system integration should be avoided until the complexity is reduced both on the product and on the production system. Attempts should also be made to make the work more effective (Roth & Miller in Bellgran & Säfsten, 2005).

The production system is a result of a design process. This operation is a more or less complex depending on to what extent the current change affects the product and production system. (Bellgran & Säfsten, 2005)

Säfsten & Johansson shows this complexity level with the figure 4.2 below, illustrated by Almgren (1992):

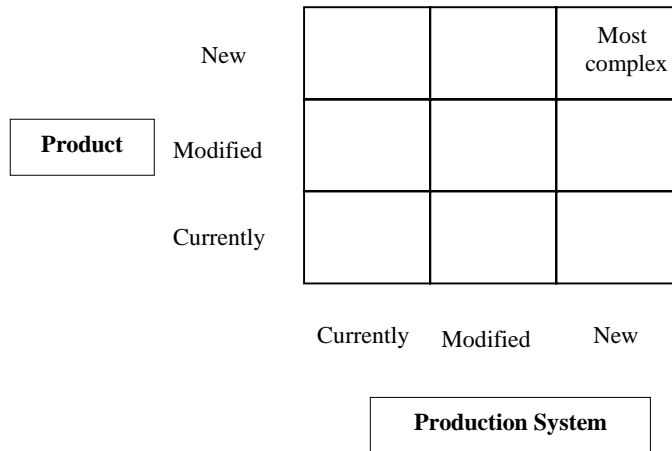


Figure 4. 2 Model classifying, different operation situations
 Source: Bellgran & Säfsten, 2005, 332

4.2.4 New approaches to product development

Traditionally, the development of a product involves the product going back and forth between customer and supplier before a good solution is reached. However, attempts are being made to develop the traditional product development process further to save resources, in this case particularly time, and reduce the original time period needed in the process. The concept of customers-as-innovators and the concept of modular products presented below are two possible ways to make a product development process more efficient. The customers-as-innovators concepts display the importance of good market and customer connection. On the other hand, the modular products concept displays the improved effectiveness of working on more than one thing at the same time. Shortened product life cycles force companies, especially those in rapidly changing markets, to improve their product development process. Therefore, we believe the presentation of these two ideas on how a product development process can be organized and structured further is of use to us. The presented concepts have the

possibility to make the process more efficient, to achieve a time profit and reduce required resources.

The *customers-as-innovators* concept is the first approach to a more efficient product development process. According to researchers Thomke and von Hippel (2002), the acceleration of pace in many markets today and increased focus on customised products can easily cause development costs to grow beyond proportions. Customized products in general require more involvement, time and resources to develop and any extra adjustments of the product is a costly addition. Extra financial resources have to be dedicated to the needed improvements and also additional time which is a scarce resource in rapidly changing markets. However, the dilemma of the situation may be solved by a new approach to value creation, used by both General Electrics as well as BBA, a global supplier of flavours to various food companies. These companies have transferred the product development process to their customers. They make it possible for customers to develop their products in the way they want them from the beginning. The companies have realized that by providing their customers with tools to develop products on their own, they save resources by reducing the need for modifications before a satisfactory product can be launched. (Thomke & von Hippel, 2002) “The user-friendly tools, often integrated into a package we call a “tool kit for customer innovation”, develop new technologies like computer simulation and rapid prototyping to make product development faster and less expensive” (Thomke & von Hippel, 2002, 74). The model illustrated in figure 4.3 below, show how the producer through the customers-as-innovators approach gives its customers the tools to develop the major part of the product. The trial and error iterations are carried out by the customer instead of the producer. This leads to a faster and more effective product development process.

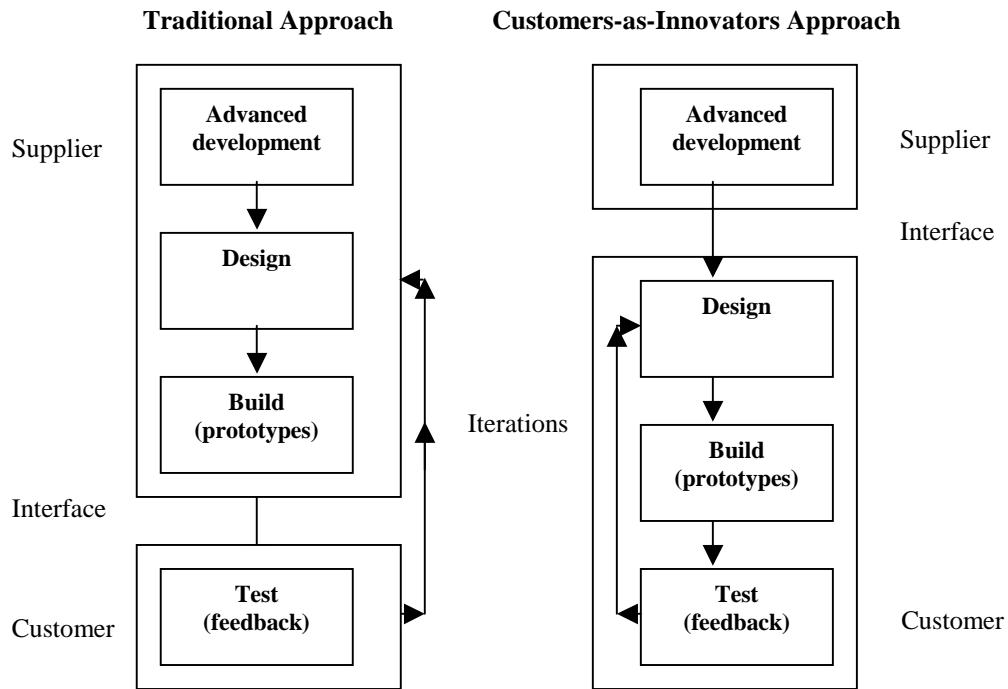


Figure 4.3 New approach to developing custom products
Source: Thomke & von Hippel, 2002, 76

Customer innovation is one way to resolve the traditional problem of product development. The problem is that information about what the customer wants lies with the customer and the information about how to satisfy the customer’s needs lies with the company. (Thomke & von Hippel, 2002) Provided with a good user-friendly tool the customers develop what they want and the company use that to produce the developed product.

A question concerning customer innovation was how customers without any knowledge about the requirements for product production can develop something that can be produced by the company. This problem was solved with the help of computer-based tools. Expertise about product development could be put into the computer-based tools. These then allow customers to develop

complex designs, constructed in a way so can be produced, in a simple way. However, the customer-driven innovation of different products also has its disadvantages. One problem is how to create a tool kit that is easy to use and understand. It should also be clearly based on the company's production processes and include a large number of components so that it is easy to construct more complex designs. (Thomke & von Hippel, 2002)

The *modular product* concept is the second approach to a more efficient product development process. The researcher Charles Fine discusses the aspects of modularity in his article (2005) concerning modular and integral product architecture. Modular products can be described as separate parts or units that can be joined together or joint with other products. They are also possible to upgrade with alternative components (Fine, 2005). Modular products can be complete products that function well separately but at the same time have the possibility to be combined with other products and create additional usage areas. A product development process can be shortened if the different product parts can be manufactured simultaneously and maybe even launched at separate occasions. The process will neither have to be based sequentially (see figure 4.8) where one phase in the process needs to be finished for the next phase to be initiated. It can instead be constructed around an overlapping principle which reduces the time period between idea to finalized product. Modular design is usually highly standardised, flexible and with standard connections to subsystems. They are also in many cases open systems, allowing for separate modules to be created by others. A company can reduce the lengths of the product development process if it should choose to transform its product architecture to a more modular one. Thereby it can narrow the development scope and decrease the needed time and gain a time profit. To make the supply system more modular can also reduce the time needed. The product development can be supported by a broader network both geographically as well as organizationally

because the parts supplied are standardised and easy to design from a distance. (Fine, 2005)

4.3 Changing markets and dynamic systems

4.3.1 Competing on the edge

Competing on the edge is a suitable strategy to apply for companies acting in rapidly changing markets. The competing on the edge theory helps companies create a flow of constant renewal within themselves. The need for constant renewal and the importance of managing transitions and rhythm is relevant for the type of company we chose to study. Therefore, this theory can be of use in our research.

The theory of *competing on the edge* constructed by Kathleen Eisenhardt and Shona Brown is as mentioned a strategy for companies wishing to succeed in rapidly changing markets. The paradigm is intended to help manage contemporary companies in new business environments where traditional approaches are no longer as successful. The theory helps the company to develop a rhythm of change, thereby affecting the market and forcing competitors to follow. Its central strategic challenge is how to manage change and it looks at where a company wants to go but also at how to get there. The goal with a competing on the edge strategy is to generate a continuous flow of advantages and create a continual reinvention in the company. The paradigm can be presented by a number of key words that will be briefly explained in the text below. (Eisenhardt & Brown, 1998)

Unpredictability is a major part of a strategy developed for competing on the edge. A rapidly changing environment does not allow for the creation of a clear, well defined strategy because the

future is not possible to certainly predict. The possibility of precision planning is not possible in a rapidly changing industry. Instead an *uncontrolled* strategical process is implemented. A strategy for these markets is about the development of strategy at the different business units and not at corporate headquarters. *Inefficiency* in the short run is said to characterise a competing on the edge strategy. The constant pace of change often causes the company to make a number of errors before finding a temporarily good alternative. A competing on the edge company is not going to be the most efficient or the most profitable because that is not possible with this type of approach. The usage of change to reinvent the business is most important. If a company can manage this and discover opportunities for growth, the profits are assumed to follow. To act *proactively* and strive to lead change is the best way for a company in a rapidly changing environment to reach success. It is about creating an opportunity and taking the initiative before the competitors do. A *continuous* movement of change is therefore important for this type of strategy. The changes should, despite its intensity, form a rhythm of repeated change that becomes familiar for the company to go through. *Diversity* in the strategical process is about diversifying the changes and moves the company makes. Due to the business climate it is not possible to invest every resource in the company according to one single strategy. In short it is about making a lot of different moves where the majority of them lead to success.

Illustrated by the key words above, the competing on the edge strategy differs in many aspects compared to traditional strategic approaches, the lack of clear consistent structure and the diversified actions being some examples. However that is what makes it flexible, something required by a company strategy constructed for generating success in a rapidly changing industry.

4.3.1.1 Core concepts

As mentioned in the previous text, a competing on the edge strategy should preferably answer two strategic questions, “where do you want to go?” and “how do you get there?” In a rapidly changing market the successful organization is the one that can manage continuous change and also manage for temporary competitive advantages to emerge. According to Eisenhardt and Brown (1998) there are three core concepts or ideas which describe a company that can change continuously, namely: *the edge of chaos*, *the edge of time* and *time pacing*. The building blocks of the competing on the edge theory are illustrated in figure 4.4 below and will be explained in the following text.

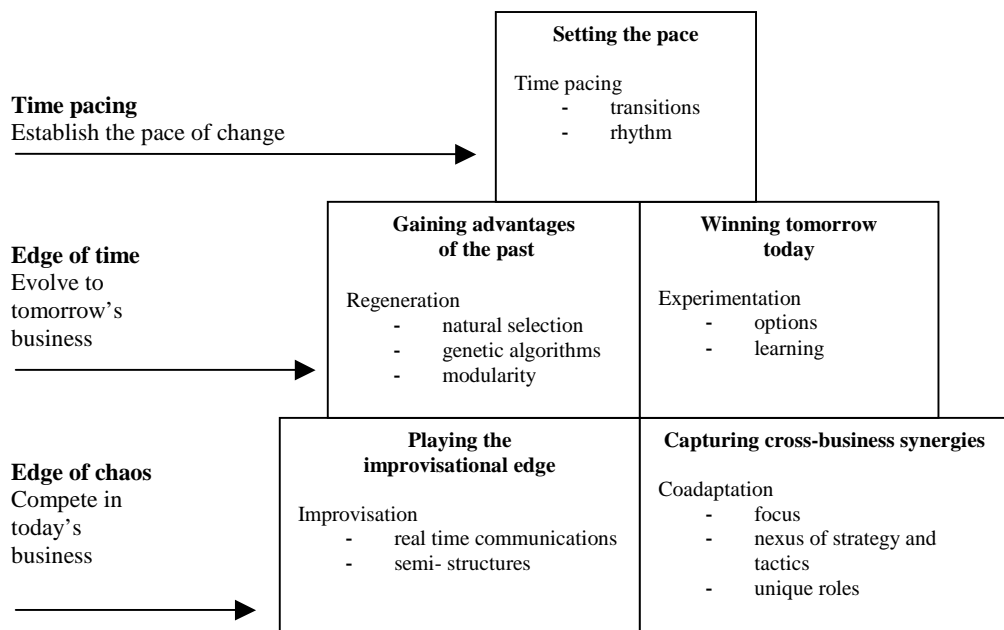


Figure 4. 4 Building blocks of the time pacing concept
Source: Eisenhardt & Brown, 1998, 23

The first core concept is *the edge of chaos* which in an organizational environment can be explained as a company that is not that highly structured. Less structure gives a better possibility to balance in the middle between chaos and order. The position between chaos and order is the best position for a company to be because that is where the most interesting things develop. The

assumption is that change in a company only happens when there is a certain amount of flexibility in the strategy and organization. The company and the strategy it employs have to be flexible enough for change to occur, but at the same time structured enough to manage and implement change. It is a balance act between structure and chaos within the organization and that can, if managed correctly, generate advantages. The company should be able to take advantage of flexibility and synergy of cross-business cooperation at the same time. The difficult aspect of the edge of chaos positioning is to see what really should, or should not be, structured.

The second core concept says that a company should balance on the *edge of time*. This means that the company should attempt to balance between past and future in order to act in the present and thereby be in line with time. Companies tied to their past will never manage to regularly reinvent itself because it is locked into the patterns of the past. Focusing too much on the future may cause the company to forget about the present business activities. Consequently, the edge of time is about acting in the present without forgetting to consider the past and the future at the same time. The difficult thing with the edge of time is how to oversee the different timeframes without laying too much focus on either one. (Eisenhardt & Brown, 1998)

The third and final concept is *time pacing* that also is the focus of a scientific article called "*Time Pacing: Competing in markets that won't stand still*" published in Harvard Business Review in 1998. It was written by Eisenhardt and Brown and presents the time paced strategy in more detail. Time pacing is about creating a proactive, regular rhythm of change in the company. The regular rhythm will allow it to sustain the market initiative instead of being forced to follow the initiatives taken by its competitors. Time pacing should generate a rhythm inside the company that will be the drive force for change. A time paced company works according to strict

deadlines. Actions and further developments made are all included in the company's strategic plan, and carried out even though no secure indications exist that the market can support them. In their scientific article about time pacing, the researchers present time pacing as the opposite of so called *event pacing*. Event pacing represents the common approach to changes in a company and its business environment. Companies that event pace follow a preset plan and only depart from it when performance fails. (Eisenhardt & Brown, 1998) Event pacing works well in stable markets because there is no need for fast reinvention and constant development. There is also possible to take more time to fit competencies to the environment. However, if the rate of required change on the market increases, event pacing is of no use.

4.3.2 Deeper insight into time pacing

As the previous text states, the purpose of the *time pacing* concept is to “avoid being left behind, gain ground by exploiting rhythms and transitions, and even set the pace of change” (Eisenhardt & Brown, 1998, 69).

This strategy suits all types of companies but is especially useful for companies in markets that always are changing. Managers that succeed with time pacing often perform well at two things, namely to *manage transition* and to *manage rhythm*. *Transitions* are important in rapid markets and they can often decide the future fate of the company (Eisenhardt & Brown, 1997). They need to be performed effectively and within a short time period. The intense pace in this type of market makes it impossible for long and unstructured transition processes to be conducted. In rapid markets there will also be a larger number of transitions for the company to manage, which in turn makes these more critical. The companies that succeed with transitions inside the organization use them not only as a movement

between two places but also as opportunities for broader change. (Eisenhardt & Brown, 1998)

Managing *rhythm* is another crucial aspect of time pacing, giving people the possibility to plan ahead and knowing what is going to happen next. The rhythm of change in a company has to be set in accordance with the marketplace as well as the company's internal capabilities (Eisenhardt & Brown, 1997). The rhythm of the market can be caused by such things as seasonal cycles or suppliers' product development. However, the most important factor that affects a market rhythm is generally the customers. Therefore are fluctuations of customer demand important to consider. To adapt and manage a rhythm of change does not have to mean that the company should have to speed up the process. Time pacing is not just about a never-ending and fast rhythm of change. The theory recognises that if a company changes too frequently it will never be good at anything. Then it will be acting too quickly to manage to build up any knowledge or competencies in one area before moving on to the next. The proactive and regular approach of time pacing can instead prevent companies making this mistake by employing regular deadlines for change and development. (Eisenhardt & Brown, 1998)

4.3.3 Hypercompetition

The conditions on a so called hypercompetitive market are conditions that companies in rapidly changing markets face. The theory of hypercompetition is possible to apply to Sony Ericsson which is we derive our primary information from. The need for renewal which consequently affects the product development is yet another reason why the concept can be of use.

The traditional competitive advantages do not provide companies in rapidly changing markets with any long-term securities to maintain a sustainable market position. This type of rapidly changing market

bears the characteristics of a so called hypercompetitive market. *Hypercompetition* is a concept which has been further developed from the national economist Schumpeter's ideas of competition as a process of creative destruction (Grant, 2002). Schumpeter's most important work was focused on economic development and he presented a theory explaining the process of economic development. The theory placed entrepreneurship and the entrepreneur as central components explaining economic growth and development (Ibid.). He thought of the economy's status quo as being in equilibrium. New inventions and ideas created by entrepreneurs caused disturbances in the market. Those in turn caused the economy to move away from equilibrium. These disturbances created opportunities to develop new things, change old praxis and opened up for new areas of economic growth (Gabrielsson, 2007). Schumpeter's theory about a healthy economy being constantly affected by market disturbances leads to the assumption of the "ideal market" as that one being in constant transformation. Similarities exist between Schumpeter's "ideal market" and what today is called hypercompetitive market. They both demonstrate the importance of change as the foundation of development and also the value of creative destruction. A hypercompetitive market is defined as:

"[A]n environment characterised by intense and rapid competitive moves, in that competitors must move quickly to build advantages and erode the advantages of their rivals"
(Grant, 2002, 93).

Such a competitive behaviour calls for the companies to constantly create new competitive advantages, and at the same time attempt to destroy those of their competitors (Ibid.). This in turn will make the market move away from equilibrium and towards a constant disequilibrium. It is generated by companies that move into new market areas, grow faster than their competitors or restart cycles

(Grant, 2002). Therefore, the only way to sustain and grow your position in the hypercompetitive marketplace is to constantly create temporary advantages and realize that they inevitably are destroyed in the current state of disequilibrium (D'Aveni, 1994). Traditional strategic management literature dealing with static competition divides the competitive advantages available for a company into the four competitive areas of *price and quality*, *timing and know-how*, *business territory* and *capital strength*. In these static strategical models the competitive situation is described at a certain point in time without sudden changes or new entrants. Consequently, the majority of these earlier models are not useful when to analyse and create strategies for a hypercompetitive environment. However, this does not mean that the four original areas of competition have lost its importance in a hypercompetitive market. They are still relevant but the idea of how they should be applied in strategic models has been modified to suit rapidly changing markets. D'Aveni (1994) means that temporary competitive advantages are better suited for a hypercompetitive market.

4.3.4 Chaos theory

To be able to give a fair description of the following sections we need to clarify: what a system is. It consists of two or more elements where each element affects the overall picture. Each of these effects of the elements is in turn also affected by other elements. Product development process consists of many elements that work together in a system. Dynamic systems are capable of changing over time, and it makes it interesting to find out how these dynamic systems behave over a time period. Unstable systems on the other hand are not capable of changes and instead they go further and further away from their origin. However this does not have to be a case of accident but can be theoretically modelled. (Häglund, 2007)

The chaos theory was first developed by Henri Poincaré and explains how there through randomness can arise a structure or occurrence within a system characterised by chaos. Chaos thus refers to system behaviours that are in disorder and randomness. Chaos and self organization is of concern for organizations and it gives managers a different and essential understanding of their strategic development. A manager of an innovative company is not able to predict or plan the long term future; instead the manager can create and discover the future. (Stacey, 1993) It was the deal for Gordon Moore, cofounder of Intel Corporation and founder of the Moore's law, named after him. The law originated from the decision to double the capacity of Intel's microprocessor computer chip and continue to do so every 18 months. His law is closely connected to the concept of "time-pacing" (see section 4.3.1.1 and 4.3.2) which became the business strategy for Intel. This was a way of expanding the capacity which prevented its competitors to enter the market and blocked them from getting a grip. In short Intel was the one to set the pace of change. (Eisenhardt & Brown, 1998)

"The changes occurred, not only because we were planning, but because we were learning" (Stacey, 1993, 11)."

A proactive environment gives a result of complex learning and in response an organization changes and develops new strategic directions. However, if the organization fails to develop in this environment there is no change or development of the strategic direction. Thus it is important to know that it is no longer possible to just have the belief of those assumptions we make about causality and know how to implement them. We have to modify our view when it comes to how organizations develop strategically. Furthermore there are four important points about the complex behaviour of dynamic systems explained by Stacey in the article "Strategy as Order Emerging from Chaos". The *first point* is made on the feedback system which is related to the chaos theory. There

are two kinds of feedback, one is negative and the other is positive feedback. The negative feedback system is implemented by all effective businesses which help them to control and regulate their everyday activities. On the other hand it is dangerous to have too much positive feedback since it generates an unstable equilibrium. The positive feedback enhances changes and do not help to bring the system back in control. Thus it is essential that the feedback relationship is linear and that is why most companies put much attention on negative feedback. The *second point* is made on the instability which chaos is a form of and because of that the long-term future is unpredictable. A company that is successful is affected by feedback processes that are not controlled by the manager and thus generates outcomes that were not planned. They are also characterized by feedback processes that are switching between negative and positive feedbacks, and those feedback patterns generate chaos. The *third point* brings up the boundaries around instability and shows that the history repeats itself but never in the same way. The *fourth* and last point is that through the unplanned process of chaos self organization creates an unpredictable new order. Nonlinear feedback systems that go further and further away from the equilibrium are able to create a complex new order. Furthermore there are eight steps that show how to create order out of chaos, these steps are as follows:

1. Develop new perspectives on the meaning of control – *change control concept*
2. Design the use of power – *use of power has different effects, open “environment” better*
3. Encourage self-organizing groups – *form groups, organize themselves, and prepare not to like all ideas*
4. Provoke multiple cultures – *mixture of people, opinions, experience*
5. Present ambiguous challenges instead of clear long-term objectives or visions – *do not give easy challenges*

6. Exposure the business to challenging situations – *expose yourself to the most challenging situations*
7. Devote explicit attention to improving group learning skills – *change learning and learning processes, study learning and interaction*
8. Create resource slack – *create “supporting” and favourable atmosphere, cause and effect link disappear in innovative human organizations, planning only on short-term basis.*

(Stacey, 1993)

4.3.5 Complexity theory

As earlier mentioned product development process creates complex behaviour that can be hard to predict. Furthermore it can be complex to understand how organizations and product development process change. Complexity theory is about how order, structure, and pattern arise from extremely complicated, apparently chaotic systems. It looks at how complex systems can generate simple outcomes (Ibid.). The reality is not understandable, it is complex and incoherent. Furthermore it can be complex to understand how organizations change. Change is necessary for companies to develop and especially for those in contemporary markets. The initial scientific understanding of how organizations change is self-referential, which means that the organization is renewing itself, for example by making innovations or perhaps by buying new machines for production. Later this understanding gained a new insight, focusing on two processes, both based on how living things grow, adapt and change. Complexity theory composes one process which explains that change appears unexpected and surprisingly. Along with this theory the adaptation of partially linked systems are more effective than greatly linked systems. This is because too much structure will make that the system stand still, whereas too little structure creates chaos. According to the complexity theory the effective way to change would be to stay balanced on the edge of chaos (see section 4.3.1.1). It concentrates on the collaboration of the managerial thinking within the organizations different parts and

on the tradeoffs which has little control for better adaptation. (Eisenhardt & Brown. 1998)

4.3.6 Evolutionary theory

The evolutionary theory first drafted by the famous natural scientist Darwin is another process which describes the gradual change through retention, selection and variation. Subsequently the evolutionary theory is the older perspective of change. Apart from the complexity theory this theory states that systems grow from natural selection, such as genetic variation and through generations over time. Additionally most efficiently developed systems is according to the theory created by regularly declaring what was useful in the past and implement it to what will be useful in the future. Thus in this theory the important thing is to stay at the edge of time (see section 4.3.1.1) where the past and the future is connected. With focus on randomness evolutionary theory is including the past and future to its managerial thinking across a longer time period. (Eisenhardt & Brown. 1998)

4.3.7 Dissipative system

As mentioned earlier managers and companies' strategies play an important role on how things develop in a company. Together with this, within the resource-based view further discussion is made on whether existing competences can be valued as a source of sustainable competitive advantage or not (Sanchez & Heene in Eneroth & Malm, 2000). A company's vision is its guiding device. Companies that ignore or filter feedback from the outside is focusing on its strategic identity and developing itself, and in this case vision is the catalyst in this process. At the same time the vision is also creating linkage between the company's past and future. A vision needs to be reliable in consideration to the company's past and to its identity. Part of the strategic identity a company has is assembled by the ability to remember the future. Vision or prospective memory as the figure 4.5 below shows is important to understand the link between where the

company is today in order to remember how the company can or will develop in the future.

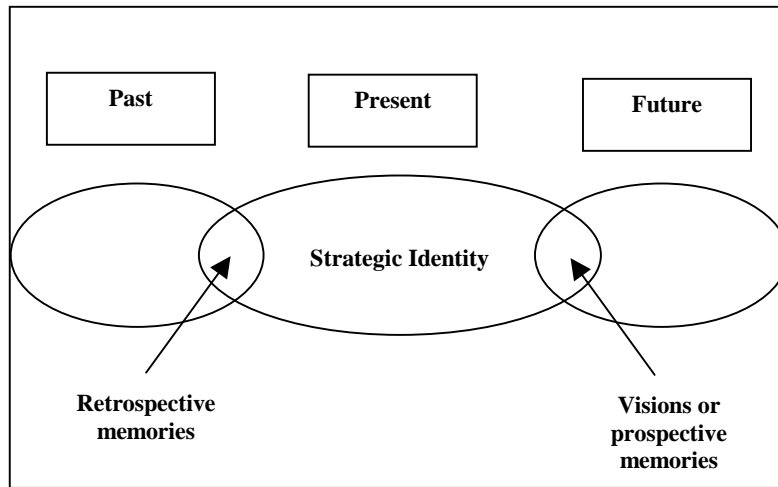


Figure 4. 5 The interlink between visions and identity
Source: Eneroth & Malm, 2000, 142

The theory of dissipative structure (Ilya Prigogine *et al.* in Eneroth & Malm, 2000) in this sense is useful to find new and better ways to understand the change that occur in companies. As it concerns open systems theories, they are not able to explain the nature stable situations. Neither are they able to explain the evolution from one state to another and this is where the dissipative systems come in. The evolving self-organizing open systems opens up new level of descriptions for the changes. This means that such open systems are pushed from the equilibrium and this can cause new forms of companies and new structures can be created as the figure 4.6 also depicts. The name of this new ordering principle is called “order through fluctuation”. Dissipative systems are those that dissipate energy to the environment without falling into pieces, but instead create new structure. Thus for a dissipative system to emerge an openness to the environment, which is not close to the equilibrium and that has nonlinear interactions is required. A self-organizing company in a stable period of time controls the development internally and it is not controlled by external forces. Fluctuations are necessary for the evolution of the system. Its occurrence, in one of the variables that describes the state of the system,

can be sudden, spontaneous and often unpredictable variations. The negative feedback system dampens small fluctuations that arise from inside or outside the system. When the fluctuations are grown to a certain limit then the positive feedbacks increase the fluctuations and thus new structure is created. When fluctuations come closer to the limit the system is in a period that is instable or in chaos, this point is called the bifurcation point. At the bifurcation point there is a number of possible paths and the system is in this point very sensitive in a case of a fluctuation, thus a small and random fluctuation can be what decides the future path of the system. Besides the fluctuations history the initial conditions plays a vital role for the creation of the new structure as well. The behaviour of the system is to some degree predictable between the bifurcation points where it is stable between the periods. (Eneroth & Malm, 2000)

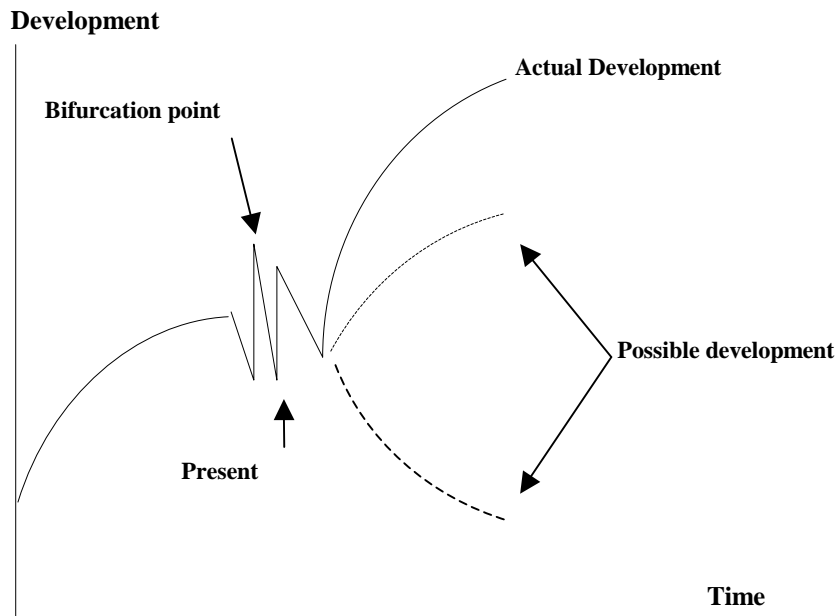


Figure 4. 6 Dissipative self-organizing
Source: Häglund, 2007

4.4 Time and time management

4.4.1 Time

Time is crucial in today's rapidly changing markets; we will therefore present some research about the meaning of time in general. This to increase the understanding of, why we believe that time as a resource is important in organizations. Bodil Jönsson has written several books concerning time and its importance. In the book *I Tid och Otid – hemma och på jobbet* (2002) Jönsson writes about the importance of so called *time saving* technology that have evolved during the last decades. The time saving technology such as cars, computers and washing machines is filling its job by doing things quickly, which means that it saves time for humans. Despite that, people are more stressed and time oriented than ever before. Jönsson writes in her book named *Tio tankar om tid* (1999) that time is the only thing one has. Time is your whole life, from the day you are born until you pass away, it is all about time. Jönsson states that time is every individual's capital. Further on, Bruzelius and Skärvad (1992) mentions that time in a psychological substance, is an experience of "then", "now" and "ever since". Jönsson also upholds the psychological substance of time as "then", "now" and "ever since" and states that this substance is the keystone in the movement of life. Jönsson also discuss the difference between *clock-time* and *experienced time*. The main difference is that people experience time in different ways. For example, every individual experience 10 minutes in their own way. People are not meant to measure the objective clock-time, since they experience every day, hour and minute subjectively. Another distinction is that people cannot affect the objective *clock time* in anyway, whereas the experienced time is individual, both when it comes in how to use it and how every person experience time in his or her life. In the article written by Keith Devlin (1999) the author tries to answer what time really is. He divides time in three parts and those are as follows: "There are three answers: one in physics

and philosophy (time as a physical phenomenon), another in psychology (our sense of passing time), the third in mathematics and engineering (the time that we measure and use to regulate our lives).” As we can conclude from theory, time is perceived in similar ways by several authors and the main outcome is the fact that time is experienced individually and that it is a big resource in every human’s life. Further on, time as a resource will be presented in section 4.4.2.

4.4.2 Speed management

We have found much of our inspiration to this research in the book *Speed Management* written by Lars H. Bruzelius and Per-Hugo Skärvad (1992). The authors discuss the importance of time based management in organizations and how the organization could be more effective when using time in the daily and long term work. According to Bruzelius and Skärvad, the main task is to focus on time, pace and timing in all processes within an organization. The authors also present time as a resource in an organization. They point out that organizations should attempt to use time in the best possible way since the time as a resource cannot be preserved and used at a later point in time. Furthermore they have enlightened the benefits of short development processes and one insight is made on the overlapping and sequential development processes which will be explained later on in this text. Time as a resource is characterized in a number of ways and those are the following;

- *Everything takes time* - whatever kind of activity we perform time is used,
- *Time cannot be recycled* – when time has passed it is used and cannot be reclaimed and come back,
- *Time cannot be stored* – we cannot refrain from using time at a certain point and save it for future use,

- *Time cannot be substituted* – we cannot exchange time with something else.
- *Time is money* – today, this expression is used regularly and it is shown that time is not just money; it is a lot of money.

Some of the ways to use time efficiently in an organization are according to Bruzelius and Skärvad; to be able to eliminate time waste, time waiting and to synchronize and time pace different activities within the company. The book *Speed Management* covers time within the following areas; time efficiency in marketing, delivery, production, development, co-workers, company culture and administration. Since our research is focused on time efficiency in product development, we will concentrate on the presentation of this part.

In today's global market it is important to be one step ahead of the competitors. But according to Bruzelius and Skärvad being first at the market with a new product is not a guarantee to success. They argue that the product development is of big importance. If an organization's product development is not in line with the competitors, the company could lose market shares which could lead to less profitability as well. For a company in today's global market, it is of importance to develop and improve the products and to be time efficient when doing so. Some of the advantages of a high development pace and time efficient development processes are possible lower costs, higher revenues, better consumer adaptation, better market position, latest technology and to be able to set higher prices. Since time is one of the main cost factors when it comes to development project, the organizations could reduce the costs through shorter development processes. A shorter development process also means that the products can come out into the market earlier and sold at higher price, leading to higher revenues. If the organization has a shorter development process, then the products will be more adapted after consumer needs. The company will have

time to identify and find out those needs. Since there then is time to regularly improve the products and be in line with competitors and even one step ahead, this could lead to a better market position.

As we can see there are several advantages of using time efficiently in the development process. But one can ask oneself how time efficiency should be reached. Bruzelius and Skärvad have presented some factors that are important in order to be time efficient and development minded. According to the authors it is crucial to draft clear goals since those will facilitate the organizations daily work. Another important fact is to set the time goal first. No matter how much resource the company has to put in to be able to manage it they should strive to follow the scheduled time table. It is also important to measure the development time that is actually used in order to reduce it in future development processes if possible. Bruzelius and Skärvad also write in their book that the organizations should have respect for the deadline that they have set up; otherwise it can lead to higher costs than planned. The importance of development and improvement of products should be implemented in the organization's culture, so that the employees are development minded. Further on, the communication between the employees at all levels is very important. Another important task is to have close contacts with the customers and to find out as much as possible about their needs. One should distinguish different types of development processes, which means that the development process should be suited for different kind of processes. The authors also mention that the organizations should get inspiration from other organizations experiences. They will by doing so gain knowledge on how to be innovative. Utilising alliances is also of advantage when it comes to the product development process. Last but not least, Bruzelius and Skärvad states that the development process should be overlapping, where different sections work parallel to each other. As one can see in figure 4.7, by this way of working, the organization

can make a bigger time profit and utilize the surplus time to do other things compared to the traditional sequential process.

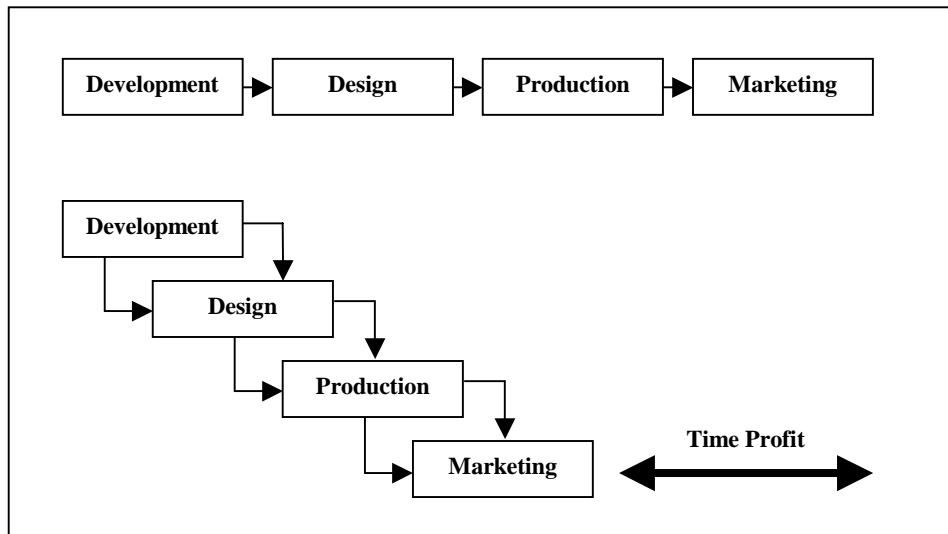


Figure 4. 7 Sequential versus overlapping development process
Source: Bruzelius & Skärvad, 1992, 81

4.5 Theoretical reflection

The theories and concepts presented in this chapter are well established and commonly used in theory and practice. However, we are aware of that theory and ideas are often presented in a subjective way by the originator(s) without displaying possible critical thoughts towards it. The theories of complexity, evolution and chaos are founding and accepted theories supported by various sources. The other ideas and theories in the theoretical chapter are in many cases relatively recent concepts. They are not yet as well founded in theoretical contexts and should therefore be regarded with a bit more caution.

4.6 Summary

In this chapter we introduced the main and significant theories and strategies that we believe will help us identify the key factors of

how to employ time in order to build an efficient product development process. This chapter contributes to an understanding of the product development process in a high-tech company in a rapidly changing environment. How things change over time in these markets and what the changes depends on is also crucial to know. Time in itself is another factor that is explained, due to its importance for companies in these markets. The theoretical framework supports the creation of the interview guides we will carry out at Sony Ericsson and Paradigmmäklarna. After the interviews have been conducted and the primary material structured, the framework will be combined with the primary data in the analysis. We are aware of the size of our theoretical framework but consider the written framework to be a relevant part of our dissertation as well.

Chapter 5 – Compilation of primary data

The chapter presents the information gathered from four interviews with employees at Sony Ericsson as well as one interview with two analysts at Paradigmmäklarna.

5.1 Sony Ericsson

The company, from which we collected a lot of our information about product development processes in relation to time, is Sony Ericsson. The joint venture Sony Ericsson started its cooperation in 2001 and is owned by Sony and by Ericsson. The head office is situated in London and the company also has offices in Sweden, Japan, China, the UK, Germany and in the US. The company has around 6000 employees all over the world. Sony Ericsson consists of several different departments such as R&D, design, distribution, marketing, sales and customer service (Internet 4). Sony Ericsson's vision is to "establish Sony Ericsson as the most attractive and innovative global brand in the mobile handset industry," and their mission is "to develop and sell wireless terminals, applications and accessories for the global mobile telecommunications market." Sony Ericsson's company values are *passionate, innovative and responsive* (Internet 4).

5.2 Empirical results from Sony Ericsson

The primary data collection was performed through interviews, where four of these were conducted with employees at Sony Ericsson in Lund. The four individual interviews revolved around a number of themes and within these a number of more direct questions. However, during the interviews the Sony Ericsson respondents were allowed to speak relatively freely also in connection to the more direct questions. The results from the four interviews are presented in the text below through a division into the themes which the interviews covered. Two of the

participating respondents wished to be anonymous. Therefore, the results will be presented without any referrals to individual statements that mention the respondents by name. The information is presented in the same order as the themes covered through the interview guide (see appendix 2), those being general information, product development process and time.

5.2.1 General information

The four respondents employed at Sony Ericsson are currently working at different positions within the company. They have all been employed at the company for different periods of time but some have been at the company already from the beginning in 2001. Since two respondents wish to be anonymous we will not present which positions they hold within the company. However, the four respondents all work with the product development. Two hold more prominent, overlooking positions and the other two less prominent positions. Two out of the four respondents had no relevant previous work experience before they were employed at Sony Ericsson but all had an education connected to their field of employment.

5.2.2 The product development process

Within Sony Ericsson the product development is performed in what is called heartbeat projects. Heartbeat projects are R&D projects that involve the development of a product from its initial idea to the finalized version. The heartbeat projects, usually named after the years they begin, are a cluster of smaller projects that constitutes the main platform project. Some of the respondents have a more prominent role overlooking entire heartbeat projects whilst others work with defined sections within the heartbeat projects, such as a specific mobile phone model or special features within a mobile phone. Therefore, when we asked the respondents to talk about their last three projects, and their roles within these, the examples varied. During their last projects, they

also had diverse areas of responsibility due to the differently prominent roles.

The respondents' influence over the projects depended on their different positions within Sony Ericsson. Seeing that some of the respondents have positions with more responsibility, the level of influence they had within the projects is naturally higher. However, the general opinion given by the respondents was that as long as you know what you are doing, you have quite a lot of influence within your own part of the project. For those with less prominent positions they also stated they had a high level of freedom within the fixed frames of the project. The fixed frames are set by the predetermined processes applied during the initial part of a project. A process is supposed to work as a guideline during a project. It is intended to be a support and for example states necessary documentation and procedures. The structures of the processes vary depending on what type of project it is applied on at that time. The respondents at less prominent positions explained that the processes they have to follow are similar in every project. They are also designed out of basic standards and on previously performed processes. After the project process has been determined, milestones are set. By using milestones you ensure that the sections within a specific project are updated with each other and that the work proceeds accordingly. Some of the respondents were restricted to discuss the procedure of their work within the projects due to the confidentiality surrounding such information.

The respondents all reflected that cooperation between the different project sections is important and that a certain amount of flexibility and synchronization is necessary. Generally the work in the different sections is carried out without too much involvement from other sections. However, to ensure that the work carried out proceed according to plan they usually have weekly meetings. The meetings serve to update each other and cross off which milestones the project sections have passed. When we discussed how much cooperation is

planned and how much of it is carried out, one of the respondents explained that previously, there were greater divisions between the different sections but that it has improved.

A project has a time frame of two to three years, from the initialized idea to finalized product, such as a mobile phone. On the other hand it usually takes more time to develop a basic platform that is intended to be used in a large number of mobile phones. In general, the product development process proceeds along a few specific steps. Our impression is that the product development process at Sony Ericsson includes the following parts (see figure 5.1); *concept, design-development, production, sales and marketing.*

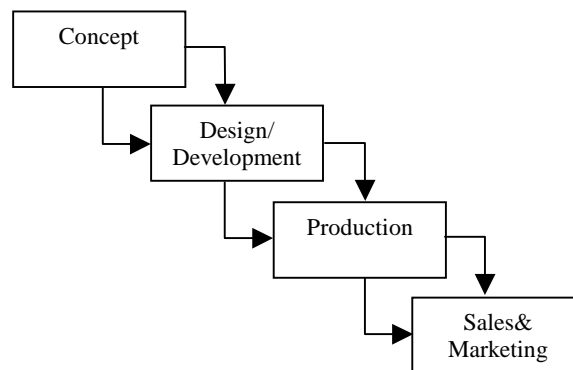


Figure 5. 1 Steps in the product development process
Source: Interpreted model

Regular feedback loops are necessary throughout the process which further supports the importance of communication. Although there is a process structure to follow, it is possible to add new ideas or innovations in the later stage of the product development as long as they do not affect long-term deadlines, greatly exceed budget or is too difficult to develop. When reflecting over past projects the general opinion was that you learn from experience. According to the respondents the initial period is the most hectic one, whereas the pace slows down during the final period. When asked about their personal project experiences, one respondent stated that the working processes

usually are characterised by a high pace. Other reflections were that there were not enough people assigned to the projects.

Suggested improvements of past projects were to increase the flexibility within them, which in turn will lead to an easier process. There is usually a lot of documentation required but there should be more efforts made to increase the relevance of it. The purpose of documentation such as this should not be to add additional workload but instead to be a support. Another comment expressed, was the importance of management listening to those conducting the actual work. To conclude, the respondents' reflections about suggested improvements of past projects where; a more flexible process, more relevant documentation, the process functioning as a support rather than an obstacle, regular debriefings and evaluations and synchronization.

After reflecting on possible improvements of their past projects, the respondents were encouraged to give their views on what they considered to be an effective product development process. Flexibility within the development process was something addressed by all four respondents. The process should be individually adapted to the specific projects and only relevant parts should be included. Documentation that is clearly relevant would provide better support during the development process and therefore also the possibility to exclude irrelevant material. A clear architecture allowing for an overview is yet another aspect that they feel characterizes an effective product development process. The respondents at less prominent positions also emphasized the significance of that the persons which conduct the work need to have the required basic knowledge. That in turn will give them possibility to perform their work in the best possible way. This can for example mean that the employees have good skills in a particular computer programme used to develop the software to the products. The employees are a valuable resource and skilled employees are important for successful product development. Finally, one respondent claimed that the only real resource the company has are its employees and the time they spend at work.

5.2.3 Time

When asked about the subjects of time, the respondents thought time to be a significant resource within their company. One of the respondents said that everything is governed by time which was confirmed by all respondents. Time is important for Sony Ericsson from a competitive point of view. As mentioned, the overall impression is that a company such as Sony Ericsson is experienced as a high paced working environment. The respondents also pointed out that the pace depends on the different seasons as well as by the competitors and environmental development. The discussions around time and work pace then brought us to the question about deadlines. We wanted to find out if they follow their deadlines and what kind of consequences that appears if they fail to do so. The respondents had similar answers to these questions as well; they work after milestones in different projects and have both short- and long- term deadlines. One of the respondents mentioned that it is crucial to follow deadlines since it is important that everyone works on the latest updated information. Another one pointed out that short-term deadlines are more flexible than long-term deadlines, since the delays of long-term deadlines can cause delays in the whole product development process. If deadlines are not followed, then it could have a number of consequences according to the respondents, such as delayed production, lower quality and lower revenues. To avoid these problems the suggestion from the respondents is to communicate more regularly between each other and to synchronize the work. This could be done by follow-up meetings and different decision forums. The importance of time in the steps of the product development process is also upheld by all the respondents. One of the respondents stated that time is especially important in the beginning of a new project. If the time is efficiently utilized in the beginning, it may reduce the high pace in the last steps. If the initial time management is efficient, then there may be time during the final steps to make some final further improvements before the market launch. However, another

respondent stated that the awareness of time is higher at the end when you are getting closer to the final deadline and there is not much room for flexibility. Further on, a third respondent pointed out that time is not equally divided throughout the different process steps. We got the impression from the interviews that the importance of time as a resource is implemented in the company culture, since the respondents agreed on this statement. Another reason why we got the impression that time is acknowledged in the company is because time is seen as a competitive advantage, according to the respondents.

Since time is important in a high-tech company such as Sony Ericsson, we also wanted to find out what they do if they finish before schedule and thereby gain a time profit. All the respondents stated that time profits does not occur that often. One of the reasons for this is that they believe that a product always can be improved. Therefore a time profit is used for additional work on the mobile phones. Neither are they able to launch the product earlier, if a time profit has occurred, because of the marketing dates, announced dates for the launching of the new product and so on. What type of additional work they could perform on a product if a time profit occurred varied. Since they believe that a product always can be better before launching, they put all the effort in improving the product. They also put more effort in new functions if it is possible and further they also improve the software. The hardware is usually not possible to change so close to the launch since it would take too long time. One of the respondents mentioned that it is possible to start with a new product when opportunity is given, since they are able to launch many products at once. During a discussion whether Sony Ericsson controls the time or if the time controls Sony Ericsson, the majority of the respondents claimed that the company controls time. They mentioned that it is important to be one step ahead of the competitors and to be innovative since the competition is intense in their industry. On the other hand, one of the

respondents stated that time leads the company as well, since they are operating in a rapidly changing market where they always have to be updated. Once more, the importance of cooperation was addressed. The respondents pointed out that they are dependent on each other since they strive towards the same goals. One of the respondents mentioned that cooperation is important to be able to be efficient as well; another one mentioned that cooperation with the right people is even more important. The general opinion was that good cooperation could be time effective, so it depends on how well one cooperate and with whom.

The possible negative effects on product quality caused by shorter product development processes was discuss as well and the opinions were many. One of the respondents stated that it would not affect the quality since the main issue is the time distribution throughout the process. All sections in a product development process are important to be able to develop good quality products. Another view was that it depends on what kind of product one is dealing with. If there is an already existing product, the product development process could differ from that of a new product. The majority of our respondents also emphasized that a shorter process could also be even more effective, if the company employ more people. When it comes to the deliberation between time profit, resources and quality, the respondents all agreed on that those three factors are connected to each other. Another important factor, the price, was also mentioned. It should be considered together with the three factors mentioned above. In conclusion, we wanted them to give their viewpoint concerning the expression “time is money”. All the respondents agreed on this expression and stated that today, time is money in everyday life as well as in business. One of the respondents reversed the expression and said that “money is time”. What he meant was that everything we pay today, we pay with our time.

5.3 Paradigmmäklarna

We also met with Paradigmmäklarna in order to get a different perspective of our research area. Paradigmmäklarna are society analysts that work to generate an understanding within a wide range of business fields and settings. It is a think tank organization that addresses various society and business subjects and topics. They do not give answers or say how things are or should be. Instead, they are the ones asking the questions, listen to the answers and then use that information as a base for analysis and new ideas. Their opinion is that the world is seen and interpreted based on how it appears to us. What is interesting is which set of glasses a person views the world through. The glasses are the paradigms that the person uses to understand the world around her. Therefore, new discoveries and ideas are in fact the result of a set of new theories which gives us another understanding of the world and the things around us.

5.4 Empirical results from Paradigmmäklarna

This primary data collection was also performed through an interview, which consisted of two persons. They are two society analysts at Paradigmmäklarna located in Löberöd. Below follows the answers from the interview, which is divided into three themes where the respondents could freely answer. None of the respondents wanted to be anonymous; however we chose to present the answers without direct referrals that state the name of the respondents. Like in the case of the Sony Ericsson presentation above, this presented information will also be in the same order as the themes covered through the interview. The first theme is time and product development process, then theories of evolution, complexity and chaos and finally rapidly changing markets and efficiency.

5.4.1 Time and product development process

Paradigmmäklarna stated that time can be understood and viewed in different ways. One way is to look at time as being three dimensional. They thought that in companies and within product development processes, time is usually thought of as a string that has a certain length. Companies want to cut the string and make it as short as possible. However, time should not only be seen as one dimensional and thereby neither viewed as a string with a beginning and an end. Instead time can be seen to be three dimensional and consist of the dimensions breadth and depth as well, illustrated in the figure 5.2 below.

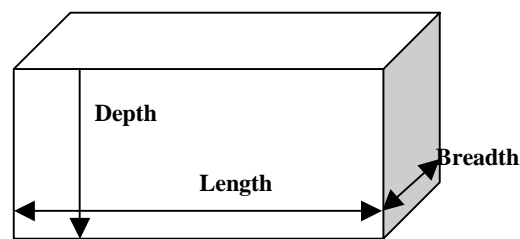


Figure 5. 2Time in three dimensions

Source: Interview, Paradigmmäklarna

The length dimension is the same for all of us and can for example be the length of a day, which is 24 hours for everyone. The breadth dimension is the extent of synchronization which is how many and which things that one can do at the same time. You still have 24 hours on the length dimension but a properly used breadth dimension increases the things you are able to perform within those 24 hours. A company can in this case look at its time as its ability to synchronize in sequential processes and in overlapping processes. The bigger the synchronization in the company is the more it will manage to do within the same period of time. The breadth of time also involves how well companies are connected with their environment which also has to do with synchronization. In the case of a product development process, the company will first collect information and then the development sections will

work with the product within a certain period of time. This is an example of a thin time pipe where the different sections work without connection with each other, resembling that of a sequential product development process. If the company instead wants to have a process which takes advantage of the breadth dimension of time, then the sections should be connected all the time during this time interval. The third dimension, depth, involves how large the commitment is and the quality of time. It is about how involved and active you are during a period of time. The employees developing a product should be active and do their best when they work with the product. Since the length dimension is the same for everybody then the difference and thereby the opportunities lies in the breadth and depth dimensions.

The analysts at Paradigmmäklarna think that companies usually talk and concentrate on the length of a certain process, and do not consider breadth and depth. Consequently, they only look at one dimension out of the three dimensions of time. The length of time is easy to measure, but the extent of the depth is harder since these measurements are subjective. Time itself is subjective and even the creation of how time and a time unit is measured is from the beginning a subjective measurement. However, since almost everybody has similar assumptions of the length of a certain period of time, there generally is an objective and general assumption of how long a certain period of time, for example 24 hours, is. When taking the product demand into consideration the analysts say that since it takes some time for a company to develop a product, it is likely that the market demand has changed by the time the product is launched. Finally when the product reaches the market it does not suit market demand anymore. Thus the time that it takes to develop the product is not there anymore, it moved to the market. The analysts made some important remarks on how important it is for a company to be close to market and thereby be synchronized all the time. Through a close market connection, a company can

know what the customer wants to buy by retrieving information about customer demand all the time. This contributes to constant product development. In this case the development process will be shorter. The important thing will be the number of times the company gathers information from the market, instead of the time it takes to develop the product. The analysts stated that companies often talk about shortening the product development process. However, these companies have a low information flow input from the market. Thereby they do not have the necessary knowledge to develop and produce what the market demands. If they cannot meet market demand, it does not matter how quickly they can launch new products because no one will buy them. Figure 5.3 below, illustrated by Paradigmmäklarna, show this situation. Companies should strive to understand its environment better and collect information from its market, develop the product and later put the product on the market. Often companies only are in connection with their environment during few occasions. Instead they should reduce the time between the information flows so the market connection is more intense, which lets the company be connected in the environment all the time. According to Paradigmmäklarna that time is important and should be utilized in the best way possible. Another important remark was made on the time of the present which is where we always are, thus the time here and now is always the most interesting.

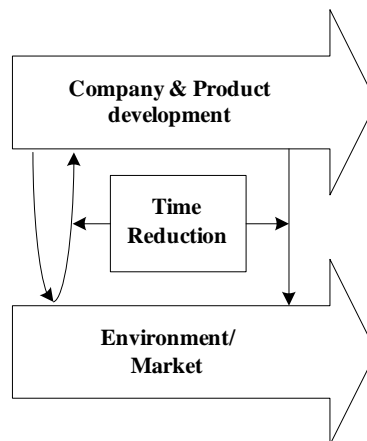


Figure 5. 3 Low information flow between company and environment
Source: Interview, Paradigmmäklarna

When presented to the expression “time is money”, the analysts declared that it is a statement that has lost its meaning. The thought of time as being money was common before, when an employment was a matter of buying peoples time. Furthermore there was a different system before with fixed working days with 8 to 10 hours of work. Later, the time at work has become more flexible and nowadays an employer is more interested in buying commitment and result. That illustrates the increased focus on the breadth and depth dimensions of time. According to the analysts, time as a crucial factor in connection to work is about to disappear and thus time is no longer the equivalence to money.

5.4.2 Theories of evolution, complexity and chaos

Furthermore we discussed the different theories related to dynamic and intricate systems in relation to contemporary companies in rapidly changing markets. We asked Paradigmmäklarna to give their explanations of the three theories which are provided below.

Evolution always uses the exact time it takes for it to create something and it therefore is always on time. To exemplify, this means that all the organisms and animals that through time has evolved into the moose were not just steps in the evolutionary chain towards the correct result. They were all the correct result at that particular time. According to the analysts this is possible, because in the evolutionary theory, things are perfectly connected with each other. Looking at figure 5.4 below illustrated by Paradigmmäklarna we see that the company is in the constant connection with its environment and is in the market all the time, just like the evolutionary theory is. It will thereby make all the produced products the correct ones at that particular time. According to the evolutionary theory, it is not possible to produce a product and one year later produces a better one. Similarly to the example with the moose, each produced product was the best and

the right for the market at the time when it was launched. There is a constant information stream as the figure also shows, which then is the reason for the product to be in the right place at the right time. To constantly be a part of the market and to require as much as information as possible is a way to shorten the connection with the market. If the company has great information integration with the market and with the customers they can predict the market demand. Then they can be able to launch a product that customers want.

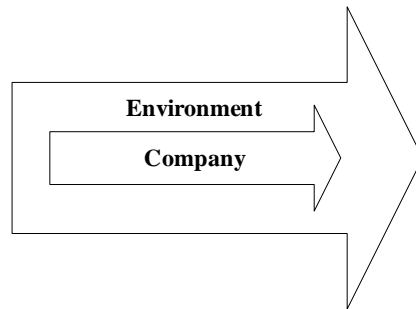


Figure 5. 4 Company in constant connection to its environment
Source: Source: Interview, Paradigmmäklarna

Very simple acts and behaviour led to big and unpredictable system occurrences. Complexity is about many mechanisms that collaborate and generate an effect in the system which is unpredictable. If we believe that the world is complex and compound then we cannot develop a product with the intention of it to be launched 1 ½ years from now. The analysts state that it is important to know that many things are connected to each other. Thus in a development process it is better to have short-term plans since it is not possible to predict the future. Chaos theory and the discussed complexity theory are connected with each other. The most discussed aspect within the chaos theory is the “edge of chaos”. Chaos is simply a complete mess. Thus the edge of chaos is very important to be on, because this is where things happen. Paradigmmäklarna states that companies should allow themselves to be on the edge of chaos. What companies often do is to cut away these things on the edge, instead of taking advantage of them and

be better because of them. The hard thing is to balance and control these events happening on the edge, which if done successfully, is advantageous for the company.

5.4.3 Rapidly changing markets and efficiency

The society analysts primarily say that to understand a rapidly changing market a constant connection to the market is required (see figure 5.4). No company can benefit from believing it knows what the market wants without having constant information flows from it. Furthermore it is important to listen and discover the demands. The best way is to basically be there, to be curious and ask, instead of telling how good the product is. The analysts claim that a company often appears to believe that the customers think about the products in the same way as it do. However, the customers rarely look at the product in the same way as the producing company. That once again points out the significance to have a good connection to the market. This is the case for an effective product development process which primary is characterized by synchronization, according to the analysts. However, it is still common for companies to employ a sequential thinking. Sequential collaboration makes us think that causes and effects are in a linear relation. The sequential thinking makes us believe that what happens today is affected and caused by what happened yesterday. However, the reality is that what happens today does not just depend on what happened yesterday. What happens today is also dependant on what happens today, which shows on a nonlinear relation. Furthermore the effective product development process is according to the analysts established by coming closer to the market and to maintain a constant connection.

Finally, we asked what the analysts thought about the sequential and overlapping product development process (see figure 4.7). The analysts saw the overlapping process to be synchronized, but only

to a certain extent. Each section is still an individual part of the entire process and therefore not fully synchronized. However, all sections within a product development process are dependent on each other.

5.5 Summary

This chapter presents the compilation of the primary data gathered through interviews at Sony Ericsson and Paradigmmäklarna. The interview with Sony Ericsson helped us gain relevant information about the product development process of a high-tech company in a hypercompetitive environment. The interview with Paradigmmäklarna gave us an external insight on time, relevant theories and the product development process. It provided an alternative perspective on how to achieve an effective product development process with a different and interesting viewpoint on time. We believe that an external viewpoint on the product development process strengthens the realization of an efficient product development process.

Chapter 6 – Analysis and results

In this chapter primary and secondary data is combined, discussed and analyzed. Based on this information our research question is answered and an illustrating model is created. It depicts how an organization better can employ time as a resource to make the product development process more efficient.

6.1 Introduction to analytical discussion

In this chapter the discussion, analytical reflections and drawn conclusions of the material will be divided into two main themes. The first part relates to product development processes and the second part to the time aspect. In order to simplify the reading, the discussion is divided into subsections below that will result in a number of assumptions and drawn conclusions. They attempt to identify what an efficient product development process should consist of. Based on the concluded results we explain how time as a resource can be better employed in order to make the product development process more efficient. Drawn conclusions will be supported by relevant parts from the theoretical framework in relation to the interviews. The results will be illustrated further in a model which we created.

6.1.1 Product development process

Already during the creation of our theoretical framework we found strong indications that a high-tech company acting in a rapidly changing market needs an adaptable and flexible product development process. To simplify further reading, we will in the following text refer to high-tech companies acting in rapidly changing markets just as high-tech companies in hypercompetitive markets. The business environment in which these companies act is a dynamic and constantly evolving system, similar to systems

addressed by complexity theory. The theory is one alternative approach of understanding how order, structure, and patterns arise from extremely complicated, apparently chaotic systems such as those in hypercompetitive markets. During interviews with the four employees at Sony Ericsson, they all spoke of the high market pace, the intense competition and the constantly changing market conditions. The mobile communication industry today is considered as an industry classified as hypercompetitive. A hypercompetitive environment in turn requires an organization to have a high degree of flexibility. The rapid pace of change in these markets force companies to adapt quickly to the market and customer needs. If the adaptation happens as a response to an event such as competitor rivalry, new product demands or changing environment, then the company has already acted too late. In the theoretical framework we present the concept of competing on the edge (see section 4.3.1.1). It is intended to help companies in market with intense change and competition to create a flow of constant renewal within themselves, which is beneficial under such conditions. The first concept in the theory is the edge of chaos. To exist on the edge of chaos is a good company approach in a hypercompetitive market. It requires the company to have enough structure to implement change in an effective way, but also to have enough flexibility to manage the rapid market changes. The balancing act between structure and chaos often generate the most innovative and exiting product ideas. The mistake many companies do is to steer away from the edge of chaos towards increased structure. One example of that is the divestment of a business division to get a more focused and delimited business portfolio. Another example may be a company that attempts to balance on the edge of chaos but has a product development process that lacks adaptability and flexibility. It can reduce the benefits of the edge position since the company may not be able to fully take advantage of the opportunities the position can give. As mentioned above, the degree of organizational and development process flexibility is important in a hypercompetitive environment. It is on

the edges of chaos that the most interesting and innovative ideas develop. This is looked-for an environment that revolves around the creation of temporary competitive advantages. To manage the balancing act between structure and chaos, it requires an amount of flexibility. Therefore, we believe that organizational as well as development process flexibility is important for the product development process.

The chaos theory, closely linked to the complexity theory, states that from what may appear to be a chaotic system, structure can develop. The theory talks about the self organization of the system where formations occur through randomness. In a complex or chaotic system it is not possible to predict what will happen next. Therefore, if you believe the world is complex it is not possible to plan and develop products intended to be launched one year from now. Market conditions change constantly and companies have no way of knowing what the market demands two years from now. They can only try position themselves so that they are at the right place and time when change occurs. We feel critical towards this statement and believe it to be slightly exaggerated. Large multinational companies today have a huge influence over markets as well as consumers. To some extent, they even control and influence market demand. Customers are the creators of market demand on which companies then base their ideas for future products. However, there are companies today with the ability to generate demand for a product before the customers themselves. To some extent they are able to control what is going to happen on the market. It makes it possible to plan and develop products intended to be launched within a near future. On the other hand, we realize this is a privilege reserved for large companies with enough capacity, resources and influence on the market. Neither does this remove the entire force of market demand but only diminishes it during a period of time. Being on the edge of time is the second core concept in the competing on the edge theory. To be on the edge of time is to take advantage of the past as

well as the future and balance in between these two. A company's strategic identity (see section 4.3.7) is what connects past and future in the present. It is not beneficial for a company to be too focused on its future, neither is it a good thing to rely too much on past success. To act in the present appears to be the most successful approach for a company. Paradigmmäklarna further supported our assumption about the need for synchronization and of being and acting in the present. The third and final concept of the competing on the edge theory is time pacing. It is about how to manage transitions and manage rhythm within a company. The rhythm of change has to be set in accordance with the marketplace, the company's internal capabilities and especially by customer demands. It is also dependant on a good information flow as well as a presence in the business environment. To have an efficient product development process in a hypercompetitive market, a company needs a continuous information flow within the organization and the process. Therefore, we believe that a constant connection to and presence in the business environment is preferred. This contributes to a well functioning development process that in turn ensures that the products will meet market demand.

Shorter product life cycles are a result of a higher market pace, increased competition and customer demand. The product life cycles have not only become shorter but their appearance has also changed. Instead of resembling a regular and symmetric curve, the life cycle of a product may now look more like a short and rapid high peak. A product development process has to be efficiently constructed and used. According to us, a sequential development process (see section 4.4.2) is not the most efficient alternative in high-tech companies. It should instead be based on an overlapping principle, like the one presented by Bruzelius and Skärvad (1992). An overlapping process allows for a higher degree of cooperation between different process sections which we found to be important. Increased cooperation is believed to improve the quality of the

developed products. Furthermore, an overlapping process reduces the time period between idea to finalized product. The gathered information also supports that a shorter development process can generate financial benefits. Time has a financial value and a shorter process can lead to increased turnover. Accordingly, any time shortage or time profit within the process should be positive. However, we criticize such a statement and think that a deliberation always should be made between the time profit and other relevant aspects. The product development process in high-tech companies is mainly constructed around the time resource. In general, a shorter process is directly assumed to be positive. However, we believe that if the process time is reduced it may affect other aspects negatively, for example quality. The time frame of a high-tech company's product development process is often precisely calculated. There are no extra margins that can be reduced because the process already has the smallest time frame possible. Therefore, to reduce it further may instead have harmful consequences. Quality and personnel risk being negatively affected. The conclusion is therefore that the benefits of a time profit within a development process always should be deliberated with other aspects it may affect. Increased time efficiency does not have to be the same thing as a shorter product development process. We agree that a time efficient development process is vital for high-tech companies but that measure taken to improve time efficiency has to be deliberated against other relevant factors. Consequently we also think that a company should attempt to reduce required process development time, but after the consideration of other affected aspects.

In the research about time based management in business organizations, Bruzelius & Skärvad (1992) discuss the connection between time and product. To be time efficient is not just about being able to do things in a shorter period of time, although that appears to be the general opinion. For Sony Ericsson it would be a large setback to miss a market window due to delays in product

development. The four employees agreed that everything is governed by time and therefore the time resource is valuable. To launch a product in a market window is the main goal for this type of company. Sometimes, time is a more important factor than quality. According to one employee, initial versions of certain mobile phones occasionally suffer from small errors in the software because the market launch date had a higher priority than the finishing touches on the software. Within Sony Ericsson they work according to milestones when developing new product platforms and products. A process is applied to every project and sets the guidelines of how the project should be performed. The external deadlines of the project are crucial to follow while internal deadlines are more flexible. Failing communication can as mentioned lead to precious time being lost and a danger of missing the important launch deadline. This illustrates once again the importance of constant information flow through the entire product development process in order to be time efficient.

6.1.2 Time

This following theme will discuss thoughts and perspectives on time and its role within the product development process. Then we will summarize how we believe a time efficient process to look like.

The distribution of time over the sections within the product development process differs between the sections. The working pace is assumed to be higher in the first and most creative parts of the process. Therefore, it is likely that the first sections in the process has longer time frames than the last ones. The Sony Ericsson employees all agreed on that there always is a deliberation between time profit, resources and quality within their company. We think such a deliberation process is good for a company faced with very short product life cycles and the pressure of high speed product development. We were told that a more expensive supplier can be

used if he/she can deliver material to the mobile phones faster. Based on what we have learnt, we feel confident to conclude that time is one of the most important factors to consider in the development process. If a time profit occurs, which happens very seldom, resources are put into further improvements, smaller additional services et cetera. A company so dependent on time makes very accurate calculations of the required time period to develop a product.

Discussions about the importance of deadlines, market windows and the deliberation between time, resources and quality shows that time management and a time effective product development process is vital. As mentioned, companies have to speed up the pace of product development seeing that product life cycles are significantly shorter than they used to be. Shorter product life cycles are seen in all industries but especially in high-tech industries that are faced with higher competitive pressure, new technologies and customer demand. In order to sustain a market position and competitive edge, new products have to be launched with shorter intervals. Therefore, the length of the period from idea to launched product should be as short as possible. However, it should once again be stressed that a deliberation between time and factors dependant on time, should first be made. If it shows that no other factors will be negatively affected by a shorter development process the company can continue with the planned time reduction of the process. With this in consideration, we can conclude that the time frame is important when constructing a time efficient product development process.

As presented above, we realize that a product development process that stretch over a shorter time period, in the majority of cases, manage to employ time more efficiently. However, during our interview with Paradigmmäklarna we came across a different way of looking at time. Companies have a habit to visualize time as a string which has a certain length. The length of time, for example two

months, is the same for every individual and company. A high-tech company strives to shorten the product development process string, attempting to reduce the needed time frame of the sections within the process. If time is seen as just a string with a certain length, then the only way to make it more time efficient is to make it shorter. If the given time period becomes too short, things such as quality and employees may suffer. Mistakes caused by lack of time can prove to be costly. There will be a limit to how much you can cut off the string in order to make a process more time efficient. If time instead is viewed as three-dimensional, it opens up for new thoughts and ideas on how an organization better can employ time as a resource to make the product development process more efficient. The three dimensions; *length*, *breadth* and *depth*, illustrated in figure 6.1, provide a different view on how to define time efficiency. A shorter development process does not necessarily mean it is more time efficient as previously could be assumed. Instead time efficiency can be measured in degrees of commitment and synchronization. We still believe the length dimension to be important, but see the importance of the other two dimensions within a product development process.

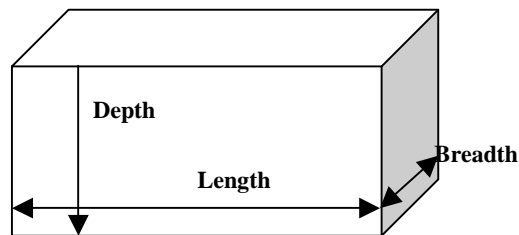


Figure 6. 1 Time in three dimensions
Source: Interview, Paradigmmäklarna

If time is considered to have three dimensions, a company then has additional possibilities to make its development process time efficient. A maximized use of the breadth and depth dimensions could allow the length dimension to remain the same. To increase the understanding of the two new dimensions, a brief explanation in combination with examples is presented in the following text.

The *breadth* of time is about the extent of harmonization of things done during a period of time. Within a sector of a product development process, the extent of things done simultaneously can be increased. It is not about trying to do things faster but to be able to do, or be more than one thing at, the same time. For example, a software engineer can both develop software and function as transition and feedback support for the product parts linked to sections close to his own. It does not have to take longer time to do, or be two things at the same time. The same employee can thereby be as two things during the same time period because the things he/she does during that time is harmonized. A company can also employ more people to utilize the breadth of time, which in turn makes it possible to perform more things on the same time length. The *depth* of time is about the level of commitment and quality within a period of time. Commitment to something often results in a better performance because fewer mistakes are made, maximal knowledge is used and there is a higher level of learning. Within a section of a product development process, the employees' commitment can make them perform the work faster and more efficient because unnecessary mistakes are avoided and the level of concentration is high. Maximal learning and use of previously gained knowledge also reduce the required time period. We believe the two additional dimensions, breadth and depth, may already be indirectly implemented in company settings. Companies do not directly view time in the three dimensions; however the commitment of the employees and the efforts to do multiple things during the same time period is believed to be encouraged. According to us, the three dimensional perspective on time should be more useful and effective when properly acknowledged and correctly implemented in business culture. In addition, we believe it would serve to make the product development process more time efficient. The conclusion will therefore be that companies can benefit from viewing time as three dimensional.

To summarize, we believe that an efficient product development process require *synchronization* which is important both within and outside the company. Constant *information flow* through the entire product development process is yet another factor that characterizes a time efficient product development process. Furthermore, the *three dimensions of time* should be founded and realized within the company and thereby in the product development process. For high-tech companies everything revolves around the aspect of time. As long as a correct deliberation between time and other relevant factors is made, a time profit in a product development process can be said to be time efficient. Our theory then suggests an overlapping process that compared to a sequential process leads to such a time profit. After our research result we realize that we are able to support some of the factors (see section 4.4.2) concerning time efficiency presented by Bruzelius and Skärvad.

6.2 Conclusion and result of analysis

Drawn assumptions and conclusions during the analyzing part showed that a product development process of a high-tech company acting in a hypercompetitive environment should consider a number of factors. These factors are reflected in the construction of the product development process. To better illustrate the underlying factors as well as the features of such a process, we decided to create a model that is illustrated in figure 6.2 below.

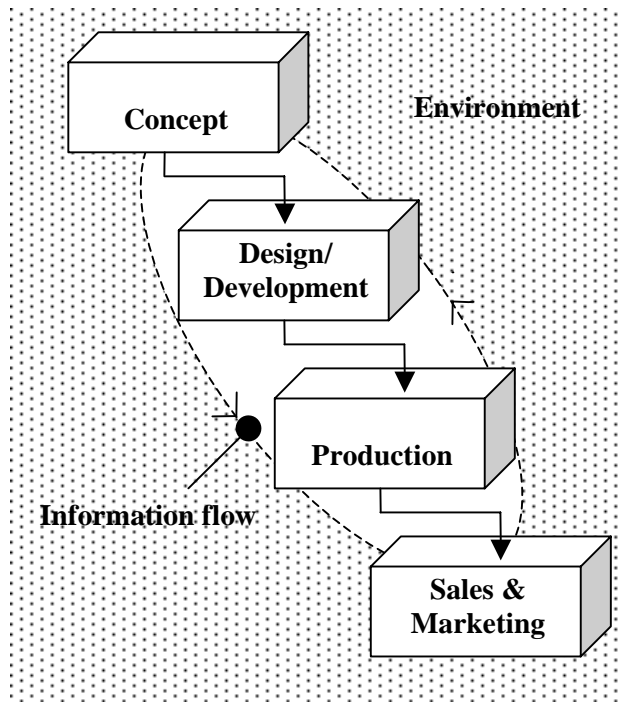


Figure 6. 2 New Model

The model is created on the base of both primary and secondary data. Our new model (see figure 6.2) is constructed around the base of the overlapping model (see figure 4.7). However, the name and context of the sections in our model are the result of the collected primary data at Sony Ericsson.

The product development process includes the sections *concept*, *design/development*, *production* and *sales & marketing*. Concept, our assumed first section, includes both strategy and innovation whilst the other sections are similar to other product development processes. The illustrated boxes depict the importance of the three dimensions of time in every section throughout the product development process. A time period with the three dimensions; length, breadth and depth makes it possible to do more in the same time period and most likely with an improved result. That will in turn be more time efficient. The dotted area surrounding the boxes represents the environment. A product development process should constantly absorb input from its environment in order to be synchronized with the market and thereby meet market demand. The

striped lines that go through all the boxes are the information flow which concerns feedback and constant cooperation between the different sections. Further on, the illustration of the information flow as a striped line was made in order to show how environmental input continuously can be absorbed into the gaps of the striped line and thereby into the information flow. By the new product development process model one can conclude that the following facts are important:

- View time as three dimensional
- Synchronization with the environment
- Constant information flow throughout the whole process

With our research we endeavoured to answer *how an organization better can employ time as a resource to make the product development process more efficient*. We recommend that organizations should view time as three dimensional, be synchronized with the environment and have a constant information flow throughout the whole process. It will lead to a time efficient product development process that employs time as a resource more efficiently. In addition, we suggest that the product development process is constructed according to the architecture of our model of a time efficient product development process.

Chapter 7 – Conclusion

This final chapter begins with a summary of the dissertation. Further, the results of the analyzed research are presented in a summarized version. Critique of the created model is given and suggestions for methodological improvements and practical implementations of the research are discussed. Finally, a number of suggestions for future research based on this dissertation are made.

7.1 Summary of dissertation

The fact that we live in a rapidly changing environment is evident in all aspects of society. Companies which act in hypercompetitive markets are especially affected by this. Since product life cycles have become shorter companies have to put more effort to increase the pace of product development processes. It requires an efficient process from idea to finalized product and time efficiency plays an important role in that process. We wished to gain a profound knowledge about product development processes in relation to the aspect of time in companies acting in high-tech and rapidly changing markets. The purpose was to establish how a contemporary organization better can employ time as a resource to make the product development process more efficient.

A study about the product development process in connection with the time aspect within a high-tech company was made. Primary data was collected through four semi structured interviews with employees at Sony Ericsson, since we thought it to be a suitable company to retrieve information from. The interviews served to get a profound knowledge about the product development process in combination with the time aspect within a company that acts in a rapidly changing market. In addition, a semi structured interview with two society analysts at Paradigmmäklarna was also conducted with the aim to gain an additional perspective on our area of research. The structured data from the five

interviews could later, with the support of the theoretical framework relate to product development, dynamic and intrinsic systems as well as time and time management, to be studied further. The analyze process lead to the discovery of relevant features as well as time efficient formations in the primary information which were supported by the theoretical base. It made it possible to identify what pieces are vital in the product development process and why they are time efficient. Our understanding of this research area along with our reflections, assumptions and conclusions made it possible for us to answer our research question. The process to answer it generated a model which illustrates how an organization better can employ time as a resource to make the product development process more efficient. A summarized presentation of it follows in upcoming section 7.2.

7.2 Summary of research results

Our purpose with this dissertation was to understand how time as a resource can be better employed in order to make a product development process more efficient. Therefore, we needed to find out which factors that should be considered in a time efficient product development process. What we found was that information flow, synchronization and time profit when seeing time in three dimensions are factors which should be reflected in the architecture of such a process. In addition to this, we present a different perspective on time. To illustrate our findings, we decided to create a model which is depicted in figure 7.1 below.

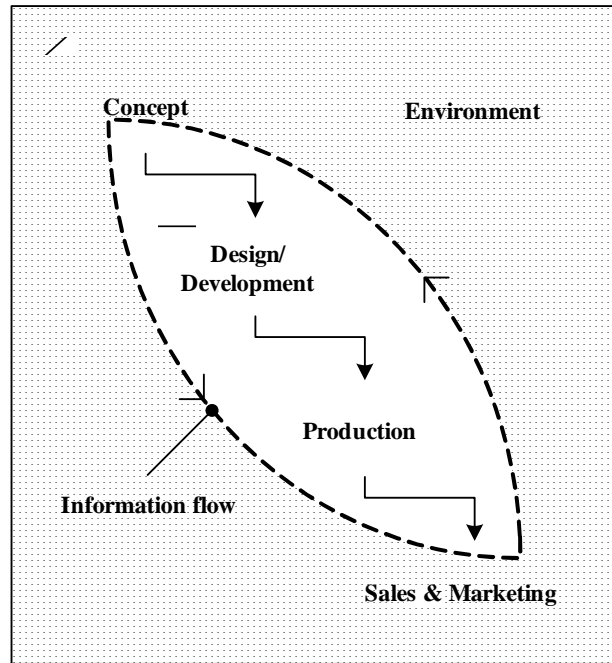


Figure 7. 1 New Model

7.3 Critique of the new model

Although we believe our model to provide a relevant architecture for a time efficient product development process, we recognise its weaknesses. As with the majority of theoretical models, the problem lies in the practical application of it. Since the model has not been tested in any organization it makes it impossible to guarantee its relevance in this sense. The design of the model, with *length*, *breadth* and *depth*, is drawn with the intention to illustrate a time efficient product development process. However, there are elements in it which may not be practically attainable. The information flow in the model shows how feedback and cooperation continuously should flow between the sections. However, we believe it can be hard to maintain that flow throughout the whole process. It takes time to absorb and process the information and that can consume the time profit created by other time efficient constructions. On the other hand the constant environmental inputs to the company may also be time consuming. In the model we suggest that time is viewed in three dimensions; length, breadth and depth. In order for these dimensions to be time efficient they have to be utilized well. It is also crucial that a

deliberation is made between the three dimensions as well as the cost aspect. The wrongful usage and focus of the dimension may consume a supposed time profit than expected and mean additional costs for a company. If the potential of one dimension is not correctly used, it will affect the other two dimensions negatively. There has to be a balancing act between the focus on these three dimensions.

7.4 Methodological improvements

Our research fits the characteristics of both an exploratory and a descriptive study and we wished to provide new insights into the research area. A qualitative research strategy was used to collect primary data since it was believed as the best way to answer the research question. Although the study cannot be clearly classified into a specific category of research studies we feel that there are resemblances and links to a case study. However, we would not go as far as defining our study as a case study. Instead we prefer to see it as a less extensive study based on secondary data and interview with similar characteristics as a case study. A proportion of our material was gathered through four semi structured interviews at Sony Ericsson and one at Paradigmmäklarna.

Even though we believe our research procedure was a good way to reach the aim of this dissertation, we acknowledge its potential shortcomings as well. We cannot be completely confident that all types of bias have been avoided during the interviews. There is a possibility that the information drawn from them is coloured by that. Our way of acting or the respondents' perception of us can have caused the respondents' answers to deviate from the truth. The tape-recorder used during the interviews may have been yet another factor affecting the relationship between us as interviewers and the respondents. Primary information from another company within the same business industry or which acts in a similar business environment may have been another useful example, adding to our understanding of the research area. The mentioned improvements above could have improved the quality of the presented research.

7.5 Practical implementations of the research

First and foremost, we hope that others find our research to be interesting and curious to take part in our findings. Further, the ambition is for it to serve as a guideline and a base for additional investigations within the same field. In addition, managers of companies in high-tech, rapidly changing markets can hopefully use our results and our model of a time efficient product development process as motivating input. Further this dissertation could be of interest for companies that want to achieve an efficient product development process. Finally, it is thought to be useful for whomever that has an interest in the aspect of time within a business setting.

7.6 Suggestions for future research

With this research study as a base or inspiration, future research in the fields of time management and product development processes can be performed. We feel that the following areas would be particularly interesting to conduct further studies into.

- The results drawn from this dissertation cannot be generalized for the entire mobile telecommunication industry, apart from a few broader assumptions. Therefore, it would be interesting to expand the study onto a larger sample of mobile communication companies. A larger study may allow for statistical generalizations.
- Our research places the focus on time as an important aspect in a company's product development process. However, it would be interesting to place the focus on another part of a company's business activities. A study like that may confirm our belief that time is crucial in various business activities, not only in the product development process.
- Another interesting track to continue on is to see whether time plays an equally important role in companies within a different business sector. In this dissertation we only studied a company within one business sector.

Therefore, the extension of the study into other various business sectors can be the foundation for further research.

- Finally, it would be useful with further development and testing of our model to improve its internal validity. That would improve the practical use of the model.

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Intervjuguide Sony Ericsson

APPENDIX 1

Allmän information:

- Vill du vara anonym?
- Hur länge har du arbetat på Sony Ericsson?
- Vilken position har du?
- Vad har du för tidigare arbetslivserfarenhet?

Produktutvecklingsprocessen:

- Vilka är dina tre senaste projekt?
- Vilken roll hade du i de projekten?
 - Hur mycket fick du bestämma?
- Hur utförde du och dina kollegor arbetet?
 - Följer ni någon särskild process?
 - Var processen likadan under alla tre projekten?
 - Hur mycket samarbete är det planerat och hur mycket samarbete utförs egentligen?
 - Vilka steg/faktorer ingår i produktutvecklingsprocessen och i vilken ordning?
 - Till vilken grad följer ni ordningen?
 - Fast tidsperiod från idé till lansering?
- Vad är dina personliga reflektioner nu i efterhand?
 - Vad gick bra och vad gick dåligt med projektet?
 - Hur skulle man kunna ha gjort det bättre?
- Vad anser du är en effektiv produktutvecklingsprocess?

Tid:

- Hur viktig är tiden (som resurs) i ert dagliga arbete?
- Hur är arbetsmiljön?
 - Vilket arbetstempo, högt eller lågt?
- Hur sätter ni era deadlines? (Short-term or long term)
 - Till vilken grad följer ni deadlines?
 - Vilka konsekvenser uppstår vid missade deadlines?
 - Vilka åtgärder kan man utföra?
- Hur viktig är tiden i de olika stegen i produktutvecklingsprocessen?
 - Är tiden lika fördelad över de olika stegen?
- Är tiden implementerad/tillämpad i företagskulturen?
- Hur viktigt är tiden i relation till konkurrensfördelar?
 - Om ni är klara före deadline, vad gör ni med tidsvinsten?
 - Om tidsvinst uppstår, satsar man på kvalitet, ny produkt, produktförbättringar, fler tjänster, design m.m.?
- Leder ni tiden eller leder tiden er?

-Leder ni utvecklingen, skapar förändringen eller orsakas den av konkurrenter?

- Anser ni att samarbete mellan olika avdelningar är bra för företaget?
-Är samarbetet tidseffektivt eller orsakar det tidsförlust?
- Tror du att kvaliteten av era produkter blir lidande av en förkortad produktutvecklingsprocess?
- Gör ni avvägning mellan, tidsvinst, resurser och kvalitet?
- Vad anser du om uttrycket ”tid är pengar”?

Interviewguide Sony Ericsson

APPENDIX 2

Introduction:

- Do you wish to be anonymous?
- How long have you worked at Sony Ericsson?
- What position do you have at Sony Ericsson?
- What type of previous work experience do you have?

The product development process:

- Which are your three latest projects within Sony Ericsson (R&D projects)?
- What was your role in these projects?
 - How much influence did you have in these projects?
- How did you and your co-workers conduct your work in these projects?
 - Do you follow any specific process?
 - If so was the case, was the process similar during all three projects?
 - How much cooperation is planned and how much cooperation is actually carried out?
 - Which steps/factors and are included in the product development process and in which order?
 - To what extent do you follow that order?
 - Is there a fixed time period from idea to the launch of a product?
- Looking back, what are your personal reflections in relation to your last three projects?
 - What went well and what could have been improved within the projects?
 - How could you have improved the process?
- In our opinion, what characterises an effective product development process?

Time:

- How important is time (as a resource) in your daily work at Sony Ericsson?
- How is your working environment?
 - How would you describe your working pace, high or low?
- How do you set your deadlines (short term or long term)?
 - To what extent are these deadlines followed?
 - Which are the consequences for missed deadlines?
 - What measures can be taken to ensure that deadlines are kept?
- How important is time in the different steps of the product development process?
 - Is time equally divided over the different steps?
- Would you say that time is implemented in Sony Ericsson's company culture?
- How important is time in relation to competitive advantages?
 - If you are finished before deadline, what do you do with the excess time (time profit)?

-If a time profit arises, do you invest more in product improvements, additional services, design, new products?

- Does Sony Ericsson control time or does time control Sony Ericsson?
-Do you lead market development/generate change or is that generated by competitors?
- Do you believe that cooperation between different subdivisions within the company is good for the company?
-Is cooperation time efficient or does it lead to a time loss?
- Do you believe that the quality of your products will suffer from a shortened product development process?
- Do you make deliberations between time profit, resources and quality?
- What is your opinion about the expression “time is money”?

Intervjuguide Paradigmmäklarna

APPENDIX 3

Om ParadigmMäklarna:

- Vilka är ParadigmMäklarna?
 - Era tankemodeller och paradig?

Tid:

- Vad anser Ni att tiden spelar för roll i dagens samhälle (människor och företag)?
- Vad anser Ni om uttrycket ”tid är pengar”?

Teori:

- Definiera evolutionsteorin, komplexitetsteorin och kaosteorin.
 - Har Ni gjort vidare undersökningar/diskuterat om dom, vad har Ni kommit fram till?

Förståelse:

- Vad ska ett producerande företag som agerar på en högteknologisk och snabbt föränderlig marknad göra för att förstå sin omvärld?
 - Vad kan vara viktigt att veta/förstå, tidsmässigt för ett företag som strävar efter en effektivare produktutveckling?
 - Kan man dra nytta av komplexitets-, kaos-, och evolutionsteorin i en företagsmiljö?
- Hur vet man att den förståelse man har är den rätta förståelsen?

Interviewguide Paradigmmäklarna

APPENDIX 4

About Paradigmmäklarna:

- Who are Paradigmmäklarna?
-What are Paradigmmäklarnas fundamental ideas and paradigms?

Time:

- What role do you consider time to play in a contemporary society (for people and companies)?
- What is your opinion about the expression “time is money”?

Theory:

- Define the evolutionary theory, the complexity theory and the chaos theory.
-Have you performed any investigations in connection to/discussed these theories and if so, what have these evolved around?

How to understand the rapidly changing market:

- What shall a producing company that acts on a high-tech and rapidly moving market do to understand its surrounding environment?
-What can be important to know/comprehend, in relation to the aspect of time, for a company striving for a more efficient product development?
-Do you believe that you can take advantage of chaos theory, complexity theory and evolutionary theory in a business environment?
- How do you know that the knowledge you have attained is the correct one in your specific context?