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Assessing the Risk of a Disruptive Technology Emergence

A Case Study of Ericsson Mobile Platforms

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Sammanfattning

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Nyckelord: disruptiv teknologi, riskbedömning, Risk Management, 3G-teknologi, organisatoriska kapabiliteter

Syfte: Syftet med denna studie är att bedöma den risk EMP står inför gällande en eventuell uppkomst av en till en lägre grad avancerad plattform. För att kunna göra detta kommer ett riskbedömningsverktyg att utvecklas och tillämpas på EMP.

Metod: Den i studien presenterade frågeställningen påkallar en forskningsansats som möjliggör en djupare förståelse av socialt beteende i en specifik organisation och kontext. Detta kriterium tillgodoses då man använder en kvalitativ ansats som tillhandahåller metoder för datainsamling med begränsad struktur.

Teoretiska perspektiv: Christensens teorier om disruptiva teknologier är de som visar närmast samband med den aktuella frågeställningen och som anses vara bäst på att förklara problemet och samtidigt erbjuda en lösning. Den teoretiska referensramen har utökats med teorier om produktdesign och värdeförskjutning för att ge en bättre helhetsbild av vilka faktorer som påverkar den i syftet påstådda risken.

Empiri: Primärdata samlades in genom intervjuer. För att undersöka de områden av intresse så var det viktigt att intervjua personer med rätt kunskap. Detta uppnåddes genom att intervjua Director of Procurement & Supply samt Vice President of Sourcing & Supply, den senare även medlem i ledningsgruppen.

Slutsatser: Några faktorer som kan öka risken för EMP att råka ut för en disruptiv teknologi som uppdragats är att EMPs utvärderingssystem för affärsmöjligheter lägger starkare fokus på existerande marknader än på mindre och icke-existerande marknader. Vidare är företagets processer inte flexibla till den grad som kan önskas för att på ett snabbt sätt anpassa sig om en disruptiv teknologi skulle uppstå.

Abstract

Title: Assessing the Risk of a Disruptive Technology Emergence – A Case Study of Ericsson Mobile Platforms

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Keywords: Disruptive Technology, Risk Assessment, Risk Management, 3G-Technology, Organisational Capabilities

Purpose: The purpose of this study is to assess the risk EMP is facing with regards to a possible future emergence of a less advanced platform technology. In order to do this a risk assessment tool will be developed and applied on EMP.

Research Methodology: The chosen research problem suggests a research strategy which closely links empirical data with theoretical conceptions, therefore an abductive approach has been adopted. The research question presented in this study calls for a research design which enables a deep understanding of social behaviour in a specific organisation and a specific context. Consequently this criterion is only met by applying a qualitative research design which provides methods for data collection with limited structures

Theoretical Perspectives: The emergence of a less advanced platform technology has been investigated by means of the theory about disruptive technologies which appears to show the closest link to our research question, and is believed to best explain the problem as well as offer solutions. The theoretical framework has, however, been broadened to include theories regarding product design and value migration.

Empirical Foundation: The primary data was collected by means of personal interviews. In order to investigate the identified fields of interest, e.g. the resource allocation processes, the decision making processes, EMP's resources and industry specific conditions, it was important to collect data from individuals with sufficient insight. The Director of Procurement & Supply as well as Vice President of Sourcing & Supply, also member of the Management Team, were interviewed.

Conclusions: Factors which can lead to an increased risk for EMP to face a disruptive technology have been identified. These factors include that EMP's business evaluation system favors existing markets over small or yet non-existent markets and that the company is characterised by fairly low responsiveness with regards to industry specific conditions.

Dictionary of Telecom Related Terms

3G: 3G is short for third-generation technology. It is used in the context of mobile phone standards. The services associated with 3G provide the ability to transfer simultaneously both voice data (a telephone call) and non-voice data (such as downloading information, exchanging email, and instant messaging). In marketing 3G services, video telephony has often been used as the killer application for 3G.

Base station: In radio communications a Base station is a two-way radio installation in a fixed location, used to communicate with one or more mobile or portable radio transceivers. They are typically used by low-power two-way radios such as mobile phones, portable phones and wireless routers.

Foundry: In the microelectronics industry, a foundry (also called a fab for fabrication plant) is a factory where devices like integrated circuits are manufactured.

3G Platform: The total offer of the chipset, software and reference design enabling the use of the 3G net in a mobile phone.

Turbo 3G: High-Speed Downlink Packet Access (HSDPA) (Sometimes known as High-Speed Downlink Protocol Access) is a 3G mobile telephony protocol in the HSPA family, which provides a smooth evolutionary path for UMTS-based networks allowing for higher data transfer speeds. Current HSDPA deployments now support 1.8 Mbit/s or 3.6 Mbit/s in downlink. Further steps to 14.4 Mbit/s and beyond are planned for the near future.

WAP: Wireless Application Protocol or WAP is an open international standard for applications that use wireless communication. Its principal application is to enable access to the Internet from a mobile phone or PDA.

WCDMA: WCDMA (Wideband Code Division Multiple Access) is a type of 3G cellular network. WCDMA is the higher speed transmission protocol used in the Japanese FOMA system and in the UMTS system, an advanced 3G system, designed as a replacement for the ageing 2G GSM networks deployed worldwide.

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1 Introduction

In the introduction chapter the reader obtains background information about the telecom industry and the 3G-technology. Furthermore, the problem which will be investigated and the purpose of the study are discussed.

1.1 The 3G-Technology's Influence on the Mobile Phone Industry

In recent years the mobile phone market has gone through significant changes. The former leading GSM technology (i.e. the second generation mobile system – 2G) finds itself in some market segments being replaced by the third-generation mobile system technology – 3G.

Promising today a 5-10 times increase in speed compared to the GSM-network, the 3G-network enables many new functions and features to be added to the traditional mobile phone services such as music downloading, video telephony and file sharing (www.telia.se). Thus, the introduction of 3G has changed the landscape considerably for both mobile phone manufacturers and operators.

“Most mobile phone producers can develop their own GSM-mobile phones. All it requires is a few hundred employees. 3G on the other hand requires thousands of people and billions of SEK of investments.”
(Elektroniktidningen, 2006-11-06)

Evidently, the new conditions facing the market participants require a larger amount of resources and generate higher development costs. As a consequence, only the largest mobile phone manufacturers can currently afford to develop and test the technology used in 3G phones. This phenomenon was commented by the Swedish telephone operator Telia who initially experienced the 3G-based mobile phones to be in short supply (www.telia.se).

Parallel with the changes manufacturers are undergoing, the role of the operators is evolving from provider of voice telephony to supplier of a variety of services. Downloadable ring tones and screen savers, Short Message Services (SMS), Multimedia Messaging Services (MMS), email services, and web browsing, are only some of the features provided in order to increase average revenue per user (The EMP Story).

The technological development has by far not reached its limits, however. At present, much attention is drawn to the most high-power 3G version in the market, turbo-3G, which in Sweden was recently launched by Swedish network provider Ericsson. Turbo-3G will eventually enable mobile phone consumers to surf on the internet irrespective of location. Some concerns persist, however, due to uncertainties as to what will happen with the net capacity as the number of users grows. Another

concern relates to the higher consumer costs connected with turbo-3G as opposed to the lesser expenses for fixed broadband. (Dagens Industri, 2006-11-17).

The developments taking place on the 3G-market, all require continuous development of the advanced services offered to the mobile phone consumers. This poses a great technical challenge to the firms developing crucial technical components, which in turn is reflected in greater costs in certain components. This especially seems to be the case for the software embedded in the mobile phone, which without doubt is its most expensive part, according to Elektroniktidningen (2006-11-06).

1.2 3G and Its Consumers

According to DN Ekonomi (2006-11-06), the Swedish sales figures for 3G-mobile phones clearly show an upward trend. During the third quarter this year sales increased by 100 per cent compared to the same period last year, reaching a market share of 42 per cent. Especially the augmented similarity to 2G mobile phones in terms of size and design has made the 3G mobile phones more popular (Dagens Industri, 2006-05-05). In spite of these positive sales figures, however, the Swedish consumers' interest in 3G is surprisingly low. Even on a global level the 3G-technology's popularity is very limited, and while 20 per cent of the mobile phone users have access to 3G, only 9 per cent use the 3G-related services offered (telekomidag.com, 2006-11-09).

Thus, mobile phones based on GSM technology are enjoying greater popularity with more than 2 billion users, as opposed to the 72 million people using mobile phones based on 3G-technology (Dagens Industri, 2006-06-13). Mobile phones based on GSM technology are consequently still dominant in terms of market share, although their dominance is diminishing.

Consumers' lack of knowledge about the benefits the new 3G technology has to offer, and high prices have been identified to cause their low interest in 3G-services (telekomidag.com, 2006-11-09). DN Ekonomi (2006-11-06) confirms this image and states that an increase in sales does not necessarily mean an increase in 3G-traffic. The choice to buy a mobile phone based on 3G-technology is rather a matter of supply than an opinion that 3G-services in fact are better, according to the newspaper.

1.3 Research Problem

Clearly, there exists a gap between the continuously improving 3G-services supplied on the market, and the actual demand from users of 3G-based mobile phones. It is evident that most consumers are not yet ready to absorb the technological progress which has been made, and continues to be made by companies striving for technology leadership. Consequently they are not willing to pay for it either.

One such company striving for technology leadership is *Ericsson Mobile Platforms* (EMP), based in Lund, Sweden. EMP develops and produces an advanced terminal platform, consisting of both the hardware and the software necessary to support advanced 3G-services; the latter constituting the most expensive component in mobile phones based on 3G-technology (The EMP Story).

As was stated earlier, the new conditions facing both operators and mobile phone manufacturers have generated higher technical barriers as well as resource barriers. Indeed, very few manufacturers are able to develop all necessary technologies themselves. Therefore, EMP has positioned itself to provide manufacturers and operators of mobile phones with advanced terminal platforms, which will enable them to remain competitive in the new 3G landscape. These platforms determine to which degree technologically advanced services can be offered to end-consumers by mobile phone manufacturers and operators (The EMP Story). To date EMP has gained market shares of 25 per cent in the 3G-market and the expectations in terms of continued market growth, as well as increased market shares, are high, according to Dagens Industri (2006-11-24).

As the technology moves towards maturity, however, and the few players with a functional 3G chipset on the device market, one of them being EMP, continue to strive towards technology leadership there exists an eminent risk that less demanding consumer segments' needs continue to be neglected. This development could give way for an emergence of companies fulfilling these needs, thereby gaining market shares from less demanding, quite possibly more price conscious, but on the other hand much larger consumer segments. In other words, the risk faced by EMP lies in the possible emergence of a less advanced, but more cost efficient platform solution for 3G-mobile phones.

The above reasoning demands further investigation which leads to this study's purpose:

1.4 Research Purpose

The purpose of this study is to assess the risk EMP is facing with regards to a possible future emergence of a less advanced platform technology. In order to do this a risk assessment tool will be developed and applied on EMP.

1.5 Delimitations

While the purpose of this study is to assess the risk with regards to the emergence of an alternative technology in the platform industry, this is merely done from EMP's perspective. This means that not all the variables influencing such an emergence are taken into account. The risk assessment is rather based on EMP's actions and organisational conditions, which in turn increase or decrease the company specific risk of such an emergence.

While this study includes the development of a risk assessment tool, it will not, however, include the development of adequate measures which can be taken as part of a risk management program. These will have to be developed by means of another study.

1.6 Positioning

The positioning of this study is to a larger extent related to the theoretical framework from which the risk assessment tool will be derived, than the empirical problem characterising the investigation. Therefore, it will be presented in chapter 2 in connection with the discussion of our choice of theoretical framework.

1.7 Disposition of the Thesis

Chapter 2, Mode of Procedure

This chapter offers a thorough description of how the investigation was conducted, which enables the reader to form his own opinion about the reliability of the study. We describe the methodological approach as well as how the study was conducted in practise. The quality of the study is discussed throughout the chapter.

Chapter 3, Theoretical Framework

In the third chapter the theories about disruptive technology, product design, and value migration are accounted for. Important elements from each theory are furthermore derived to develop a risk assessment tool, which will be applied in order to analyse the empirical data.

Chapter 4, Risk Assessment Tool

This chapter covers the introduction of the analytical tool. Additionally, an explanation of how to apply the tool is presented to the reader.

Chapter 5, Empirical Data

In the fifth chapter empirical data about the telecom industry and EMP will be accounted for, including the data derived from the interviews.

Chapter 6, The Risk Analysis

In the sixth chapter we analyse all empirical data by means of the risk assessment tool. The analysis includes an estimation of the variables within EMP which are critical with regard to the emergence of a disruptive technology. The chapter ends with a retro perspective of the chapter and some risk management advice which should be taken into consideration in order to avoid a possible disruption.

Chapter 7, Conclusions

In the last chapter we summarize the most important findings from earlier chapters in order to answer our research question. We also give some proposals regarding future research and discuss if our findings could be useful in another context.

2 Mode of Procedure

This chapter includes a description of how the study was conducted. Its purpose is to help the reader to form his own opinion about the validity and reliability of the study and its findings.

2.1 Research Strategy

2.1.1 Abduction

The study's starting point is an empirical problem, namely the possible emergence of less advanced technologies replacing EMP's 3G-platforms. For the purpose of investigating this phenomenon the analysis of empirical data has to be combined with studies of existing theories in order to discover patterns, as well as to create a greater understanding of the phenomenon and the context in which it occurs. Hence, the chosen research problem suggests a research strategy which closely links empirical data with theoretical conceptions.

Such a close connection and interaction between data collection, analysis and theoretical concepts was established by adopting an abductive approach (Alvesson and Sköldbberg, 1994). The abductive approach enabled a deeper understanding of the phenomenon being studied and permitted the continuous development of the empirical area of application as the theory was being refined (Ibid.).

More precisely the abductive approach has had the following implication for this study: The identification of the research problem was followed by the extensive study and analysis of theoretical data in order to discover possible theoretical frameworks on which the analysis of the problem could be built. As the studies of theory proceeded, empirical data was collected. The empirical data collection therefore could be continuously adjusted as the theoretical framework was refined. Consequently, a close connection and interaction between theory and empiricism occurred.

2.1.2 Choice of Theoretical Framework

Several theories regarding innovations and technological development could have constituted the framework on which the analysis of the empirical data is based. Many studies have been conducted on these and related subjects, resulting in a broad terminology.

Christensen's theory on disruptive technologies, however, appears to show the closest link to our research question, and is believed to best explain the problem as well as offer solutions. His findings have attracted very much attention amongst practitioners as well as scholars; some find his theories brilliant while others tend to adopt a more critical approach. Most of the critique regards the theory's lack of

predictive value and most scholars request further research to be conducted in order to develop this very same. It is therefore our aim to add to this development by conducting our research with an *ex ante* perspective. This means that a risk assessment tool will be developed which when applied to the case of EMP, will help identify the risk facing the company with regard to the emergence of an alternative technology, i.e. a disruptive technology. Consequently Christensen's theory on disruptive technologies constitutes the core of this study.

The theoretical framework has, however, been broadened to include theories regarding product design and value migration. This decision was based on their close connection with disruptive technologies when taking the specific context of the platform industry, and EMP as a company, into account.

Together these theoretical components constitute the theoretical framework from which the risk assessment tool will be derived. This tool will enable companies to evaluate their own actions and strategic choices with regards to the emergence of a disruptive technology. Thereby the risk of such an emergence can be broadly assessed.

By combining these theories and developing a risk assessment tool we hope to be able to make a contribution to the development of the predictive value of the theory. While it is our aim to develop a tool which, when adjusted and thoroughly tested, may be applicable to other industries than the platform industry, it is not our aim to generalise and create a certain truth.

2.1.3 The Development of a Risk Assessment Tool

Christensen's theoretical concept is derived from studies of industries in which a disruptive technology has led to the fall of former market leading companies. By analysing the circumstances which lead to their fall, he was able to identify the mistakes these companies presumably had made during the process. Based on these identified mistakes, conclusions have been drawn as to which company actions increase or decrease the risk of a disruptive technology emergence, respective. An evaluation of a company's actions, therefore, enables a risk assessment to be conducted.

In order to facilitate the evaluation of a company's actions, with regard to the specific conditions favouring the occurrence of a disruptive technology, the risk assessment tool has been based on concrete questions, derived from the underlying theoretical concept as well as the theories on product design and value migration. This was done for the purpose of presenting a user friendly tool which easily can be applied to any given company under investigation. It was furthermore considered important that the risk assessment tool offers a clear image of the critical variables, which primarily need to be addressed. Therefore, the replies to the questionnaire are

to be placed on a scale directly connected to the risk of a disruptive technology emergence.

2.1.4 Positioning

Christensen's theory of disruptive technologies has thus far been applied to a number of industries by several researchers. Hüsigg et. al (2005) and Lewis (2003) have for example analysed the telecom industry from its perspective. However, they, as well as others, have done so from an *ex post* perspective, meaning that they have analysed the disruptive potential of technologies which have already emerged. Therefore, the predictive value of Christensen's theory is drawn into question (e.g. Tellis, 2006, Danneels 2004, Cosier and Hughes 2001). It is claimed that the term *disruptive* implies that a disruption already has to have occurred, if managers are to identify a technology as such. Hence, the theoretical concept does not provide tools or instruments which enhance managers' ability to predict the emergence of a disruptive technology, before it has in fact occurred. Therefore, its applicability to companies and industries faced with the risk of such an emergence is in practice very limited.

To our knowledge, no research findings with regard to this specific problem have been published. Several scholars have thoroughly evaluated and discussed the theoretical concept, but no actual supplements aimed at enhancing its predictive value have been made. Building our study on this premise is justified by the continuous publication of such criticism, with the most recently having been published as late as 2006 (Tellis, 2006). This study is conducted with the objective to make a contribution to the theory's practical value for business managers. Our contribution to the field of business research consists of the development of a risk assessment tool which when applied to a specific company enables predictions to be made about the possible emergence of a disruptive technology. Further contributions lie in the following attempt to test its applicability by applying it to the case company of this study.

2.1.5 Case Study

The research question in itself distinguishes the focus of interest which is a single organisation – EMP. Evidently the study is conducted from an *ex ante* perspective since the investigated phenomenon has yet not occurred and risk assessments are to be made. These assessments require not only a deep understanding of the organisation itself, but also of the platform industry and the specific context in which it operates.

Therefore, it is our aim to gain a greater and deeper understanding of the variables influencing the emergence of a disruptive technology within the investigated unit. Furthermore, the objective is to investigate the connections and interactions between these variables. This reasoning suggests that a case study be conducted, which is in accordance with Bryman & Bell (2003) who define a case study as an object of

interest in its own right, in which its unique features constitute the focus of research. Additionally the contextual perspective will be best taken into consideration by conducting a case study (Yin, 1994).

The choice to conduct a single-case study is based on this study's particular character which includes the extension of theoretical concepts by developing a problem specific risk assessment tool. Within the theoretical framework which will be applied in order to investigate the research problem, EMP represents a critical case, meaning it meets the conditions for which the theoretical propositions are believed to be true (Yin, 1994). Therefore a single-case study of EMP will represent a significant contribution to knowledge and theory-building. Hence, the developing character of this study motivates our choice to focus on one single case company (Lundahl and Skärvad, 1999).

Our choice to conduct only one case study is further defensible due to the adoption of an abductive approach. The interplay between theory and empiricism ensures the interdependent support of theory and empiricism which in relation with single-case studies is congruent with high validity (Bryman and Bell, 2003).

2.1.6 Choice of Case

The choice to focus this investigation on EMP, which consequently constitutes the case, was based on several factors. Firstly, its leading position on the 3G-platform market played a decisive role. To lead a market with only few additional players, results in a high impact on market development and supply. EMP's actions therefore influence, to a large extent, if an opening is left on the market resulting in the possible emergence of disruptive technologies. Secondly, a critical factor pointed out by Ghauri and Grønhaug (2002) is access to the research object. This hurdle was overcome due to EMP's positive attitude towards research being conducted in this particular field. Hence, access was granted and assistance was offered with regards to the establishment of contacts within the company. Furthermore EMP's location and other practical issues pointed in favour of basing this study on EMP (Ibid.). Easy access consequently has been of great value for this study, and has decisively facilitated the data collection process.

Within EMP further selections were made in order to establish a focused approach for in-depth data collection. According to Yin (1994), the case study inquiry benefits from the prior development of theoretical propositions to guide data collection and analysis. Hence, the abductive approach characterising this study has been of great value. It enabled a constant interaction between theory and empiricism which permitted a precise definition of where the focus of interest within the organisation should be placed. The identified fields of interest were, broadly defined, the platform industry, EMP's resources, decision making processes, resource allocation processes, strategic choices and its products.

2.1.7 Qualitative Research Method

The research question presented in this study calls for a research design which enables a deep understanding of social behaviour in a specific organisation and in a specific context. Information about strategic decisions, expectations regarding future market demand, decision making processes etc., cannot be expressed in quantitative measures since details in description are of high importance. Consequently this criterion is only met by applying a qualitative research design which provides methods for data collection with only limited structures (Bryman and Bell, 2003).

By adding as little structure to the data collection process as possible, it was our aim to minimize the risk of imposing our own views on the objects being studied. We also valued the possibility of discovering new aspects in the course of the process by enhancing the research objects' influence on our study. Another advantage that could be derived from the qualitative research design was the possibility of adjusting the research direction in the course of the investigation, whenever this appeared necessary (Ibid.).

2.2 Method of Data Collection

This study is based on primary as well as secondary data. Deriving data from different sources has strengthened the research process and its findings since the received information was combined and compared. By using more than one source of information, the risk of misinterpretations or inaccuracies leading the research process was reduced. Collecting data from different sources also resulted in multiple descriptions of the investigated problem, which in turn increased the knowledge about the problem (Bryman and Bell, 2003).

Primary data was collected for the purpose of receiving in-depth information concerning EMP's strategic choices and the company's organisational design with regards to resource allocation processes, decision making processes, as well as attitudes towards investments, products and markets. Information regarding these issues was considered too specific to be drawn from material produced for other purposes, i.e. from secondary sources.

Other data such as historical company events, technological details about the product, official strategic goals and market sales figures needed not be derived from primary sources, however. These issues are of rather factual character. Hence, such data was drawn from secondary sources.

2.2.1 Primary Data

2.2.2 Interviews

The primary data was collected by means of personal interviews. The interview process offered flexibility and the possibility to adjust the focus of interest as important issues arose in the course of the data collection process (Bryman and Bell, 2003). According to Saunders et al. (1997), interviews enable a personal contact with the interviewee which may be in favour of the investigation. This was believed to be true for this study, too, since a certain amount of trust from the interviewees' part was considered very important in order to obtain an open discussion and an in-depth data collection process. Therefore an interview where both parties got to meet in person seemed wise.

Two individual interviews were conducted. The reason these interviews were carried out individually as opposed to group wise, is that the interviewees were supposed to answer slightly different questions. Most importantly, though, individual interviews were expected to generate different views and perspectives thereby providing the study with richer information.

2.2.3 Selection of Respondents

In order to investigate the identified fields of interest, it was important to collect data from individuals with sufficient insight. It was not a matter of interviewing as many individuals as possible, however. Hence, the following respondents were selected to participate in this study:

The Director of Procurement & Supply

The Vice President of Sourcing & Supply; also member of the Management Team.

The Director of Procurement & Supply (*DoPS*) was interviewed because it was considered to be of great importance that the supply chain of the industry was well understood. His position as middle-manager in the company enabled him, furthermore, to provide information considering resource allocation and decision making processes etc. Additionally his insights into the technical aspects of the product and his extensive market knowledge pointed in favour of his selection. The Vice President of Sourcing & Supply (*VPS*), also a member of the EMP Management Team, enriched the empirical data with in-depth knowledge about EMP's overall strategies and Management's attitudes towards the competitive landscape, expectations regarding future market demand and such.

2.2.4 Interview Process

The two interviews conducted for this study varied slightly in terms of length and focus of interest. The common objective was, however, to provide the interviewees with as many opportunities as possible to influence the direction of the interview.

Both respondents received information about the research purpose, and the issues around which the questions would be circling, prior to the scheduled meeting. They did not, however, receive detailed lists of questions in advance. The meetings were then held in conference rooms at EMP's headquarters in Lund.

The character of both interviews was open but semi structured, meaning that there was room left for reasoning on topics that the interviewee considered relevant (Bryman and Bell, 2003). The questions were therefore posed in a way which enabled the respondents to freely decide on their response's formulation and length. They could not, however, simply be answered with yes- or no-replies since that would have implied the use of a structured interview design, which was considered critical to avoid (Davidson and Patel, 1994).

Additionally the semi structured interview design enabled us to ask successive questions as they arose. Hence, the method chosen secured a flexible interview process, where adjustments were made as significant issues emerged in the course of the interviews.

In accordance with the semi structured interview method an interview guide was prepared in advance; securing that all the relevant topics were to be addressed. The questions were based on both the theoretical and empirical knowledge which so far had been acquired. Hence, the first interview was slightly less structured than the second one, which focused more directly on topics linked to the risk assessment tool of this study. Also, we had received very reliable information during the first interview, why the most basic questions regarding the industry and the company needed not be asked during the second meeting.

The interviews were both recorded which neither of the respondents opposed to. Hand written notes were abandoned in favour of tape recordings since they would have drawn too much attention away from the respondent, which might have cut off the communication process (Andersson, 1994). Considering the high complexity of the issue and the advanced technology discussed, it would furthermore have been impossible to follow the interviewee's reasoning, let alone ask successive questions, had the recording not taken place. This way full coverage of the discussion was enabled (Denscombe, 2000).

The danger of recording an interview is that the respondent reveals less information (Andersson, 1994). This, to some extent, may be true for this study as well. Nevertheless, both respondents spoke rather freely about all addressed issues and did not refuse any answers. Since both respondents considered the findings of this study to be of interest for the company they were motivated to answer as thoroughly as possible. It was clear, however, that they were well aware of the data they were providing and that they made conscious decisions about how much to reveal.

2.2.5 Secondary Data

The external secondary data which was utilized in this study consists of information derived from articles presented in the media, or in industry magazines covering the 3G-evolution, the semiconductor industry in general and the platform industry in particular, as well as the history of EMP and important events concerning the company. Relevant research studies, articles and analyst reports which focus on the mobile industry were also used in order to broaden our understanding of the industry.

These secondary sources were chosen with great care, and only those considered the most reliable were used. Nevertheless, the journalistic perspective characterising most of the secondary sources differs from ours. Therefore the data included in this study was chosen consciously and careful attention was paid to the publishers' credibility, perspective and relation to the subject. Furthermore, the secondary data's relevance for the purpose of this study was investigated thoroughly prior to its utilization.

During the research process the most frequently used secondary source was internal, namely The EMP Story – a written document provided by EMP itself (Ghuri and Grønhaug, 2002). The document naturally reflects EMP's views and was furthermore written for marketing purposes, which was taken into consideration. Nevertheless, it offered rich product information, technological facts and figures, official strategic goals, historical overviews, market expectations, and industry information in general. The data derived from The EMP Story has mostly been used as a supplement to the primary data which was gathered during the interviews. Therefore, when The EMP Story offered sufficient and reliable information, other more important or complicated and time consuming issues could be addressed in the course of the interviews.

2.3 Preparation and Analysis of Data

2.3.1 Compilation of Primary Data

Both interviews were recorded as has been mentioned. Shortly after they had been conducted the interviews were transcribed in full to make sure none of the data was lost.

The abductive approach, enabling an interaction between theory and empiricism, proved to be helpful when identifying the areas of interest into which the data was to be compiled. Hence, the underlying theoretical concept could be taken into consideration from the beginning, thereby permeating the compilation of the data. The division of data into certain areas was believed to facilitate its analysis and to increase our understanding of the information which was provided.

Although transcripts were made after the recordings, the tapes were nonetheless saved in case any mistakes had been made or anything would appear unclear further

ahead in the course of the research process. Considering the manageable number of interviews, this seemed reasonable.

2.3.2 Analysis of Primary Data

The data analysis process following the interviews was characterised by a continuous alternation between the interpretation of the overall interview, and the interpretation of individual sequences and statements. Additionally, comparisons between the respondents' replies were drawn. This method of analysis is comparable to Kvaales (1997) definition of a hermeneutic circle, which emphasizes the importance of such an alternation in order to gain greater understanding of the gathered information. Due to repeated discussions regarding the collected data during the course of the analysis process, new interpretations emerged as our understanding of the subject increased.

The understanding of the subject was further increased by a sensitive approach to the context within which the statements were made. According to Lundahl and Skärvad (1999), it is of great importance to understand the subjective reality from the respondent's point of view. Therefore consideration was given to the respondents' position within the firm, their perspectives and motives as well as their biased view on EMP. Furthermore the impact on the findings resulting from these subjective realities was continuously discussed and taken into consideration.

However, our study focuses on hidden information only to a small degree, as opposed to studies of corporate culture or leadership and the like. Much of the data presented concerns technical facts and figures as well as processes. Therefore it contains limited amounts of personal values from the respondents. As a consequence the room for interpretation and the risk of biased information has been reduced considerably.

2.3.3 Analysis of Secondary data

The hermeneutic approach is just as applicable to the analysis of secondary data in the form of written documents, as it is to the analysis of verbal primary data (Bryman and Bell, 2003). Therefore, articles and other written documents were initially analysed separately and the most important facts were extracted. The preliminary analysis was followed by a broader analysis in which all the data was put into a greater context and comparisons between the findings were drawn. Extensive discussions with regards to the perspective given by individual articles versus the wider picture provided by all the written documents together, enabled the selection of the most trustworthy data.

The advantage of applying a hermeneutic approach additionally lies in the attention to the social and historical context within which the documents were produced (Bryman and Bell, 2003). The most obvious implication this has had for the analysis of the secondary data, is that only the most recently published sources promising accurate up-to-date information were included. This was considered important since

the industry in which EMP operates is characterised by relatively rapid changes and continuous technological progress. Furthermore, the perspective of the authors and the subjective reality from their point of view was taken into consideration during the analysis of the secondary data. Articles which were very sensationally written, thereby implying that exaggerations of events and statements had been made by the author, were abandoned in favour of articles which more clearly were based on facts and reliable sources.

2.4 Quality of Research

The quality of this study is evaluated by means of four criteria proposed by Yin (1994) and Bryman and Bell (2003). Although the authors use partly different terminology, their concepts are in essence congruent.

Construct validity concerns the establishment of correct operational measures for the concepts being studied. In order to increase construct validity, Yin (1994) recommends three tactics which have been applied throughout the investigation. Firstly, multiple sources of evidence were used to increase the trustworthiness of our findings. Hence, data was derived from primary, as well as, internal and external secondary sources, and attention was paid to their support of each other. Secondly, a thorough description of the methodological approach leading to the derivation of evidence is offered. Thus, the reader is presumably able to follow the chain of evidence, which facilitates the formation of an opinion with regards to the validity of the study. Thirdly, the draft case report was reviewed by *the DoPS* with the purpose of eliminating inaccuracies with regard to actual empirical facts of the case. According to Yin (1994), the study is not finished before such disagreements are settled. Consequently, minor adjustments were made based on *the DoPS*' objections.

External validity concerns the question if the findings of the study can be generalised beyond the immediate case study (Bryman and Bell, 2003). According to Yin (1994), case studies rely on analytical generalisation, meaning that the investigator is striving to generalise a particular set of results to some broader theory. Hence, it is not a matter of being able to generalise the findings of this case study to other cases. Rather, the attempt is made to generalise the findings to "theory". As such, the findings can be applied to examine other cases. However, since this study is a single-case study, the generated findings are not directly and automatically applicable to other cases. The findings must be replicated and tested, before generalisations are legitimate. Therefore, further research needs to be conducted based on the findings of this investigation.

External reliability is high if a later investigator conducting the same case study, following the exact description of procedures, arrives at the same findings and conclusions (Yin, 1994). Therefore, a detailed and rich description of the methodological approach characterising the investigation, as well as the underlying inferences and the empirical data, is offered. Furthermore, thorough documentation

of interview guides and references is provided. Hence, the reliability of this study has been ensured to the best of our ability.

Internal reliability concerns the internal agreement within the research group about what is heard and seen in the course of the investigation (Bryman and Bell, 2003). To ensure high internal reliability, discussions were continuously held in order to arrive at conclusions which were defensible by every member of the group.

Ultimately, the reader has to determine whether the findings resulting from this study are characterised by high validity and reliability. We hope that enough information has been provided to enable such a determination.

3 Theoretical Framework

In this chapter the theories from which the risk assessment tool will be derived are presented. The main theory is the theory about disruptive technologies; since we do not consider the theory to offer enough solutions we have decided to combine it with theories about product design and value migration. Lastly an overview of how the theories are transformed into the risk assessment tool is given.

3.1 Disruptive Technologies

“No sooner is anything called changeless than it proceeds to change. The drive to stability forces us to ignore the change that is occurring now and to deny or explain away the change that has occurred.” (Schon, 1967: xii)

There has always been a conflict between the human efforts to accomplish stability by seeking knowledge about how things really are, and the discovery that nothing ever is as stable as it appears to be (Schon, 1967). The concept of technology and change therefore constitutes the focus of interest of many scholars and has been widely studied. Consequently, over time, many theories have evolved generating new terminology in order to explain the drivers of change and the techniques used by companies to correspond to these changes. Theories on incremental vs. radical innovation, for example, explain technological innovation in terms of changing existing products within existing markets vs. creating entirely new business models for transformed markets (Miller, 2006). Other theories are built around terminology such as competence-destroying innovation and architectural innovation (Tellis, 2006).

Following earlier research on technology and innovation, Harvard Business Review published an article in 1996 written by Clayton M. Christensen. This article was the first of many describing the findings of Christensen’s studies with regard to the connection between technological development and the risk of company failure. His research findings gained much attention and were even called revolutionary by some.

According to Christensen (1995), one of the most consistent patterns in business is the failure of leading companies to stay at the top of their industries when technologies or markets change. One of the most prominent examples is to be found in the computer industry, where IBM dominated the mainframe market but missed the emergence of the technologically much simpler minicomputers, i.e. a disruptive technology, by years (Ibid.). The paradox of leading companies suddenly failing due to lacking investments in future technologies constitutes the core of Christensen’s studies.-The research, on which Christensen’s theory originally was built, was mainly conducted in the disk-drive industry, since its history was one of rapid change in technology and market structure (Christensen and Bower, 1996). Twenty-one

companies were studied in terms of product-specifications, strategic choices and decision-making processes associated with key innovations. However, the theory has since then been applied to a number of industries (e.g. Christensen, 2003).

The failures of leading firms can sometimes be ascribed to variables such as short-sighted investments, organisational exhaustion, bureaucracy, insufficient resources or expertise, and tired executive blood (Christensen and Bower, 1996). These variables, however, are insufficient in order to explain the paradox at hand since the failing companies studied by Christensen were characterised by none of these characteristics. Instead they were known to be well managed, to pay close attention to their competitors, to listen carefully to their customers and to invest aggressively in new technologies; and yet they lost market dominance (Christensen, 2003). In fact, while these qualities were often imitated, and surely much admired by competitors, Christensen (1998) claims that they were precisely the factors which caused the market leaders to fall, and to lose their dominant position. In other words, his findings suggest that what are now widely accepted principles of good management are, surprisingly enough, inappropriate under certain circumstances (Ibid.).

3.1.1 The Failure of Firms

Based upon the findings drawn from his study presented in “*The Innovator’s Dilemma*”, Christensen (2003) has developed what he calls a *Failure Framework*. The purpose of the framework is to offer an explanation as to why leading companies fail. In order to comprehend the reasoning it is important, however, to know the underlying definition used by the author with regard to innovation and technology:

“Innovation walks hand in hand with technology, which I define as the processes by which an organisation transforms labour, capital, materials, and information into products and services of greater value. All firms have technologies. This concept of technology therefore extends beyond engineering and manufacturing to encompass a range of marketing, investment, and managerial processes. Innovation refers to a change in one of these technologies.”(Christensen,1998:3)

This understanding of technology is comparable to some scholars’ definition of a firm’s business model. Chesbrough and Rosenbloom (2002), for example, argue that a business model’s function is to articulate a value proposition, identify a profitable market segment, define the value chain needed to create and distribute the offering, estimate the cost structure and profit potential, and formulate the strategy by which the innovation will gain advantage over rivals. Our understanding of technology follows this concept, and the term disruptive technology will therefore be used synonymously with the company’s overall business model in the course of this study, unless, it is specifically stated otherwise.

For the purpose of understanding the logic behind Christensen's theories', it is furthermore important to understand the distinction between different technological innovations. The two kinds constituting the underlying core of his studies are sustaining and disruptive technologies (Christensen, 1995).

3.1.2 Sustaining and Disruptive Technologies

Most new technologies foster improved product performance and are therefore called *sustaining technologies* (Christensen, 2003). Sustaining technologies can be discontinuous or radical, as well as incremental. They all have in common though that they improve the performance of established products along the performance dimensions, which mainstream customers in major markets have traditionally valued (Christensen et al, 2004). In other words sustaining technologies give customers something more, or better, in the attributes they already value (Christensen, 1995).

When *disruptive technologies* emerge, they bring to market a very different value proposition than has been available previously (Christensen, 1998). In general, a disruptive technology underperforms established products in mainstream markets, at least in the near term. Nevertheless, it offers features which a few fringe (and generally new) customers highly value; typically they are cheaper, simpler, smaller, and frequently, more convenient to use. (Ibid.)

Occasionally the pace of technological progress outstrips market need, which means that the relevance and competitiveness of different technological approaches can change with respect to different markets over time (Christensen, 2003). In pursuit of providing better products than their competitors, and earning higher prices and margins, companies often overshoot the market. Customers consequently are supplied with excessively advanced products which they cannot make use of, and ultimately are unwilling to pay for. (Ibid.)

Besides causing a surplus in supply, technologies progressing faster than market demand have another, even more important, impact on market dynamics. Disruptive technologies, which may under perform today relative to what users in the market demand, may be fully competitive in terms of performance tomorrow (Christensen, 1998). Once disruptive technologies are established in the new markets, their performance is raised by sustaining innovations which soon results in product performances perfectly satisfying the needs of customers in the established markets (Christensen, 1995). Differently put, disruptive technologies may well take over the market once dominated by the sustaining technology.

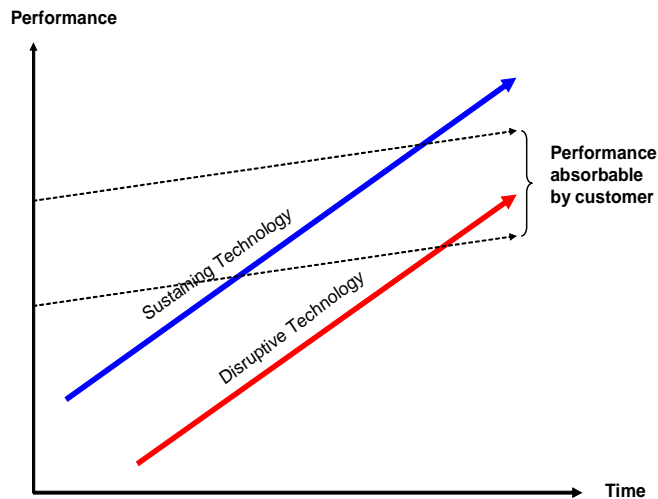


Figure 1. (Christensen, 2001)

For established companies, investing in disruptive technologies is not a rational financial decision to make for three reasons (Christensen, 2003). Firstly, disruptive products are simpler and cheaper, therefore promising lower margins. Secondly, disruptive technologies are generally at first commercialized in emerging or insignificant markets. And thirdly, leading firm's most profitable customers generally do not want to, and indeed initially cannot, make use of the disruptive products. Consequently, companies focusing on their most profitable customers and on product offerings which promise greater profitability and growth, are rarely able to invest in disruptive technologies until it is too late (Christensen, 2003).

3.1.3 The Principles of Disruptive Innovation

As was stated earlier, Christensen argues that there are times and situations when the generally accepted and widely taught principles of good management do not apply. At times it is right not to listen to customers, to invest in developing low performance products promising lower margins, and to aggressively pursue small, rather than substantial markets (Christensen, 1998). In order to help managers distinguish the situations demanding alternative management principles, from those that do not, Christensen (2003) has derived a set of rules to follow. These rules are based on organisationally related areas and are so strong that managers who ignore, or fight them, will find it very difficult to lead their companies through disruptive technology shifts. If, however, managers can raise their awareness of, and harness these forces, rather than fight them, they can in fact succeed remarkably well when confronted with disruptive technological change (Christensen, 1998).

3.1.3.1 Resource Allocation

Christensen's study (2003:117) shows that companies are ready to invest enormous amounts of money if the customers are demanding a certain innovation. At the same time, they are reluctant to allocate resources aimed at implementing less advanced,

disruptive projects, if their existing customers do not demand them. This observation verifies a theory called recourse dependence, which posits that companies' freedom of action is limited to satisfying the needs of those entities outside the firm which give it the resources needed to survive – primarily the customers and the investors (Christensen, 2003). Consequently, organisations will survive only if they provide their customers with the products and services they demand, while satisfying their investors by earning the profits they require. Thus, the most successful firms in an industry are generally those whose people and processes are best tuned to satisfy their customers and investors. In other words, it is not the manager who is in control of the firm's resources; rather the flows of resources, and consequently the decision-making process preceding investments, are controlled by external entities (Ibid.). As a result, when the initial price/performance characteristics of emerging technologies render them competitive only in emerging market segments, and not with current customers, resource allocation mechanisms typically deny resources to such technologies (Christensen and Bower, 1996). This inability of some successful firms to allocate sufficient resources to technologies which initially cannot find application in mainstream markets, but later invade them, constitutes the root of many failures accounted for in Christensen's studies (Ibid.).

With few exceptions, the only instances in which mainstream firms have successfully established a timely position in a disruptive technology, have been those in which the firms' managers have set up an autonomous organisation charged with building a new and independent business around the disruptive technology (Christensen, 1998). Such organisations can cut themselves loose from the power of existing customers and are free to focus on customers demanding products of the disruptive technology. This solution is argued to be the only viable one, since it cannot be expected of the mainstream organisation to allocate freely critical resources in order to gain a strong position in the small, emerging market. The argument is strengthened by the fact that it is very difficult for a company, whose cost structure is tailored to compete in high-end markets, to be profitable in low-end markets as well (Christensen, 2003). The conclusion to be drawn from this reasoning is that managers can, in fact, influence and change the company's strategy as long as their actions are consistent with the principles of resource allocation (Christensen and Bower, 1996).

3.1.3.2 Small Markets

Disruptive technologies typically enable new markets to emerge in which early entrants can gain significant first-mover-advantage over later entrants. And yet, as these former early entrants succeed and grow larger, it becomes progressively more difficult for them to enter the even newer small markets destined to become the large ones of the future (Christensen, 2003). Causing this progressing difficulty are the increasing requirements in terms of growth and profit, as the companies grow over time. Therefore, as becomes evident in Christensen's studies, many large companies

adopt a strategy of waiting until new emerging markets are large enough to generate a certain required profit (Christensen, 1998). This strategy, though, is not very promising. Instead, those established firms which have been able to seize the opportunities presented by the emergence of a disruptive technology, have been giving responsibility to commercialize the disruptive technology to an organisation whose size matched the size of the targeted market (Christensen, 2003). Small organisations can more easily respond to the opportunities for growth in a small market, as opposed to large companies whose resource-allocation processes are inadequate for this given purpose (Ibid.).

3.1.3.3 Non-existent Markets

When dealing with sustaining technologies, the market's size and growth rate, as well as the trajectories of technological progress, have been established. Additionally, the needs of existing customers have been well-articulated. Therefore, reasoned approaches such as market research and intensive planning are valuable and considered to be virtues of good management. (Christensen, 2003)

When dealing with disruptive technologies, however, these approaches are not feasible since the market is yet to emerge and therefore cannot be precisely quantified (Christensen, 1998). Christensen's research (e.g. 1998) shows that companies using planning and marketing techniques which were developed to manage sustaining technologies in the very different context of disruptive ones, make serious mistakes. They demand market data when none exists, and make judgments based upon financial projections when neither revenues nor costs can, in fact, be known (Ibid.).

Bower and Christensen (1996) imply that one approach to identifying disruptive technologies, and emerging markets, is to examine internal disagreements over the development of new products or technologies. Marketing and financial managers, being guided by their managerial and financial incentives, will rarely support a disruptive technology. On the other hand, technical personnel with outstanding track records will often persist in arguing that a new market for the technology will emerge – even in the face of opposition from key customers and marketing or financial staff. Disagreement between the two groups might signal a disruptive technology.

3.1.3.4 Technology Supply May Not Equal Market Demand

Although disruptive technologies initially merely are used in small emerging markets, they subsequently can become fully performance competitive against established products, by undergoing continuous sustaining innovation (Christensen, 1998). Ultimately, even the progress in disruptive products exceeds the rate of performance improvement which mainstream customers demand, or can absorb. Consequently, products valued by mainstream customers today will eventually be replaced by the products of tomorrow (Ibid.). When the performance of competing

products has improved beyond what the market demands, and customers no longer can tell which are the differences in terms of performance, then the basis of choice evolves from functionality to reliability, then to convenience, and, ultimately to price (Christensen, 2003). Only those companies, which carefully measure trends in how their mainstream customers use their products, can catch the points at which the basis of competition will change in the markets they serve (Ibid.). This is especially important in disruptive innovations where little is known about the emerging market, and where strong first-mover-advantages do exist (Christensen, 1998).

3.1.4 Where an Organisation's Capabilities Reside

An organisation's capabilities define what it is capable of accomplishing with regard to disruptive change occurring in the industry. Christensen (2000) analyzes an organisation's capabilities in terms of three categories of factors: resources, processes, and values. These factors vary in terms of flexibility and adaptability (Burgelman et al, 2004). Both processes and values are not considered to be very flexible, i.e. they are not to be changed very easily. Therefore the processes and values which constitute an organisation's capabilities in one context (e.g. in a context of sustaining innovations), define its disabilities in another context (e.g. in the context of a disruptive innovations). Addressing disruptive innovations by developing new capabilities therefore poses a great challenge to the leading firm, which historically has focused on sustaining technologies. (Ibid.)

3.1.4.1 Resources

Resources include people, equipment, technology, product designs, brands, information, cash, and relationships with suppliers, distributors, as well as customers. Usually these are assets which can be easily transferred across the boundaries of organisations (Christensen, 2003). Without doubt high-quality resources can enhance an organisation's chances of coping with disruptive change. Therefore, it is no surprise that managers most instinctively identify their resources in order to assess how well their company can implement the changes, by which it is confronted. Such an analysis, however, is insufficient because the capabilities to produce goods and services of greater value lie embedded in the organisation's processes and values. (Ibid.)

3.1.4.2 Processes

Christensen (2000) defines processes as the patterns of interaction, coordination, communication, and decision making through which employees accomplish to transform resources into products and services of greater worth. Examples of such processes are product development, manufacturing, budgeting, resource allocation, employee development and compensation.

The most important capabilities, and concurrent disabilities, are likely to be in the less visible background processes which support decisions about where to invest resources, i.e. the resource allocation processes. It is in these processes that many organisations' most serious disabilities in coping with change, namely the emergence of disruptive technologies, reside. (Christensen, 2000)

The dilemma regarding processes and change is that by their very nature, processes are set up in order to enable employees to perform tasks in a consistent way, time after time. For the purpose of ensuring consistency they are not meant to change (Christensen, 2003). Therefore, processes are likely to perform the tasks they were originally designed for very efficiently. When the same processes, however, are used to tackle very different tasks, they might seem bureaucratic and slow, why satisfying results are less certain (Christensen, 2000). In other words, a process which defines a capability in executing a certain task concurrently defines disabilities in executing other tasks (Christensen, 2003).

3.1.4.3 Values

In Christensen's (2003) opinion, an organisation's values are the standards by which employees make prioritisation decisions in terms of attractive orders, important customer segments, attractive business opportunities etc. Decisions such as these are made daily by employees at every level. The larger the organisation, the more important it is that independent decisions about priorities are aligned with the overall strategy, as well as the business model of the company. But consistent, broadly understood values also define what an organisation cannot do. A company's values, by necessity, must reflect its cost structure or its business model because these define the rules employees have to follow in order for the company to gain profits (Ibid.).

The values of successful firms tend to evolve in very predictable ways in two dimensions:

- How does the company judge acceptable gross margins?
- How big does a business opportunity have to be before it is considered interesting?

It follows that an opportunity which excites a small company, is not big enough to be interesting to a large company. The disability of large firms to invest in small emerging market segments is, in fact, caused by an evolution in values as the company grows bigger (Christensen, 2000).

3.2 Product Design

According to Christensen et al (2001) depending on the stage of a product's evolution, companies need to compete in different ways. As long as the functionality of the product does not meet the needs of key customers, the base of competition is product performance. Later as the technology improves and these needs are met,

other characteristics such as convenience, customisation, price and flexibility are valued more. Thus, depending on how far the evolution has progressed, different product architectures are called for. In markets where product functionality is not yet good enough, companies must compete by making better products. This typically means making products whose architecture is interdependent and proprietary, because competitive pressure compels engineers to fit the pieces of their systems together in ever more efficient ways in order to wring the best performance possible out of the available technology (Christensen, 2002).

When technological progress overshoots mainstream customers' demands, however, a more flexible, customised solution is needed. The competitive advantage shifts from product performance to speed, flexibility, and price (Christensen et al, 2001). This reasoning is supported by Ulrich and Ellison (1999) who believe that differences in the degree to which components are designed for a specific product, can be explained to a large extent by the nature of the customer requirements for the product, and by the fundamental constraints of engineering design.

The architecture of a product can be defined by the interface coupling (Ulrich 1995). Two components are coupled if a change made to one component requires a change to the other component in order for the overall product to work correctly. Based on the degree to which the components are coupled (or de-coupled), products can be divided into integral vs. modular architectures (Ibid.).

Product architectures which are characterised by a high degree of modularity typically have components or subsystems which are loosely coupled together in design and operation (Fine et al, 2005). These components tend to be fairly standardized with interchangeable options, thus enabling the up- or downgrading of the product by replacing lesser components with better ones, and vice versa (Ibid.).

A product whose architecture exhibits a high degree of integrality will typically have subsystems that are tightly coupled together in design, as well as in operation (Fine et al, 2005). Interfaces between these subsystems will thus tend to be complex, non-standard, and designed and built explicitly for a particular product. Components which are part of an integral product tend, furthermore, to perform parts of multiple functions, and function/performance dimensions delivered by multiple subsystems (Ibid.). Products also exhibit characteristics of an integral architecture, if some of their functional requirements must be delivered by various subsystems, and cannot be reduced to a single component or subsystem (Fine et al, 2005).

According to Ulrich (1995), the architecture of the product determines which functional elements of the product will be influenced by the change made to one particular component. Consequently, it also determines which components need to be changed to achieve a desired change to a functional element of the product. It is argued that the architecture is closely linked to the ease with which changes to the product can be implemented. At one extreme, modular products allow each

functional element of the product to be changed independently by changing only the corresponding component. Fully integrated products, at the other extreme, require changes to every component in order to effect change in any functional element (Ibid.).

3.3 Value Migration

It is widely known and accepted that products go through different phases. As the product matures the probability of a modular design increases, and ultimately products are rendered obsolete and out of date. Slywotzky (1996) asserts that this line of argument can be held for a company's business model as well.

Customer priorities - the issues that are most important to them, including and going beyond the product or service offered - have a natural tendency to change while business models tend to stay fixed, according to the author. When the mechanism which matches the company's business model to the structures of customer priorities breaks down, value migration begins to occur. Value can migrate to other business models within an industry, or flow out of one industry and into another, where models are better configured to satisfy customer priorities and make profits. (Ibid.)

According to Christensen's theories accounted for previously, the emergence of a disruptive technology can be explained by product performance overshooting customers' needs. This discrepancy between performance and need changes customers' priorities to less advanced products, which according to Slywotzky (1996) is one of the factors triggering the migration of value. The company most effectively responding to these changes, perhaps by introducing a disruptive technology, is the one capturing the most value. Herein lays the link between the two theoretical concepts, where value migration can be thought of as a consequence of the emergence of a disruptive technology in a given industry.

Slywotzky (1996) further claims that the most successful companies are the ones which best detect and foresee value migration. Foreseeing value migration is difficult due to a company's internal focus and that signs of migration are hard to detect. By conducting a business model evaluation it can be easier for a company to realize when value migration is occurring, and if so, to where. This type of evaluation is important when investigating the model's ability to capture profit and can be done by asking questions with regards to the assumptions about customers and economics on which the business model is built. Furthermore comparisons to competitor's business models can be made in order to investigate indicators pointing towards the occurrence of value migration in the industry.

Slywotzky (1996) identifies three different phases of value migration, in which a business model can find itself. However, it can only exist in one of them at a time. The phases describe the business model's relative value-creation power, based on its

ability to satisfy customer priorities better than competitors do. These three phases are *Value Inflow*, *Stability* and *Value Outflow*.

In the first phase, inflow occurs because a company has produced a product which satisfies customer priorities and, thus, begins to attract value from other parts of its industry. Due to its superior ability to satisfy customers, firms using the new business model absorb value from firms that persist with the old design, hence gaining market share and value compared to their competitors. Typical characteristics of firms in the inflow phase are that they are very customer focused, have entrepreneurial management and enjoy an advantageous industry position. In the second phase, stability is indicated by a leveling off of value migration as customer-priorities and company-products align. There is overall competitive equilibrium and value remains in the business model, but expectations of moderate future growth prevent further inflow of new value. Characteristic of the stability phase is an increase of competition, where focus begins to shift inward and capital spending and head counts increase. In the third phase, the outflow phase, value moves away from a corporation's product line towards products more directly tapping customer's top-priorities. Financing becomes more difficult to obtain as cash flow diminishes and market value shrinks, rendering the business model obsolete. In order to remain competitive, a company must understand its business design's ability to capture value in the Inflow Phase, its sustainability in the Stability Phase, and its vulnerability in its Outflow Stage. (Slywotzky, 1996)

3.4 From Theoretical Framework to Risk Assessment Tool

The emergence of a disruptive technology can pose a great threat to an established market leader, who is possibly blinded by the continued strive for technology leadership. The consequences of such an emergence could be great losses of market shares, and hence, profits, which would put the strong position on the market at risk. Furthermore, the peculiarity of disruptive technologies lies in their unexpected and sudden emergence, which raises the question: How can this specific risk be handled when the circumstances are unknown? Managing disruptive technologies should therefore be part of the overall risk management of the firm, which aims to provide the decision makers with a systematic approach to coping with risk and uncertainty (Williams et al, 2006). Thus, it would be in the leading company's interest to develop a tool, which enables the firm to assess the risk caused by a possible emergence of a disruptive technology. By applying the theories described above the development of such a tool will be attempted in this study.

3.4.1 Risk Assessment

Companies are faced by different types of risk which all need to be addressed in different ways in order to be managed adequately. The risk posed by a disruptive technology falls under the category *optional risks* (Williams et al, 2006), i.e. the

organisation has to choose whether to manage them, and if so, to what degree, depending on its risk profile.

According to the authors, managing risk ranges from ignoring the risk, to attempting to nullify the effect of each and every identified risk. The choice of action will be a trade off based on comparing the cost/likelihood of insurance with the cost/likelihood of risk. In order to manage optional risks, a three-step process is suggested to be necessary:

- risk recognition
- risk prioritisation
- risk management

The risk of an emergence of a disruptive technology has been recognized and its consequences could most definitely be harming the business, according to Christensen (e.g. 1998). Therefore the first step of the process has been managed previously during the course of this study.

Subsequent to the identification of the risk, the nature and the level of it needs to be understood, in order for it to be managed in an appropriate manner (Williams et al, 2006). Therefore, a risk analysis, which is based on likelihood and consequence, and a risk evaluation against appropriate risk-acceptance criteria resulting in a ranking, need to be carried out. The ranking could be based on criteria such as “low” (tolerable), “medium” (as low as reasonably practicable), and “high” (intolerable). (Ibid.)

The purpose of developing an analytical tool is to enable a risk analysis, and hence an estimation of the risk facing EMP with regard to the threat of a disruptive technology. Relevant questions derived from the theoretical framework of this study compose the core of the risk assessment tool, which when applied to EMP will result in a deeper understanding of the individual factors’ risk level, and their influence on the overall threat facing the company. The assessment of risk levels will furthermore allow for conclusions to be drawn with regard to the prioritisation of these factors. In other words it will determine where EMP’s greatest shortcomings are embedded and which of them should be given the most attention in order to minimise the risks of a disruptive technology to emerge.

The last stage in the process of risk assessment is the management of the risk factors which have been identified and prioritised (Williams et al, 2006). Obviously there exists a large number of management approaches with regard to risk management. To name a few Williams et al. (2006) suggest terminating the activities related to the risk, adding control measures to manage the likelihood and consequence of events, accepting the risk or moving the impact of the risk to another entity. For the purpose of this study, however, possible risk-minimising actions will be suggested based on the theoretical framework and the risk analysis conducted by means of the risk

assessment tool. These take into account the specific context related to the emergence of disruptive technologies in the platform industry, and will therefore generate more valuable suggestions.

4 Risk Assessment Tool

In this chapter the reader will be introduced to the risk assessment tool which was developed by the authors. First, however, a short instruction on how to use the tool is given.

4.1 Instructions

This risk assessment tool consists of four parts covering different areas considered important in order to be able to determine whether or not a given company faces a risk of being affected by a disruptive technology. Each part is built upon a set of general questions and sub questions pointing out important industry factors as well as company specific factors. For each general question (in bold) the colour scale should be marked according to the given answer. The colours signify the corresponding risk levels as follows:



Low Risk

Medium Risk

High Risk

Where there are sub questions, the answers to these should be combined to provide one single marking for the general question. The proposed sub-questions, however, may vary depending on company specific characteristics. Therefore they need not be followed strictly and are to be used for explanatory purposes.

The variables resulting in high risk assessments need most urgently to be addressed, while medium risk variables require no immediate action. They should, however, be kept in mind and re-evaluated at a later point in time. The green area indicates that no action needs to be taken.

4.2 Business Specific Factors

The first part, business specific factors, should be used as supplementary background information. By combining the findings regarding specific business characteristics, with the company's attitude towards them, the risk of a disruptive technology can be appreciated.

Does a company which offers a potentially disruptive technology enjoy lasting advantages due to its early entrance on the emerging market, as opposed to later entrants, i.e. do first-mover-advantages (FMA) exist?



No FMA

Strong FMA

Are consumers' demand and priorities changing towards higher or lower product performance?



**Towards Higher
Product Performance**

**Towards Lower
Product Performance**

Have competitors' priorities changed over time regarding product performance, and if yes, towards higher product performance or towards lower product performance?



**Towards Higher
Product Performance**

**Towards Lower
Product Performance**

Is the industry characterised by fierce competition?

- Are there many players in the industry?
- Is the competition characterised by intense price pressure?



Moderate Competition

Fierce Competition

4.3 Company Specific Factors

4.3.1 Organisational Awareness

Is the company characterised by high or low responsiveness regarding the business specific factors mentioned above?

- Is the company aware of the FMAs characterising the market?
- Does the company respond to changes in customer priorities?
- Is the company aware of changes in terms of competitor priorities?



High Responsiveness

Low Responsiveness

4.3.2 Market Approach

Does the resource allocation process favour technologically advanced high-cost products and continued performance enhancement, or less advanced low-cost products?

- Does the company primarily allocate its resources towards technically advanced existing products, or towards new low-cost products?
- Is the resource allocation process influenced by current customers preferring increasing performance in existing products, or by emerging customer segments valuing increased customisation?
- Which proposals from employees get attention; those regarding higher technological performance or those regarding low-cost solutions?
- When investing in a new customer segment, which markets are considered attractive; those valuing technological performance over price, or those valuing low-price solutions over technological performance?



Low-Tech, Low Cost Products

High-Tech, High Cost Products

Where does the company's attention level reside in terms of small and non-existing markets?

- Do small or yet non-existent markets get attention from the company?
- Is the company paying much attention to small and non-existent markets by conducting market research in order to learn more about them?



**High Attention Towards
Small Markets**

**Low Attention Towards
Small Markets**

Does the company adapt to different market requirements by applying different measures for existing versus small and non-existing markets?

- Has the required rate of growth increased since the company has become larger? If yes, it signifies low adaptability.
- How is market research and planning conducted? If it is conducted identically when analysing existing and non-existing markets it represents low adaptability.
- Is the rate of growth adjusted to both non-existing markets and existing markets? If not, it signifies low adaptability.
- Are the financial measures adjusted to measure both existing and non-existing markets individually? If not, it signifies low adaptability.
- Are qualitative measures which are applied to non-existing markets as valued as quantitative measures, which have been developed for existing markets?



**High Adaptability
Differentiated Measures**

**Low Adaptability
Undifferentiated Measures**

4.3.3 Organisational Capabilities

4.3.3.1 Recourses

Is the company characterised by a high level of resource capability which enables it to detect and react to the occurrence of a disruptive technology, or, a

low level, meaning that it would be difficult for the company to discover and react to an upcoming disruptive technology?

- Does the company have sufficient financial resources in order to invest in non-existing and small markets?
- Does the company have sufficient knowledge and employees to discover changes in market demand?
- Does the company have an agile and flexible supply chain which enables it to respond to sudden market changes?
- Does the company have a strong brand, which will prevent customers from turning to competitors?



High Resource Capability

Low Resource Capability

4.3.3.2 Processes

Are the company's processes adapted to react if a disruptive technology occurs in the business?

- Is the resource allocation process characterised by high or low adaptability with regard to sudden changes in the industry?
- Is the organisation flexible enough to produce different kinds of product solutions as demand changes (low-tech vs. high-tech, low-cost vs. high-cost etc.)?
- Can the manufacturing processes be adapted easily to sudden changes?
- Do the decision making processes support quick decisions, thereby indicating high adaptability?
- Can decisions regarding investments be easily changed, and can unsuccessful projects be terminated if necessary, thereby indicating high adaptability?
- Do the established communication routines amongst employees and company divisions enable a rapid execution of new decisions and strategies, thereby ensuring high adaptability?



High Process Adaptability

Low Process Adaptability

4.3.3.3 Values

Do the company's and its employees' priorities work in favour of existing markets and technologies, or new yet non-existent markets and technologies?

- Does the company have an expressed vision which permeates the entire organisation, and which indicates a prioritisation of either new or existent markets and technologies?
- Which technologies and market segments guide employees in their daily work?
- In which segments are new business opportunities considered to be attractive?
- Do the company's expressed visions/financial goals direct employees towards prioritising existent businesses, or new business opportunities in their daily work and in their decision making process?



New Technologies and Markets

Existent Technologies and Markets

4.4 The Design of the Product

Does the company offer customised products thereby fulfilling both low-end and high-end segments' needs?

- Is the product customised?
- Does the product design enable the emergence of a more customised product?
- Are there technological or organisational limits which prohibit an increase in customisation?



Customised Product Offerings

Un-Customised Product Offerings

4.5 Value Migration

Based on the comparison of the company with the criteria given below, in which phase does the company reside; inflow, stability or outflow?

- **Inflow:** The company gains increased market share. There are high expectations of growth. The organisation is recruiting personnel.

- **Stability:** The company has had a constant level of market share over the past few years. The expectations of growth are moderate. Competition is increasing. Capital spending and head counts increase.

- **Outflow:** Market shares diminish. There are low expectations of future growth. Customer priorities are shifting away from the company's product. Financing gets increasingly difficult and cash flow diminishes.



Inflow

Stability

Outflow

5 Empirical Data

In this chapter information about the telecom industry and EMP is presented. Moreover, the empirical data which was derived from the interviews, as well as from secondary sources, is accounted for.

The empirical data presented in this chapter, is based on both secondary and primary sources. When referrals are made to the interviewees, their titles will be abbreviated to facilitate the reading process. The Vice President of Sourcing & Supply, Magnus Hansson will, as was mentioned earlier, be referred to as *the VPoSS*, and the Director of Procurement & Supply, Peter Unelind, will be referred to as *the DoPS*.

5.1 EMP – The Company

EMP, based in Lund, Sweden, was founded by Ericsson in 2001 in order to keep control over the platform technology within the company, as the joint venture with Sony was initiated. Jan Uddenfeldt, vice president of Ericsson Technology at the time, predicted an imminent change in the mobile phone industry, with few suppliers of platform chipsets (chips that work together to achieve certain functionality) as opposed to a larger number of producers of mobile phone handsets – a scenario Ericsson intended to be prepared for. (Dagens Industri, 2002-04-16)

In 2002 and 2003 EMP still struggled with negative year end results amounting to -795 million SEK and -1 500 million SEK respectively. In 2004 however, EMP finally reached profitability during all four quarters. Since Ericsson was very enthusiastic about the opportunity to offer an end-to-end solution to different customers, EMP was allowed to operate at very high cost during the first two years (Dagens Industri, 2003-08-21). In 2004 EMP reached a turnover of 1.9 billions SEK (Dagens Industri, 2005-08-15).

Having had Sony Ericsson as its initial main customer, EMP signed additional contracts with fourteen new customers, among them LG, Sharp, Amoi, NEC and HTC. In fact, six world leading mobile phone manufacturers were using EMP platforms this year.

EMP's 3G technology was launched in the device market in 2003 and their platform was being used in more than 30% of all phones sold at that time. Presently, over 30 million handsets based on the company's platform are sold, and the number of released phones by their customers is increasing rapidly year by year. (The EMP Story)

5.1.2 The Business Model

EMP's business model includes the development of mobile phone platform software and core technology in the form of an integrated circuit design. *The VPoSS* offers

further clarification by stating that although EMP develops the software and multimedia technology included in the mobile phone, the company is not responsible for the customer look-and-feel. This part of the development process is left to EMP's customers, the mobile phone manufacturers, who use it in order to differentiate themselves amongst their customers, namely the consumers.

EMP's platforms are available for several mobile phone standards, more specifically GPRS, EDGE and WCDMA.

“The idea behind EMP is that all mobile phones need this basic technology. Therefore it would be silly if all mobile phone manufacturers, e.g. Sony Ericsson and LG, were to develop the technology themselves when their needs in fact are identical. Instead EMP takes care of the development of the technology and sells its solution to others.” (The VPoSS)

EMP also provides its customers with a reference design, i.e. a tried-and-tested blueprint for making a mobile phone, which enables them to shorten the product's time-to-market. In addition to the physical reference product, assistance with application development tools, training, operator acceptance and customization are offered. The business model practiced consequently includes licensing EMP's core technology and selling consultancy support service to its customers. In most cases the license fee paid by the mobile phone manufacturers consists of two parts, an up-front charge for access to the core technology and a per-unit royalty when the products have reached volume production.

“The price paid to us is just a fraction of what it would have cost the manufacturers to do everything themselves...” (The VPoSS)

Since EMP, itself, does not manufacture the integrated circuits upon which the platforms are based, the customers purchase these directly from EMP's silicon partners. A silicon partner is a larger semiconductor company owning its own manufacturing facility, and is usually called Integrated Device Manufacturer (IDM). (The EMP Story)

EMP's vision is for its platforms to be included in as many mobile phones as possible, independent of brand.

“Obviously, Sony Ericsson is a large customer but we try to get as many brands as possible to use our platforms in order to spread the platform development costs across the largest possible number of mobile phones.” (The VPoSS)

Combined with the networks solution provided by Ericsson, the company is one of few to offer their customers complete end-to-end solutions for all major mobile communication standards.

“The rest of Ericsson is very focused on the infrastructure, i.e. the base stations, the network behind the infrastructure and related services. Ericsson therefore focuses on end-to-end solutions and the company makes sure that the services offered in the phone are supported throughout the entire infrastructure.” (The VPoSS)

5.2 The Industry

5.2.1 The Competitive Landscape

The number of companies which already manufacture functioning 3G platforms, or which currently are developing 3G platforms, is limited. Amongst EMP’s largest competitors are Broadcom Corporation, Qualcomm, Freescale Semiconductor Inc., Infineon Technologies AG, NXP and Texas Instruments Inc. An explanation as to why there are so few companies operating in this industry is offered by the resource intensity related to the platform business. According to *the DoPS*, it took EMP 2000 man-years to develop its first platform and investments amounting to several billions of SEK were required.

“The development of 3G is so much more complex than GSM and requires a lot of both the hardware and the software in terms of functionality and performance which consequently means higher costs. You need certain resources and I think there are few others who invest enough in R&D resources...” (The DoPS)

The most obvious aspect of how these companies differ is in the parts of the value chain they control. Freescale, Infineon and Texas Instruments are vertically integrated semiconductor companies, IDM’s as was explained above. They therefore control the entire value chain, whereas EMP, Broadcom and Qualcomm have outsourced most parts following the manufacturing phase; confer to the section on value chain below.

At present, Texas Instruments does not have a proven 3G platform and is therefore not a direct player on the market. They do however benefit from 3G through Nokia’s handset volumes. In the second half of 2006, Panasonic mobile phones were put to market powered by 3G platforms from both Infineon and Broadcom. These were reportedly the first phones put to market using platforms from these companies. This can be put into context with EMP powering almost sixty models as of 2006. (www.infineon.com, www.broadcom.com)

5.3 The Product

The actual product provided by EMP is a complete mobile phone platform which contains all critical integrated circuits and software necessary for its customers to build a competitive handset.

A very important aspect of the product is its design and the level of component integration.

“Within all microelectronic products, Moore’s Law helps us to constantly reduce size in order to fit in more and more features... This is how we have been working ever since the mobile phone was born; we have integrated more and more. And that is a key driver of technological development – constantly integrating more and more into microelectronics.” (The DoPS)

Reducing the size of the platform, consequently increasing the integration of the chipset, has proven to be very important in order to reduce the silicon area used, hence lowering the cost. With a higher degree of component integration in the integrated circuits, more functionality can be added to the platform as a whole. In addition to this, the integration of the chipset affects the power consumption in a positive manner. Low power consumption is crucial for success on the mobile phone market, according to *the DoPS*, and constitutes one of the most important challenges EMP’s customers have to overcome to remain competitive. The impact of this is strongly felt by the platform provider, who experiences power consumption to be EMP’s top priority. Another important challenge is to include all antennas needed to make use of the features offered by mobile phone providers. The number of antennas has increased parallel with the evolution of more advanced technologies.

“In a couple of years a mobile phone could have up to nine built-in antennas. One for GSM, different antennas depending on frequency bands used for 3G, Bluetooth, GPS and so on... This poses a great problem in terms of interference. (The DoPS)

Despite the product’s very integrated character, it does have certain modular characteristics in the meaning that most of the components are the same regardless of the mobile standard they support. They can therefore be combined accordingly. It would be possible to modularize the platform further. The choice to develop a more modular product is, according to *the DoPS*, a matter of product architecture and flexibility. But above all it determines the size of the chipset, which in turn determines power consumption and cost.

It would also be possible to focus on ultra low-end products by reducing certain functions and features, thereby creating a smaller platform. Hence, there is a certain trade-off between function and size. Today, GSM-solutions, which offer only voice services and Short Message Services, represent this ultra low-end segment.

“EMP has thus far only been operating in the mid-high segment due to its technological leadership. This is where we are competitive. In the ultra low-end segment, which is GSM, there are perhaps 30 competitors fighting for

market shares. Everybody can do GSM but only a handful can do WCDMA...” (The DoPS)

Also *the DoPS* believe that a different organisational structure would be needed if EMP was to enter the low-end market.

“To be successful in the low end market means increased cost pressure. It also quite possibly means a different logic of doing business and a different organisational structure. I don’t believe that compromises can be made in this matter. The reason for our success probably is that we have a very good product architecture. We have prepared modules which we put together and which are upgraded when the need arises. However, if these modules are not optimised from the beginning in terms of a low cost structure, then we have a problem...” (The DoPS)

5.4 The Value Chain

Up until the turn of the century when the mobile phone’s value chain was partly broken up, mobile phone manufacturers were to a great extent vertically integrated. However, at the back end of the value chain horizontalization had to some degree already occurred, since no phone manufacturer owned its own chip fabs, i.e. a manufacturing site for integrated circuits. The various players downstream selected different routes where they felt they could get their piece of the pie. Nokia, for example, kept its design above the chip manufacturing level in-house, while EMP drew the line at what today is called the “platform”. The joint venture Sony Ericsson Mobile Communications was one of the new players which covered only part of the value chain above the platform.

One of the reasons for the changes in the value chain, and the emergence of the platform industry, could be that terminals for the upcoming generation (3G) of telecom systems were so complex that few players could manage to produce an operational design that passed all tests and functionality requirements.

Below the parts on which the value chain is built, will be explained. This will be done by describing the value adding process of a platform, from design to the shipment to the mobile phone manufacturers. This process is by no means an easy task and this description of the development of a platform is extremely simplified and contains numerous steps not concluded here.

First of all, the chipset has to be designed in terms of physical layout and functionality. This initial design phase, confer to figure 2 below, is an integral part of the development of the platform and the result is a graphical design code describing a physical design layout of what the platform will look like, and how it will function. This is where EMP resides in the value chain; the company makes some parts of this

design and hands over a graphical design data file to its silicon partners, who do the actual manufacturing of the integrated circuits.

The next step is to manufacture the integrated circuits according to the design description. As a consequence of the extreme costs involved in owning a semiconductor manufacturing facility, the actual manufacturing of integrated circuits for basically all consumer electronics is outsourced to silicon partners, who could be the so called foundries, or the vertically integrated IDMs.

Before the integrated circuits can be used in the physical platform, they have to be protected by packages and thoroughly tested. This is done by companies specialized in assembling and testing, and the components are thereafter shipped to the customers.

The vertically integrated IDMs own a substantial part of the value chain and perform all of the above explained tasks in-house. Since EMP mainly develops the software and some parts of the chip design, it relies on IDMs for the manufacturing, assembly and test, as well as shipping of the platform product. EMP has an in-house sales force and most of the customer support is covered in-house as well.

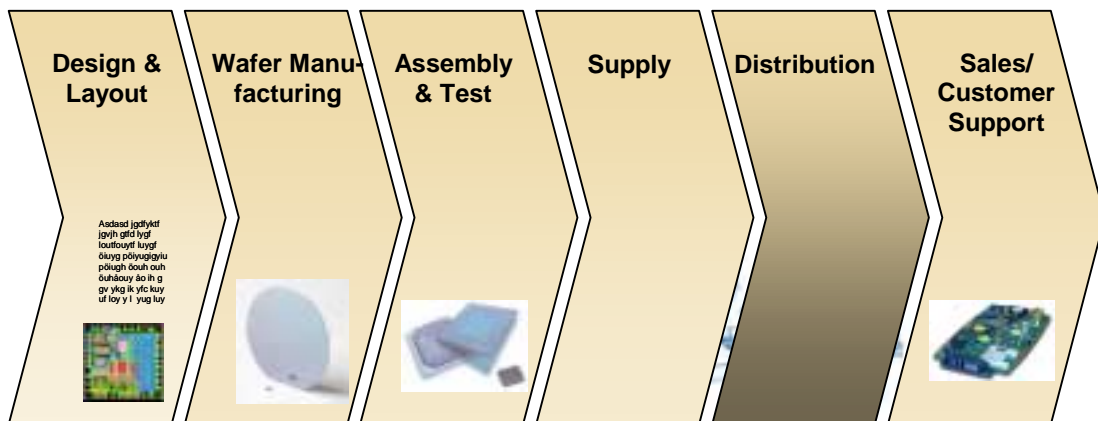


Figure 2, the mobile platform value chain, (The EMP Story)

5.5 The Migration of Value

The platform industry is part of, and highly dependent on, the semiconductor industry as a whole. Changes in this volatile industry of course affect the platform industry in general and EMP in particular.

Looking into the future of the device industry, there is reason to believe that it will be an economy of scale business in many respects. The structure of, and position within the industry, as well as what parts of the value chain different players will cover, remain uncertain.

The uncertainty as to where the main value will be generated in the future value chain was commented by *the VPoSS*. He drew parallels with the PC-industry in which the value migration from hardware to software has been occurring. Nevertheless, he remains uncertain about future changes within the value chain of his industry. What can be said, though, is that the cost and price development in the hardware has been directed by Moore's Law since 1965. In other words, the cost of the chip and by extension its price, is decreasing in relation to the diminishing size of the chip. Other changes have been identified in terms of functionality increase. Higher functionality levels do not, however, result in lower costs. Additionally, end-consumers and consequently platform customers, adjust to lower prices in general, which adds to the dilemma.

Regarding the software, which in the PC-industry has proven to generate increasing value, many companies have difficulties finding cost models which allow them to charge adequate prices. *The VPoSS* mentions Microsoft as a successful example from which to draw lessons.

“It's crucial to be where the future value will be generated, to create great margins in these areas. Where that is, that's the key question...” (The VPoSS)

When asked about the expected value migration within the 3G industry, should an extreme volume market emerge, *the VPoSS* makes a comparison to the GSM industry. GSM has attracted vertically integrated IDMs, and every supplier aims at developing chipsets, platforms, and end-to-end solutions. The advantage of this business model is the possibility of gaining higher average selling price by providing more of the expensive parts of the mobile phone, e.g. digital cameras.

Those manufacturing the least value generating components of the mobile phone, aim towards the manufacturing of modules.

“All companies try to build their own monarchies where higher value can be generated.” (The DoPS)

The future value generation in terms of the entire mobile phone's value chain, is closely connected to the overall trends within consumer products in large. According to *the VPoSS*, the greatest value therefore lies in the brand and the design of the mobile phone. He further argues that consumer products have tight margins, why profits will be earned by globally operating companies serving high volume markets through superior distribution channels.

5.6 The Market

EMP's products, i.e. the platforms, are not designed to be offered directly to end consumers. Thus, EMP engages in business to business sales, offering and selling its platforms only to other companies. EMP's customers are different mobile phone manufactures all over the world, and the platform is used in mobile phones directed to the mid-high¹ segment. EMP focuses on technological leadership, and according to *the DoPS*, the mid-high segment is congruent with the focal point.

5.6.1 Mobile Phone Manufactures

EMP sells its platforms to mobile phone manufactures such as Sony Ericsson, Korean LG Electronics and the Japanese manufacturer Sharp. In order to sell large volumes of platforms, it is desirable for EMP and its competitors to sign license agreements with one of the top three mobile phone manufacturers Nokia, Motorola, or Samsung. In 2004 EMP's technology was found inside 50% of all mobile phones sold by one major operator. (The EMP story)

EMP's mission is to "help customers sell more phones" and the company has de facto helped its customers, and operators, to gain significant shares of the 3G market, confer to the discussion in the section regarding the historical overview.

5.6.2 Operators

The biggest customers of the mobile phone manufacturers are the mobile operators, who specify and purchase mobile phones for their subscribers. Operators frequently mandate the use of a certain platform technology in these phones. Although the operators are not directly part of EMP's customer base, the company has decided to work closely with key operators for the purpose of understanding their requirements more thoroughly (The EMP story).

According to *the DoPS* it is important for EMP to conduct market research among operators as well as manufactures.

"We focus just as much on talking to the operators as we do on talking with the mobile phone manufacturers (...) so we are one step ahead. If we understand the demand of the operators, we are prepared when the customers come and ask for the same thing; if we are already prepared for it we can deliver faster."(The DoPS)

The DoPS also mentions that many industries are driven by consumer demand, meaning that companies ask the consumers about their preferences with regard to the product on offer, before they produce it. This, however, is not typical for the telecom

¹ Mid-end phones have added functionality besides voice and SMS such as MMS and games. High-end phones have even more functionality and hardware, such as cameras and mp3 players, added.

industry. The technical features in a mobile phone are not controlled by consumers. Instead the supply of technical features included in the platform is controlled by the services operators want to include in their offers, and the speed required in order to support these services. *The DoPS* compares this phenomenon to the Internet and illustrates his point with an example:

“When you are thinking about what you as an end-consumer want from the technological development of mobile phones, you are not thinking: I want HSPA-technology² in my phone. Maybe you do not even know what that is. It is similar to the development of the Internet. When computers had no graphical interface and connections were very slow, people did not say that they wanted to download movies.”(The DoPS)

The DoPS nevertheless emphasizes that EMP’s customers, on the other hand, need to listen to the end consumers, since their mobile phones must correspond to consumers’ demand regarding design and specific functions.

5.6.3 End Consumers

Most of the consumers’ preferences are more directly linked to the features added to the mobile phone by mobile phone manufactures, rather than those added by platform manufacturers. However, there are some technological matters affecting the performance of the platform, which are directly experienced by consumers and which therefore are considered important by them. One of them is size, according to Dagens Industri (2006-05-05). The popularity of 3G mobile phones has grown since their similarity to 2G (GSM) mobile phones in terms of size and design has increased. However *the DoPS* does not want to exaggerate the meaning of size:

“The way mobile phones look toda, there is not that much we, as a platform provider, can do about size as functional requirements and the requirements on peripherals match the decrease of the size of the chips. The outer design is hereby largely set by mobile manufactures. (...) But one important thing that affects end consumers, and which is dependent on the platform, is power consumption,” (The DoPS)

According to Ny teknik (2006-09-06) not only the technological matters should be of interest to EMP and Ericsson. It is stated in the article, that in order to survive it is important for Ericsson to get to know everyday people. Michael Treschow, chairman of the board of Ericsson agrees, by declaring that EMP together with Ericsson’s other business units needs to be more consumer minded (Ny Teknik, 2006-09-06). In addition *the DoPS* emphasizes the importance of understanding the end consumers; he says that Ericsson has a unit, Consumer Lab, whose only task is to map the

² High Speed Package Access is a collection of mobile telephony protocols that extend and improve the performance of existing protocols.

preferences of the consumers. Thanks to Consumer Labs' findings, EMP has been able to establish that the trend setters in the mobile phone market are women aged 25 to 35, living in big cities. Members of this consumer segment have just started to earn a good income and prefer services to be included in their mobile phone.

Another concern, indirectly affecting EMP, is the consumers' ability to pay for a mobile phone. In Southern Africa the users of mobile phones have increased rapidly in the last three years, and for next year forecasts predict that 25 percent of the population of Zambia will own their own mobile phone. The price for a mobile phone in Africa is 300 SEK, which is comparable to a monthly salary for an African family. Recently, Ericsson has begun to focus on the African market with the aim to expand the 3G-net, which will enable advanced services such as bank services to be carried out online over the 3G-net. (SVT, 2007-01-04)

Concerning consumer preferences *the VPoSS* states that EMP together with its customers historically has had great success with mobile phones including multimedia features such as music, videos and camera functions, and to some extent also smart phones³. But *the VPoSS* also emphasizes that EMP does not primarily focus on end consumers:

“We deliver a feature rich platform with great flexibility which is simple enough for our customers to use in any way they wish” (The VPoSS)

Even if EMP does not primarily focus on end consumers, Maria Corell, senior consultant and expert of telecom industry at Ernst and Young, claims that many of the features which seem to be important to platform manufactures such as MMS, video on demand and video conversation, are not considered valuable among end consumers (Johard, 2006). As was indicated by Vodafone's annual account, voice conversation is the most important income for operators, since less than five per cent of its turnover was generated by mobile data services. Even if the 3G net is available to 65 percent of the population in Europe, the amount of subscribers of 3G is less than ten percent (Ibid).

At EMP low-end markets are not considered attractive and *the VPoSS* believes that the company would have difficulties engaging in a market where success depends on offering the cheapest platform, since this would be incongruent with EMP's business concept.

Low-end or not, EMP is nevertheless looking for alternatives in order to offer 3G to a volume market. Presently EMP is developing a certain solution, which thus far seems promising. But *the DoPS* has some problems when categorising and clarifying the new 3G solution:

³ A Smartphone is a handheld combination of a pc and a telephone.

“It is definitely not an ultra-low-end⁴ solution and maybe not even low-end⁵ since it is a 3G solution. The consumer of this end- product is a person who neither wants video conversation nor turbo effects.” (The DoPS)

The DoPS describes the new solution to be a telephone with pure 3G, where the consumer will get a stylish mobile phone and a possibility to WAP fast with low power consumption. The operators’ gain from the new solution is the possibility to increase traffic on their net.

The market trend with regards to product portfolio and consumer demand, seems to be that performance has stagnated in terms of processing power. Now focus lies on making the platforms cheaper, less power consuming and smaller. But higher downloading speeds are still under development:

“It seems it can never get fast enough when wapping or downloading music or videos.” (The DoPS)

5.6.4 Non-Existing Markets

Like many large organisations, Ericsson conduct profound background research before considering entering non-existent markets. When other companies have created an emerging market, Ericsson enters the market itself or acquires another company existing on that market. The DoPS declares that it would be impossible to enter numerous of potential markets. Instead he argues it might be a better strategy to wait and see, at least from an economic point of view.

The DoPS continues his line of argument by stating that EMP does not look at markets being way off in terms of EMP’s business concept. As a mature company EMP has to be careful about where to invest:

“It takes 2000 man years to develop the platform, what if there is not an existing market; how will you get the money back?” (The DoPS)

The DoPS says that this line of argument is common among other companies as well, and lets an example illustrate how it works in the industry:

“In the beginning of 3G, Nokia only had a very limited share of the market. They were not very good at 3G and did not have video conversation. Nokia only had one 3G model, but the company knew that its brand was well-known and it knew how to distribute its products. Nokia entered the market later on and holds now as big a share of the market as they did before.” (The DoPS)

⁴ Solely voice and text message.

⁵ Meaning EDGE standard.

Even if EMP tends to have a cautious attitude towards non-existent markets, it works closely with other companies and research institutes to develop new technologies. EMP also listens very careful to the findings of, the earlier mentioned, Consumer Lab. When acquiring a company Ericsson tends to focus on small specialised companies. (*The DoPS*)

5.7 EMP's Resource Allocation Process

Despite the fact that EMP cooperates with Consumer Lab in order to obtain a better understanding of the end consumer, it is impossible to get reliable answers from consumers about their future mobile phone preferences. As *the DoPS* declares:

“EMP might be developing a technology four to five years before it is presented on the market and the consumers do not think about what they want to do with a technology thus far ahead. Present consumers do not think about what features the next generation, 4G, will entail. Similarly, consumers did not think ‘I want to see the person I talk to’ when EMP initially was developing video conversation.” (*The DoPS*)

Because of this, there is a risk that consumers will ignore a developed technology once it enters the market. This is what happened to WAP when it was first introduced in the beginning of the 21st century; hardly anyone used it. Hence, it is always a balance act for EMP to invest in the right project and to develop features which eventually will be appreciated by end consumers. (*The DoPS*)

5.7.1 Resource Allocation Criteria

The VPoSS considers it to be a complex situation when discussing what features to add to the platform - different aspects have to be taken into consideration. The first step is to develop features which are congruent with the demand of end consumers. When EMP has come to a conclusion as to what kind of features consumers presumably will prefer in three years, the next step is to develop a cost effective interpretation of that feature. Before EMP decides if a development proposal will receive any resources a business case is done, meaning that customer value and costs of implementation are taken into consideration. Some features are characterised as hygienic factors, which means that the product will be unworkable without these factors.

The VPoSS states that when deciding what technology to invest in, EMP's customers are of great importance. In addition, communication with the operators is significant, since they have a strong influence on the models which will be on supply in the stores. Consequently a bad business case is characterised by not including features demanded by the operators. If EMP does not pay attention to operators' demand, operators will not give priority to mobile phones including a platform from EMP.

Another player of importance regarding the resource allocation within EMP is the Ericsson-concern in large. Ericsson sells network systems, and by developing a technology supporting Ericsson's network in an early stage, EMP can contribute significantly to Ericsson's success. Sometimes that technology is incongruent with the demand of EMP's customers. From a short-term point of view *the VPoSS* considers it to be a suboptimum strategic choice, but in a long-term perspective there are clear advantages:

“From a short-term point of view it might be better to invest in features that consumers are aware of and require. But the demand of the market changes very quickly, which means that if EMP only had a short-term perspective we would not survive for long. Hence, the cooperation with Ericsson forces us to focus on the future, which will gain competitive advantages in a long-term perspective.” (The VPoSS)

To avoid the continuation of a development process which does not promise profits, all projects must go through toll gates, where every project needs to fulfil certain criteria before it obtains more resources. Hence, a project can be terminated at any point during the development process. *The DoPS* confirms that this works better today than it used to do. In the 1990's when the company was much less strictly controlled, the development process was much more random and it was easy to obtain resources for a project. Now, however, the approach is stricter and projects are terminated if they do not show positive results.

Furthermore, EMP manages dissimilar projects differently. Small projects, for example, which do not require large investments to be made, can be decided upon by managers at lower levels. The larger the necessary investments in order to pursue a project, the higher the decision making manager needs to be in the hierarchy. For investment decisions too large to be made by one manager, EMP's management group holds discussion meetings once a month. Urgent business matters can additionally be decided upon on a weekly basis. Hence, managers from different divisions come together, ensuring that all decisive decisions are aligned throughout the company.

5.8 Development Work and Employee Participation in the Process

Although EMP can be held to have a rather structured approach when dealing with developing projects, some features of the platform are developed more randomly than planned. SMS is such an example:

“To my knowledge no one actually invented SMS as a consumer application, but someone saw that the system was set up in a way that made it possible to send 160 signs between different base stations. After a while someone

suggested that the consumers might appreciate a service like SMS, which obviously has proven correct because SMS is a great success.” (The DoPS)

The SMS example shows that in this business new features can be a result of synergy effects or optimum use of resources, as well as a result of planning or pure accident. *The VPoSS* mentions that EMP’s engineers play an important role when it comes to inventing new features based on optimum use of resources or synergy effects. He also mentions the importance of competent product managers, who have a good relation with the operators and thereby good knowledge about consumer demand.

5.8.1 Development Focus

Earlier in this chapter it has been discussed that the operators’ closeness to end consumers makes them important when deciding whether to develop a certain feature or not. But in their search of earning greater profits, operators influence the development focus of EMP in other ways, too. EMP wants the operators to fill their net capacity because if they do, the operators will earn money enough to invest in more capacity, which favours Ericsson and in the long run EMP as well. (*The DoPS*)

It is the operators, rather than the consumers, that require as high a speed as possible, because speed is connected to more than downloading speed, namely to how many conversations a certain base can manage at the same time. Higher speed means more users at the same time, which is advantageous to operators. Comparing GSM and 3G, GSM needs more base stations than 3G. (*The DoPS*)

According to the earlier mentioned vision, and according to *the DoPS*, EMP’s key success factors are built on technical leadership, which means that EMP focuses on high-tech development rather than low-tech development. *The DoPS* also mentions that the vision is congruent with the amount of engineers in the organisation. He thinks it would be difficult to attract engineers to a low-end track. If EMP was to invest in a low-end platform, *the DoPS* believes, it would be necessary to separate the low-end part from the present business, since the low-end business would require a low-cost focus through the entire organisation.

5.9 Underlying Values Influencing the Developing Process

While EMP strives for technological leadership, *the VPoSS* also emphasizes the importance of cost effective solutions, a value which also permeates the organisation. He agrees that technological leadership and cost effectiveness can be in contrast to each other, but clever technical solutions can also reduce the costs, therefore they do not have to be contradictory.

“EMP is permeated by two extremes; on the one hand EMP is to be leading regarding the fastest 3G solution, on the other hand to be competitive the platform can not be too expensive.” (The VPoSS)

6 The Risk Analysis

In this chapter the empirical data is analysed by means of the risk assessment tool, which was presented in chapter 4. The analysis includes an estimation of which variables are critical with regard to the risk of a disruptive technology, and hence, of specific interest to EMP. The chapter ends with risk management measures which should be taken into consideration in order to avoid the emergence of a disruptive technology in the industry.

6.1 Risk Prioritisation

6.1.1 Business Specific Factors

Does a company which offers a potentially disruptive technology enjoy lasting advantages due to its early entrance on the emerging market, as opposed to later entrants, i.e. do first-mover-advantages (FMA) exist?

The platform industry is a very resource intensive business in which the development of products takes up to several years, and costs consequently are high. Therefore, a company which originally focused on being technology leader producing its products at relatively high costs will experience difficulties when forced to abandon years of development work in favour of a similar product, but at lower cost. Its organisational structure will need to be adjusted, as well as its supply chain. Therefore, an early entrance on an emerging market is advantageous since competitors, due to organisational inertia, will require time to adapt to the new conditions characterising the emerging market. This time can be used to refine the company's competences and its products, as well as building supplier networks and a strong customer base.

Furthermore, shifting focus from performance enhancement in existing products to developing products which must meet different demand may require specific competence. This competence could quite possibly be difficult to obtain in a timely manner. In a high pace industry, such as the platform industry, a company lagging behind competitors will have great difficulties catching up, unless enormous resources are spent in order to minimize this time.

Consequently there are strong indications of existing first-mover-advantages. However, these are not as strong with respect to the end consumer. Since brand recognition in terms of platform providers is low amongst end consumers, it is solely a matter of performance which platform mobile manufacturers will include in their mobile phones. This increases the chance of being able to catch up with competitors who earlier recognized the possibilities of the small emerging market.

To summarise, being an early entrant is advantageous in the platform industry.



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No FMA

Strong FMA

Are consumers' demand and priorities changing towards higher or lower product performance?

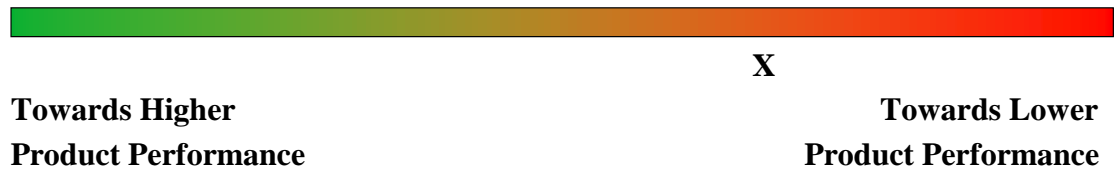
When it comes to 3G, the end consumer has not fully adopted all the services provided by the operators. For instance, only 5% of Vodafone's revenues come from other sources than voice and SMS. But the consumers' interest in 3G has grown in the last couple of years, partly due to the fact that the design and price of 3G phones are comparable to those of GSM phones. According to the empirical findings, technological aspects of importance to end consumers are size and power consumption, and although it cannot be considered a change in priorities, the consumers indirectly demand a higher product performance than previously available.

In order for mobile phone manufacturers to develop 3G phones with sizes and battery time comparable to those of GSM phones, great and costly efforts have been made by the platform producers to lower the power consumption and integrate increased functionality into the chipsets, in order to reduce the size. Even though end consumers might not fully use all services provided by the operators, their need and demand for smaller size and longer battery times have pushed the platform products to higher performance, rather than lower.

One critical matter for EMP concerning future strategies and changes in consumer demand is the African market, as was mentioned in the empirical findings. It seems evident that the 3G technology, which enables an internet connection by means of a mobile phone, would be highly valued by the African people. But on the other hand, the 3G platforms are too expensive to be available to the African market. If the forecasts about the African market are accurate, it can create an opening for a more cost effective and, hence, cheaper platform. However, there is an eminent risk that EMP's prognoses are built upon research focusing on high absorbing consumers who are willing to pay for high technological performance. Christensen discusses that disruptive technologies often emerge on small markets where consumers' demands differ from ordinary market demand. Likewise, we estimate that there is a risk that such an opening might occur on the African market in the future.

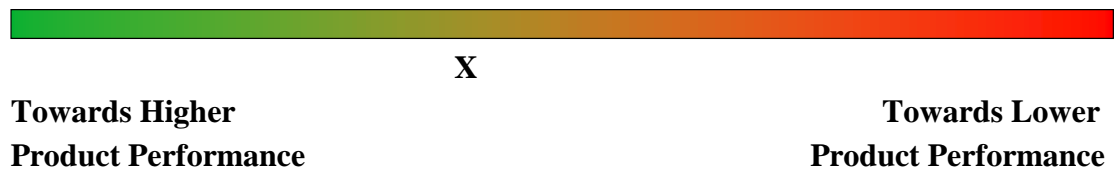
In sum, since the early adopters of the 3G technology, consumers' priorities have been refined, rather than changed, to smaller sizes and lower power consumption. Thus, platform and mobile phone manufacturers have been required to increase

product performance. But considering the African market, consumer demand will presumably change towards low-cost platforms in the future.



Have competitors' priorities changed over time regarding product performance, and if yes, towards higher product performance or towards lower product performance?

The technology has yet to reach maturity and up to this date most competitors have sought to get a fully functional platform or chipset out on the market. Their products must be exactly as advanced as EMP's or Qualcomm's, but to state that there are competitors which have changed their priorities towards lower technology is wrong. Qualcomm and Freescale are both very innovative companies and are together with EMP considered to be the technological leaders in this industry, and there is no proof indicating that the other players are moving in any other direction than the leaders.



Is the industry characterised by fierce competition?

There are not many competing companies present in the mobile platform industry. The 3G market is still fragmented compared to the GSM market where Nokia, Motorola, Samsung and Sony Ericsson together cover 4/5 of the volumes. Only a handful of companies have successfully released functional platforms on the mobile phone market. The largest companies are EMP, Qualcomm, Freescale and Nokia, but since Nokia only uses its platform in its own mobile phones and doesn't sell them to other phone manufacturers, they cannot be considered to compete on the same market. Other platform producers such as Broadcom, NXP, Infineon and Texas Instrument, have yet to prove themselves with a functioning advanced platform.

Although the market is not characterised by extreme price pressure the companies increasingly focus on cost efficient solutions. Thus, the competition is increasingly based on reducing costs although this has not become evident in lower prices or margins. The product offerings vary in terms of service and support, reference design etc. Therefore a comparison by price is neither easy nor relevant.

Given the facts above, the platform industry is not characterised by weak competition, and by no means are the positions at a steady state. Competition in order to get the top three mobile manufacturers, Nokia, Motorola and Samsung to use their platforms respective is fierce, since this is synonymous with large increases in sales volumes, and once a company has signed with one of the top three, the competition still persists since the playing field changes for every new product release.



Moderate Competition **X**
Fierce Competition

6.1.2 Company Specific Factors

6.1.2.1 Organisational Awareness

Is the company characterised by high or low responsiveness regarding the business specific factors mentioned above?

EMP clearly is aware of the advantages which can be derived from being the first to enter a given market. This becomes evident in the company's long-term planning and its heavy investments in R&D, which ideally should have been spread across all markets. However, since operating in the platform industry requires vast resources due to high development costs, entering every market is impossible. A selection of the most promising opportunities has to be made in favour of less certain ones.

Being forced to prioritise amongst new business opportunities naturally puts EMP in a precarious position. The risks involved in making the wrong development prioritisations, and the losses facing the company in such cases are very high. According to *the DoPS*, the damage can be reduced, however, since EMP has the possibility to acquire smaller competitors which, unlike EMP, did recognize the now promising business opportunity from the beginning. Therefore EMP does not experience the need to enter all emerging markets immediately. Rather the company acknowledges the advantages of adopting a wait-and-see-strategy. Having access to Ericsson's resource base heavily works in favour of EMP under these circumstances.

Consequently EMP appears to take the view that due to its strong financial position the company can afford to adopt a restrictive approach, thereby partly ignoring the first-mover-advantages which characterise the industry.

Although adopting a wait-and-see strategy may seem a rational choice to make considering EMP's strong position, it nevertheless involves certain risks with regards to the first-mover-advantages which are at stake. For example, the first competitor to enter the market may be one of the larger ones which eliminate the possibility to acquire the company.

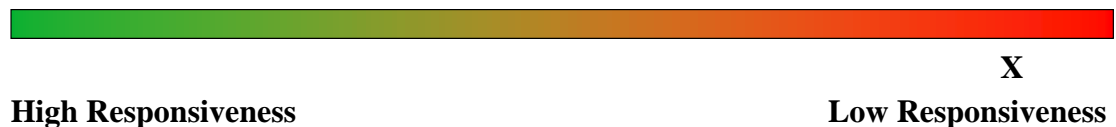
However, most of EMP's technologies and products have been developed in-house, and to our knowledge the company has never actually acquired any of their smaller competitors. Hence, EMP either is aware of the defects connected to the wait-and-see approach, or the company actually has made the right prioritisations and concentrated its efforts on the right markets most of the times. A third possibility could be, however, that EMP does not actually consider the first-mover-advantages to be of such great importance that entering numerous markets is justified. This argument is strengthened by the somewhat arrogant approach which characterises EMP's approach towards acquiring smaller competitors.

Changes in end consumers' preferences and priorities do not immediately affect platform providers in their product development work. The lead times for a new platform, i.e. the time between the development of the platform and its appearance on the market as part of an actual mobile phone, can amount to several years. Therefore, it is very difficult for EMP to quickly respond to sudden changes in consumer priorities. Furthermore, EMP more directly collaborates with its customers, namely the manufacturers of mobile phones, as well as its customer's customers, i.e. the operators. EMP can even be considered to be highly dependent on manufacturers and operators, since it is in their power whether or not the platforms will reach the end consumer. Hence, EMP's first priority is to satisfy their needs in terms of product performance and technical requirements, which is why, as was stated by *the DoPS*, EMP does not consider itself to be primarily consumer driven.

Although EMP's business is not directly consumer driven, it can to some extent be assumed that the manufacturers and operators bear the consumers' interest in mind when ordering features and services to be added to the platform by EMP. However, other influences than consumer preferences are directing EMP's customers in their demand. Operators for example request higher data speed in order to enable more advanced features to be added to their services. While this will increase the operator's income per user, it does not correspond to consumers' preferences. Listening only to its customers, therefore, can mislead EMP into directing its efforts towards the development of products which will not be valued by end consumers. Consequently, end consumers will not be prepared to pay for them either, which in the long run puts EMP's position at risk.

Consumer Lab, whose purpose is to increase EMP's understanding of end consumers' preferences can make no precise predictions as to which services and new features consumers will use in three years. It can, however, based on its conducted market research clarify into which direction consumers' preferences are moving, what type of functions and services they use today and which they might use in the future. According to *the DoPS*, it is for example believed that consumers will use the mobile phone in the same way they currently use the computer when it comes to connectivity and file sharing. Those are the kinds of reports which EMP can react to, and which enable it to respond to changes in consumer trends. The reports' accuracy can by no means, though, be taken for granted and certain risks are tied to their adoption. Consequently there have been cases when technologies which were believed to become the next big thing on the consumer market did not receive the expected positive response, e.g. WAP.

According to the above reasoning, EMP is very well aware of the business specific factors characterising the platform industry. However, the company is found to act on its knowledge only to a small degree. Consumer preferences are indirectly partly ignored in favour of customers' priorities and the existing first-mover-advantages do not direct EMP in its priorities.



6.1.2.2 Market Approach

Does the resource allocation process favour technologically advanced high-cost products and continued performance enhancement, or less advanced low-cost products?

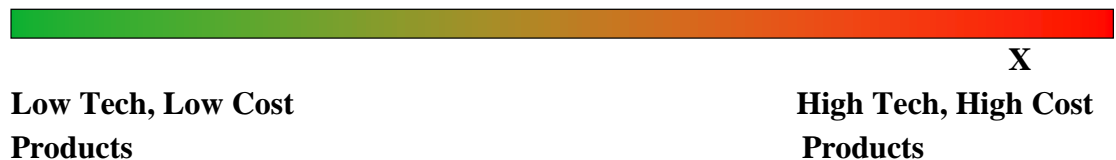
According to Ericsson's vision, which also permeates EMP's organisation, the company strives for technology leadership in its industry. It even considers its position as technological leader to be one of the company's key success factors. Therefore, resources naturally are allocated towards projects which will secure this position on the market. One sign of resources being allocated towards advanced projects is the large number of engineers working at EMP.

The products consequently are aimed to satisfy mid-to-high-end consumer segments, which are prepared to pay higher prices in return for technologically advanced, high-quality solutions. While the engineers put a lot of effort into developing these products, they are not allowed to solely focus on product performance. *The VPoSS*

also emphasizes the importance of cost effective solutions in order to be competitive. However, the strong impression is given that employees are offered resources relatively readily in order to enhance product performance. EMP, thus, by no means can be considered to support low-cost, low-end solutions and mid-to-high-end consumer segments are the only markets considered attractive when engaging in new business opportunities. Volume markets may, however, be attractive as EMP's current development of a new 3G solution aimed at a volume market shows. Nevertheless, they are only of value to the company as long as they are not part of the low-end segment, which primarily values cheap solutions over technological performance.

When decisions regarding product development are to be made, EMP is most strongly influenced by their current customers, i.e. manufacturers of mobile phones and operators. They engage in a close collaboration which primarily aims at increasing the performance of existing products. Additionally predictions about future preferences of EMP's existing end consumer are taken into consideration. Assessments about total demand constitute a business case which forms the basis from which a decision is derived. Hence, EMP's resource allocation process is primarily influenced by current customers and consumers, favouring increases in existing product performances.

The conclusion derived from the above reasoning, is that the resource allocation process primarily favours high-tech, high-cost solutions.



Where does the company's attention level reside in terms of small and non-existing markets?

Being a large organisation, EMP hesitates to enter non-existing markets. The risks connected with such a venture are considered too high. Thus, EMP rather lets other companies explore the market possibilities before entering the market itself. The company relies on its strong brand and its resources in general to enable it to catch up with competitors who dared an earlier entrance.

An important prerequisite for its entrance on a new market is, however, that the business opportunity is in accordance with EMP's general business concept. Within its business concept, EMP works closely with other companies and research

institutes in order to detect yet non-existing but possibly emerging markets – despite its cautious attitude. Consumer Lab also offers valuable findings with regards to which markets will emerge in the future. Those identified markets are, if proven promising, supported by Ericsson which has a unit specializing in new business opportunities.

EMP cannot be argued to ignore small and non-existing markets in general. The company obviously has several information channels which enable it to detect new opportunities and developments in the industry. However, the prerequisites which are applied to rank the small and non-existent markets respectively result in the ignorance of certain markets. Hence, the general attention-level which is given to small and non-existent markets is lowered somewhat.



X

**High Attention Towards
Small Markets**

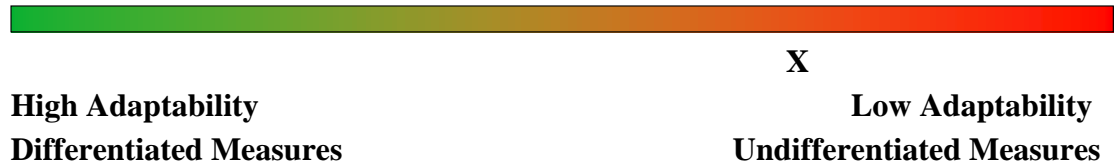
**Low Attention Towards
Small Markets**

Does the company adapt to different market requirements by applying different measures for existing versus small and non-existing markets?

When evaluating a business opportunity, EMP initially applies qualitative measures. Synergies for example, which can be generated amongst business units due to the new business, are considered important. Furthermore, the business opportunity needs to match Ericsson's requirements with regard to upholding the end-to-end solution concept. The evaluation by means of qualitative measures is then followed by the application of quantitative measures. Based on its performance by quantitative means, the business opportunity is presented to decision makers on higher levels. Hence, in practice the decision to pursue a business opportunity appears to a very large extent to be dependant on its quantitative performance.

Yet small or even non-existent markets are difficult to evaluate correctly in terms of quantitative variables, however, since these are very uncertain and cannot be assessed. This implies that evaluations of small and non-existent markets will not be able to convince managers at EMP of their profitability. The evaluation system used to determine whether a business opportunity is lucrative will, thus, discriminate opportunities in such markets. This discrimination is further strengthened by the uniformity by which the measures are applied, meaning that the quantitative requirements are the same irrespective of market type.

The fact that EMP, as it has grown larger, has not increased its requirements for lucrative business opportunities works, however, in favour of small and non-existent markets. Therefore, its evaluation system is regarded to be moderately more adaptable than was initially expected.



6.1.2.3 Organisational Capabilities

Is the company characterised by a high level of resource capability which enables it to detect and react to the occurrence of a disruptive technology, or, a low level, meaning that it would be difficult for the company to discover and react to an upcoming disruptive technology?

The empirical data shows that EMP was legitimated by Ericsson to generate high costs from the very first beginning. Since the resource intensity related to the platform business is very high, investments amounting to several billions of SEK were required until EMP could show a positive result. Even if the revenues did not cover its costs, EMP still had support from the parent company to invest in different development projects, due to Ericsson's dependency on EMP's platforms. But even if EMP has strong financial support by being a part of Ericsson, one can also look at it from another perspective. Because on the other hand Ericsson is dependent on EMP since Ericsson needs platforms in congruence with their base station's technology to be developed. One prerequisite for Ericsson to sell its base stations is that mobile phones supporting the technology of the base stations are available on the market. By letting EMP's platforms complement Ericsson's base stations it is assured that these conditions are met. EMP thus enjoys great financial strength through Ericsson, which enables it to invest when the need or the opportunity arises. Therefore it can reasonably be claimed that EMP has the financial resources and the ability to invest in both non-existing and small markets.

Combined with the network solution provided by Ericsson, EMP is one of few to offer their customers complete end-to-end solutions for all major mobile communication standards. Consequently, EMP has easy access to information regarding the changes taking place throughout the value chain. For example EMP can, due to its connection to Ericsson, easily achieve knowledge about occurring changes with regards to the necessary technology which is needed to support the base stations and network solutions. Since Ericsson, by means of its base stations and

network solutions, indirectly determines what end consumers will demand in the future this ought to be very valuable for EMP. The company can adjust its development work to that of Ericsson, thereby ensuring the timely launch of a supporting platform.

Another advantageous resource which is derived from EMP's connection with Ericsson is its close relationship with Sony Ericsson. While *the VPoSS* emphasizes the equal importance of all customers, it cannot be denied that Sony Ericsson presumably enjoys a unique position within EMP. Partly belonging to the same concern indicates in our opinion that the communication process between the business partners is fairly deep as well as frequent. Furthermore it signifies that information about changes in consumer demand and such are thus shared on a regular basis. The collaboration with Consumer Lab, whose task is to map consumer preferences, further adds to EMP's knowledge about end consumers. It additionally facilitates forecasts about changes in market demand. Thereby EMP's capability to detect and respond to sudden market changes rather quickly is increased considerably.

The brand of the platform cannot be considered to be of value to the end consumer since it is hidden in the mobile phone, and hence, does not receive any attention. It is an important resource when considering EMP's customers, however. A strong brand might indicate that customers are less likely to trade platform suppliers as a disruptive technology emerges. Therefore, EMP enjoys the advantages derived from Ericsson's brand which indicates quality and security for the future. Customers can be certain that EMP's platforms are congruent with the technology used in Ericsson's base stations and that they have been thoroughly tested. Sony Ericsson by association is included in Ericsson's and hence EMP's brand. Other customers presumably are affected by Sony Ericsson's apparent satisfaction with regards to EMP's products and are therefore more likely to stick with the company.

To summarize we claim that EMP has by being part of an end-to-end solution sufficient intangible recourses to discover changes in market demand and adequate financial recourses to react if a disruptive technology is about to occur in the business. The Ericsson concerns' distinguished name is a valuable recourse and might stop customer to choose another, disruptive platform, instead of EMP's.



X

High Resource Capability

Low Resource Capability

Are the company's processes adapted to react if a disruptive technology occurs in the business?

As mentioned in the empirical data all development projects have to go through different toll gates, i.e. they have to pass certain stages before they are allowed to continue to the next level and projects showing insufficient signs of profitability is immediately terminated. At first glance this implies that the resource allocation process is characterised by high flexibility. The immediate termination of one project in favour of another, more promising project, indicates that the organisational processes can easily be adjusted and rapidly shifted into new directions. It also indicates, however, that projects aimed at pursuing opportunities in small emerging markets, where profit margins may be significantly lower, are terminated prematurely. Hence, reacting to the emergence of a disruptive technology, which typically occurs in initially unattractive market environments, is complicated by the toll gate system. Despite the fact that EMP's decision process can be seen as rather flexible, it is not likely that EMP will be able to respond quickly to such an emergence. When examined from this angle, the resource allocation process appears to be rather inflexible.

The inflexibility of the toll gate system with regards to projects aimed at reacting to the emergence of a disruptive technology is partly compensated by the authority of managers at different levels to grant resources. As mentioned in the empirical findings, decisions are made on different levels in the hierarchy dependent on the size of monetary recourses needed for the project and urgent business matters can additionally be decided upon on a weekly basis instead of the regular monthly basis. Hence, managers from different divisions come together, ensuring that all decisive decisions are aligned throughout the company. The division of resource allocation authority between different managers furthermore shortens the communication process and enables decisions to be made close to the employees. The flexibility of the decision making process is thus enhanced, and the lead time from proposal to project start is reduced. Thereby a rapid reaction to the emergence of a disruptive technology appears to be enabled. It is, however, unlikely that managers will allocate resources to projects which would not be qualified when measured by means of the toll gate system. This argument is strengthened by the increasingly restrictive approach towards the allocation of resources which has been applied since Ericsson's crisis in the late 1990's. Rising above company standards and giving their consent to ill-qualified projects measured by those standards, consequently puts them in a precarious position. Hence, while rapid decisions and consequently rapid reactions are enabled, it is less certain if EMP's processes would actually permit resources to be allocated towards projects aiming at defending EMP against the emergence of a disruptive technology.

Should the resource allocation and decision making processes, nevertheless, permit a reaction to the disruptive technology, EMP's freedom to act might be limited by its close relation to Ericsson. If developing a platform similar to the disruptive technology is in contradiction to Ericsson's future business plans, EMP will have great difficulties justifying its choice. A shift in focus from high-tech platforms to cheaper low-tech solutions would require enormous amounts of monetary resources. Ericsson's support, therefore, would be crucial.

EMP's ability to enter the emerging market would furthermore be reduced by its organisational structure and its additional processes. Presently EMP's key success factors are built upon the principle of technological leadership. While for example the importance of cost efficient solutions is emphasized, vast resources are invested in employing qualified engineers who are motivated by the development of advanced platforms. With a sudden shift towards low-cost solutions EMP would find it difficult to attract such personnel. Furthermore it would require an organisational restructuring where the low-cost focus permeates the company from the bottom. At present the organisation by no means is able to produce low-end solutions, as is recognized by *the DoPS*.

Initially we considered EMP to be characterised by rather high flexibility, since the company has tried to find different solutions to make its processes more flexible. But we do not estimate the processes to be adapted to react in a way that will help EMP to take action if a disruptive technology emerges in the industry.



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High Process Adaptability

Low Process Adaptability

Do the company's and its employees' priorities work in favour of existing markets and technologies or new yet non-existent markets and technologies?

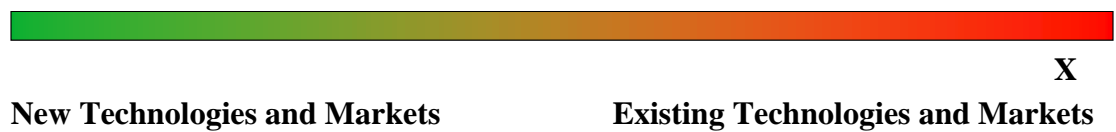
EMP's vision clearly emphasises the importance of technological leadership by means of cost efficient solutions. This indicates that while development costs need to be kept reasonably low, primary focus lies on developing intelligent technological solutions. The vision thus implies that EMP considers the performance enhancement of existing products to be more important than developing a simpler platform lacking advanced technological features, but at minimum cost.

Neither small, nor low end markets are considered attractive by EMP. Empirical findings show that the company does have the possibility to reduce certain functions and features, thereby creating a simpler and smaller platform for low-end purposes.

Nevertheless, the mid-high-end consumer segment is considered much more attractive and has therefore been receiving all of the company's attention. Proposals to shift this attention towards technologically less advanced products, is met by negative response.

Employees' daily decisions need to comply with EMP's values which clearly favour high-tech solutions over simpler ones and high-end markets over low-end segments. Their ability and willingness to detect and react to yet non-existent markets which are incongruent with these values, therefore presumably is very low.

We consider EMP's vision to prove that the priorities of the company and its employees are directed towards the development of existing markets and technologies.



6.1.3 Product Customisation Ability

Does the company offer customised products, thereby fulfilling both low-end and high-end segments' needs?

Thus far, the development of the platform has been characterised by the constant integration of components in order to fit in an increasing number of features while reducing power consumption and size. EMP thereby has been able to continuously enhance the performance of the platform. *The DoPS* further claims that the higher degree of component integration has lowered the cost of the platform. This line of reasoning, however, appears to derive from the assumption that the highest possible number of features ought to be added to the platform in order to drive technological development. Hence, the costs in relation to the number of features are decreasing as these are added to the platform. This argument is strengthened by the existing possibility to produce platforms aimed at low-end segments. The reduction of certain functions and features would result in a smaller platform, which in turn would reduce the costs connected to the lower amount of silicon being used. EMP, thus, has the opportunity to customise its platform further, thereby satisfying additional consumer segments. If a disruptive technology, i.e. a cheaper, simpler product was to emerge in these markets, EMP theoretically would have the ability to respond accordingly.

Offering an increasingly customised platform is not a matter of increased modularity, however. While it would be possible to modularize the platform design further, this would not be in favour of a low-cost solution. On the contrary, increased modularity

parallels with an increase in size and consequently cost. Therefore, the development of a low-cost solution would require an integrated product design, as does the mid-high-end solution. This option is, however, dismissed by *the DoPS*, who claims that EMP can be competitive only in the mid-high-end segments. A low-end product would demand a different logic of doing business and a strict low-cost focus throughout the entire organisation, he argues.

Despite EMP's theoretical capability to produce simpler and cheaper platforms, management attitude and organisational aspects are not working in favour of such a solution. It seems the urge for technological development and leadership is stronger than the experienced need to supply low-end segments with simpler products. Therefore, EMP's ability to customise its platform further by means of adjusting its architecture appears very limited. An increase in customisation could, nevertheless, be accomplished by means of limitations with regard to added services, such as customer support, training, and assistance with application development tools as well as the provision of a reference design. While this would decrease the cost of the platform provided by EMP, mobile phone manufacturers presumably would experience an increase in costs, since they would have to perform the mentioned services themselves. Hence, the price of the mobile phone, and indirectly the platform, paid by the end consumer would consequently be equally high, if not higher. The possibility to customise the product by decreasing the number of services for the purpose of offering a cheaper, simpler product therefore appears to be irrelevant.

The product is customisable to a higher degree than is currently made use of. Organisational limits prevent EMP from offering customised solutions in the meaning of low-end as well as high-end products.



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Customised Product Offerings

Un-Customised Product Offerings

6.1.4 Value migration

Based on the comparison of the company with the criteria given below, in which phase does the company reside; inflow, stability or outflow?

EMP's goal to increase its work force with nearly 30 per cent in order to meet higher demand of its products indicates that EMP might be in the inflow phase. In 2004, 30 per cent of all WCDMA phones sold were based on EMP's platforms and the company has kept its position since, with only smaller variations of market share.

- The values guiding the company and its employees are working in favour of existing technologies and markets.
- EMP only offers advanced platforms aimed at mid-high-end markets and does not fully make use of the product's customisability.

EMP's primary problem, which becomes evident in every identified risk factor, is Ericsson's vision to lead the technological race in the industry. Ericsson's pursuit of the technological leader position blinds EMP with respect to presumably less profitable markets and consumers, and indicates certain ignorance. Hence, the risk of a disruptive technology's emergence is obvious in this respect. Therefore, it might be advantageous if EMP was to adopt a vision which would take these factors into consideration. A vision which to a larger extent emphasizes market leadership, rather than technological leadership, would draw focus away from the product and be more flexible with regards to fluctuations on the market.

Maybe a modified vision, which to an even larger extent emphasizes the need for cost efficient solutions, would make EMP more sensitive with regards to low-end market trends. For example, the emerging and very lucrative African market should trigger EMP to develop a cost efficient platform aimed at the low-end segment.

According to Christensen (e.g. 2003), however, firms which are able to respond to the emergence of a disruptive technology, are only those who can either build a separate organisation which better matches the size and conditions of the targeted market, or acquire an organisation which meets these requirements. Hence, it is suggested that EMP should free resources and build a separate business unit, which to a larger extent considers the first-mover-advantages and the changes in consumer preferences.

A separate organisation dealing with low-cost, low-tech solutions would furthermore solve the problems related to the company specific processes. Processes, by definition, are hard to change (Christensen, 2000). While this is true for small organisations as well, a small organisation with corresponding processes could more easily respond to the opportunities for growth in small markets. They would, thus, facilitate EMP's effective response should a disruptive technology occur. With regards to the resource allocation of the firm, a separate organisation could apply more flexible measures, thereby enabling a separate evaluation of each business opportunity, while taking into account the market specific conditions. For emerging markets with extremely high potential future earnings, adequate measures could for example be of more qualitative character requiring none or low ROI⁶. This would consequently have a positive impact on the values which guide employees in their prioritisations.

⁶ Return on Investment

EMP's lack of product customisation is mainly due to the difficulties of developing both low-cost and high-cost solutions within the same organisation. The high requirements with regard to product integration demand a separate organisational structure. Hence, separating the low-cost development from EMP's ordinary business would enable a wider range of product offerings. All consumer segments could thus be satisfied which would leave less market space for a disruptive technology to occur.

The other possibility proposed by Christensen, is to acquire competitors who are better suited to meet smaller markets' demand. Many of the advantages which are derived from this approach are congruent with those derived from building a separate organisation.

Building a new organisation or acquiring another company in order to defend the business against possible disruptive technologies has some drawbacks, however. Firstly, it requires vast amounts of resources, and complications are to be expected. Especially, since it is crucial that both organisations and their businesses are kept strictly apart while supplementing each other. Secondly, as Christensen himself points out, every organisation will eventually have grown larger and the disruptive technology will eventually become a sustaining technology. Continuous product performance will lead back to the former starting point. Hence, establishing a separate organisation or acquiring one, will not offer enough protection against the threat posed by disruptive technologies. Since the technological progress is constantly increasing, the concept needs to be implemented on a more regular basis. Consequently, routines have to be developed for the purpose of facilitating the process and reducing the costs involved.

7 Conclusions

In this chapter the most important findings from our study are presented, and the research purpose is answered. Furthermore the authors discuss their findings and lastly, some proposals for future research are given.

7.1 Research Results

The purpose of this study was to assess the risk EMP is facing with regards to a possible future emergence of a less advanced platform technology. In order to do this a risk assessment tool was developed and applied on EMP.

The emergence of a less advanced platform technology has been investigated by means of the theory about disruptive technologies. A disruptive technology is characterised by both unpredictability and unexpectedness, hence the only way to protect oneself against it is for the company to be prepared, thereby reducing the risk of being displaced by a disruptive technology. Since no general model enabling an estimation of the risk of a disruptive technology's emergence existed, one part of this study was to develop such a risk assessment tool.

When applied on the case of EMP, the risk assessment tool generated the following results with regard to the critical variables currently posing decisive disruption risks:

- EMP is characterised by fairly low responsiveness with regard to the industry specific factors.
- The resource allocation process heavily favours high-tech, high-cost solutions.
- EMP's business evaluation system favours existing markets over small, or yet non-existent, markets.
- The company's processes are not flexible enough to react if a disruptive technology should emerge in the industry.
- The values guiding the company and its employees are working in favour of existing technologies and markets.
- EMP only offers advanced platforms aimed at mid-high-end markets and does not fully make use of the product's customisability.

These variables need to be addressed in order to decrease the risk of a disruptive technology emergence. While it was not this study's purpose to develop a risk management plan, we have, nonetheless, been able to identify some measures which can be taken in order to decrease the assessed risk with regard to the above mentioned variables.

Our main suggestions regarding risk management measures are the following:

- EMP should adjust its vision to include an increased low-tech focus.
- EMP needs to establish a separate organisation aimed at low-cost, low-tech market segments.

7.2 Result Discussion

Our contribution to the field of business research lies, as was accounted for previously, in the extension of Christensen's theory regarding disruptive technologies. The development of a risk assessment tool based on Christensen's findings adds to the theory's predictive value, and increases a company's possibilities to protect itself from being disrupted.

The risk assessment tool will not enable risk elimination, however, since a disruptive technology emerges suddenly and without prior warning. Rather, the developed tool offers means by which a company can continuously evaluate its actions, thereby allowing a decisively increased responsiveness to changes in market trends and, by extension, to the emergence of a disruptive technology.

While we acknowledge the value of Christensen's theory, as well as the potential value of the risk assessment tool which was derived from his findings, we also recognize their shortcomings.

Firstly, the risk assessment tool only focuses on one risk variable, namely the possible emergence of a disruptive technology. In order to be truly valuable to a company, it needs to be compatible with the overall risk management portfolio of the firm, which additionally focuses on other relevant variables.

Secondly, the findings which were derived in the course of this study indicate that EMP, among other things, needs to change its organisational structure and its strategies in order to avoid a possible disruption. Seen from another perspective, though, these recommendations could instead be harming the business, for example due to their lacking congruence with EMP's overall strategy. Therefore, the findings, which are derived from the application of this risk assessment tool to company specific cases, need to be weighed against other relevant business factors. The choice of action will then be a trade off based on comparing the cost/likelihood of insurance with the cost/likelihood of risk.

Thirdly, in our opinion Christensen's theory still lacks reasonable risk management proposals. His recommendations therefore need to undergo further investigation in order to become more refined and to prove their applicability.

7.3 Proposals for Future Research

The external validity of our research findings suffers, thus far, from limitations. The risk assessment tool needs to be replicated and tested in terms of applicability to other industries and companies in order to legitimise generalisations. Furthermore,

refinements may be required in order to ensure its universal applicability. Therefore, it is suggested that further research be conducted in this research field.

A re-examination of EMP and the platform industry in some years time, in which comparisons are made between this study's risk assessments and actual developments, would also generate valuable findings as to the practical qualities of the risk assessment tool.

Furthermore the risk assessment tool needs to be supplemented with risk management advice generated for this particular field of interest. Therefore, further research with regards to risk management in relation with disruptive technologies is requested.

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Appendix

Interview 1

Marknad/Kunder/Slutkonsumenter:

Vilka är de viktigaste kunderna för företaget?

Vilka segment satsar man på?

Vilka kunder rättar man sig efter?

Lyssnar man bara på existerande kunder eller tas även hänsyn till icke-kunder?

Hur ser ni idag på dem som inte är era kunder?

Är det alltid viktigt att lyssna på kunden?

Finns det situationer då man inte lyssnar på kundernas krav?

Vem förutom kunderna lyssnar man på / styr utvecklingen?

Resursallokering:

Investerar man idag i low-end kundsegment?

Vilken makt har kunderna vid investeringsbedömning? Dvs. i hur stor utsträckning styr kundernas efterfrågan resursallokeringen?

Satsar man på utbrytaridéer? Dvs. satsar man resurser på högriskprojekt med osäker framtidspotential?

Organisation:

Vilka för- & nackdelar har EMP av att ingå i en stor koncern; indirekt SonyEricsson?

T ex vad gäller avkastningskrav,

När investering görs, hur stora avkastningskrav har man?

Är avkastningskraven stela eller flexibla?

Vem beslutar om utvecklingssatsningar?

Vem vänder man sig till då man ansöker om resurser till en idé? Finns det flera kanaler att vända sig till?

Är den stora andelen ingenjörer en möjlighet eller ett hinder för företaget? De har andra intressen än marknaden kanske har...

Är first-mover-advantage viktigt i branschen?

Produkten/Teknologin:

Produktens förbättrings-/utvecklingspotential – kan den bli jättemycket bättre?

Hade en modulär design varit tekniskt möjlig idag eller inte?

Om det idag hade funnits en extremt low-cost plattform som når en volymmarknad, vad hade skiljt den produkten från det som finns idag?

Konkurrenter:

Antal aktörer på marknaden; största konkurrenterna osv.

Jämför sig EMP med sina konkurrenter eller kör man på en egen linje?

Hur viktigt är det vad konkurrenterna gör?

Styr något enskilt företag i större utsträckning än de andra utvecklingen på marknaden?

Värdekedja:

Vad kommer hända inom värdekedjan de närmsta åren? Var kommer värdet genereras i huvudsak?

Skiljer sig framtidens konkurrenter från de som man har nu?

Hur skulle en extrem volymmarknad förändra värdekedjan?

Interview 2

Resursallokering

Efter vilka principer allokeras resurserna?

Vem styr investeringsbeslut? Ekonomer, Ingenjörer, kunder?

I hur stor utsträckning styr kundernas efterfrågan resursallokeringen?

Vilka bedömningskriterier/avkastningskrav används då investeringar bedöms?

Visioner/Värderingar

EMP's framtidsvision?

Finns det några uttalade värderingar i företaget som man vill ska vägleda de anställda i deras dagliga arbete?

Kunder/Marknader

Hur ser EMP på icke-kunder? Tillgodoses de?

Vilka kundsegment är viktigast för EMP?

Value Migration

Är EMP's affärsmodell tillräckligt flexibel för att kunna svara på förändringar i värdekedjan?

Var tror man att störst värde genereras i framtiden?

Hur bedömer du att marknaden kommer utvecklas de närmsta åren?

Hot, möjligheter

Konkurrenssituation

Teknologi

Kundpreferenser

Vad måste EMP göra för att behålla sin framgångsrika position?