# How to make decisions on software based service development in the handset industry

The Rapid Model for Holistic Application Evaluation

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Master Thesis, Technology Management - Nr 168/2008
ISSN 1651-0100
ISRN LUTVDG/TVTM--08/5168--/SE

KFS i Lund AB
Lund 2008
Printed in Sweden

# Summary

**Title:** How to make decisions on software based service development in the mobile handset industry.
–The Rapid Model for Holistic Application Evaluation

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**Problem formulation:** Academically the questions of finding out what constitutes a sound decision base and finding out how to handle the issue of a holistic approach must be addressed in order to make a well balanced and relevant decision model. The core question is which decision criteria to include and which drivers are important in estimating the status of the criteria? Practically to provide Sony Ericsson with a formalized evaluation process for decisions on software development that is transparent, objective and challengeable.

**Purpose:** Academically to contribute to the field of decision making research by elaborating on how to make a holistic, rapid and rational decision model. Primarily for software development in the handset industry but also valid to other related industries. The framework needs to support the decision makers and should also make the reasoning behind the decisions more transparent. Practically an adaption of the model for use at Sony Ericsson and evaluate its usefulness to the organization.

**Method:** Parallel case and literature study to establish the most relevant estimation criteria. Development of well defined drivers of the criteria followed by a two stage evaluation: qualitative interviews and a case evaluation.

**Conclusions:** The contribution to the fields of decision making and estimation primarily lies in the general approach which has showed a method of building decision models from a holistic view point. Essential criteria and underlying drivers enabling faster and more informed decisions have been determined and

the aim of making a normative model is fulfilled by the synthesis of current practise and theoretical input. The Rapid Model for Holistic Application Evaluation (RaMHAE) fulfills its basic purpose by functioning as a ground for decision making by incorporating the existing organizational know-how.

**Key words:** Decision model, handset industry, software development, software based service, Rapid Model for Holistic Application Evaluation, RaMHAE

# Preface

Initially we would like to thank our tutors at Sony Ericsson, Mats Lindoff and Anders Östsjö and the rest of the Chief Technology Office for enabling us to write this master thesis. We would also like to extend our gratitude to our tutors at Lund University Dr. Robert Wenglén and Prof. Björn Regnell for their assistance and valuable input.

Furthermore we would like acknowledge the crucial help that other employees at Sony Ericsson provided by letting us interview them on their current work practises and earlier development projects. Ericsson Consumer Labs also made a valuable contribution by giving an informative presentation of their marketing research and supplying market research reports.

Finally we want to thank our opponents Jenny K Andersson and Therese Wemnér and our examiner Carl-Henric Nilsson for their work.

Lund 08-05-09

Per-Inge Andersson
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# 1 Background

Companies in most industries and markets face the need for continuous innovation to stay competitive (Boone, 2000). As the competitive pressure increases and the life cycle of the product gets shorter companies need to make decisions based on insufficient knowledge of technological, market and strategic factors. Since the decisions on development must be made ahead of the actual development the decision makers are faced with uncertainty and need a way to make informed decisions (March, Simon & Guetzkow, 1958). This is valid in most industries, especially in industries like the software & fast moving consumer electronics industries with their short product life cycles.

During the latest decades tremendous progress has been made in the field of software based services as well as the platforms that run the services. Therefore the research regarding both the development methods (Goldenson & Gibson, 2003) and how to estimate resource consumption (Agrawal & Chari, 2005) has advanced a lot. New consumer needs, new cost structures and distribution channels (Accenture, 2005) has also made an impact on the research on management of software intensive companies and new business models for these businesses. All this has been driven by an extraordinarily rapid technological evolution of both hardware and software continuously pushing the boundary of the economically feasible (Bell, 2008).

One field where the technological innovations have made great strides lately is the mobile handset industry. The innovations and developments of the handsets have been accompanied by corresponding development of software to support new features and services. Our particular interest is to find out how to make decisions on development of these services under such circumstances.

## 1.1 Practical problem

Trends in the usage of handsets has changed rapidly over time, from being merely used as a voice communication device to becoming a converged device used for a host of local and networked services. The expectations on handsets and adoption rate of new areas of use are of fundamental importance in the decision making on development of new services. The geographical proliferation of mobile handsets also puts new requirements on the services offered as lower income countries are much more price sensitive.

The mobile handset industry has produced numerous services in the form of pre-installed and downloadable software, although very few have been highly successful. In a strict sense only two network dependent services (one that uses the cellular network to communicate with either another cell phone or a server) have become non-negotiable: SMS and voice calls. A few other services based on integrated non-communication functions have also became widely successful such as MP3-playback

and digital picturing functionality, however this thesis will be focused on the network-dependent services. The most important questions being: what makes a service successful and how it can be predicted?

The dilemma is that there are seldom, or even never, enough resources to pursuit every potentially beneficial idea due to financial and personnel constraints. At the same time there is a risk of being left behind in the development of the next mainstream service. Businesses need to balance the risk of committing resources to development of a service which future usefulness are unknown and the risk of missing out on important technologies. The industry players must continuously ask themselves if we are supposed to work with this. Or more correctly they must ask themselves if they should commit additional resources to find out if the project in question will take off. (Bengtsson, interview 2008-02-11)

The high pace of development and the sheer volume of suggested projects put pressure on the industry players to develop fast and uncomplicated processes when determining which projects to invest in and which to discard. As the industry increasingly depends on replacement purchases a shortened life span of the devices is critical for growth. Therefore it is highly important to investigate how to make these decisions in a quick but yet thorough way as the stakes and cost of failing increases as the pace of the industry increases (Accenture, 2006). The number of companies that has withdrawn from the cell phone manufacturing business or generated large losses forcing restructuring (such as Ericsson, Siemens and lately Motorola) shows that not delivering the experience the customers expect quickly can become fatal even for the biggest players in the industry. On the other hand the recent success of Apple shows that the opposite also is true, what is important is that the main differentiating factor is not the hardware often regarded as “check box features” that any manufacturer can acquire relatively fast, it is the software (Gonsalves, 2007).

Currently the decision making at Sony Ericsson are based on experience and a sense for the industry something described as *gut feeling*, in order to give the best advice on how to work in the future the deliberations hidden behind the *gut feeling* has to be made explicit and integrated in the new decision making practise (Lindoff, meeting 2008-01-10).

## 1.2 Theoretical Problem

In order to be able to make such decisions it is crucial to have the accurate decision basis, it is of crucial importance to gain a holistic view of the situation. Our literature review of the current research in the area found that it seems to focus on a single dimension of the problem and thus lacks the integral picture. Technical aspects of the decision like how to estimate effort (Kemerer, 1987; Braz & Vergilio, 2006; Jacobson, Christerson & Vergaard, 1992) and quality (Regnell, Berntsson Svensson & Olsson, 2008; Banker & Slaughter, 2000; Austin, 2001; Krishnan & Kellner, 1999) or the processes involved in running software development projects (Agrawal &

Chari, 2007; Goldenson & Gibson, 2003) do not account for the strategic or market aspects of the decision.

Also most of the research, especially the process oriented, focus on mainly defence (Diaz & Sligo, 1997) and space related (Maxwell, Wassenhove & Dutta, 1999) or other large projects (Kemerer, 1987) that do not relate that well to the smaller, highly dynamic projects in the handset industry. It is also obvious that critical applications in these industry segments have another set of requirements than the consumer electronics producer's software are submitted to.

Market-wise there is some research specific to the handset industry regarding intention of usage and consumer perceptions of mobile services (Anckar & D'Incau, 2002; Tang & Veijalainen, 2001; Luarn & Lin, 2005; Wang *et. al.*, 2006). Although these articles are highly relevant it is our opinion that they lack the holistic approach connecting the market opportunity to cost of development. There is also a strategic concern that an application has to fit with the company's overall offering that are not discussed in these articles.

Regarding the strategic and business model aspect of the decision making the current general research is well developed and in many cases specifically directed towards the mobile handset industry. Yamakami (2005) discusses business models and Cansfield (2007) branding while Venkatesh & Morris (2000) among others discuss the network effects all connected to the handset industry but neither of them gives an holistic picture. A model for the balance between strategy, market and technology is needed to make an informed and holistic decision and is currently lacking in the academic research. Our theoretical contribution will be to tie these loose ends together and make a normative model that are applicable to the software development in fast moving consumer electronics industries, handset software in particular.

## 1.3 Problem Formulation

Academically the questions of finding out what constitutes a sound decision base and finding out how to handle the issue of a holistic approach must be addressed in order to make a well balanced and relevant decision model. The core question is which decision criteria to include and which drivers are important in estimating the status of the criteria? Practically to provide Sony Ericsson with a formalized evaluation process for decisions on software development that is transparent, objective and challengeable.

## 1.4 Purpose

Academically to contribute to the field of decision making research by elaborating on how to make a holistic, rapid and rational decision model. Primarily for software development in the handset industry but also valid to other related industries. The framework needs to support the decision makers and should also make the reasoning

behind the decisions more transparent. Practically an adaption of the model for use at Sony Ericsson and evaluate its usefulness to the organization.

# 2 Method

## 2.1 Basic Framework

Since the decision model shall consider all aspects of developing the service in question a starting point for this work is to consider the two very basic needs of all economically successful enterprises: profitability and strategic fit. Profitability is in turn split into two dimensions; market potential and development and production cost/time e.g. revenue less cost of sold goods (Koller, Goedhart & Wessels, 2005). The strategic fit is necessary to ensure that a standalone business cannot derive higher value than the manufacturer from the same idea (Grant, 2005). Based on these established aspects of a business a three dimensional model consisting of development, market and strategy was formed as an initial framework to be able to build a holistic understanding of repercussions of the software development decisions. The basic presumption is that each of these three dimensions should be attributed equal importance in the model construction and that they are mutually dependent.

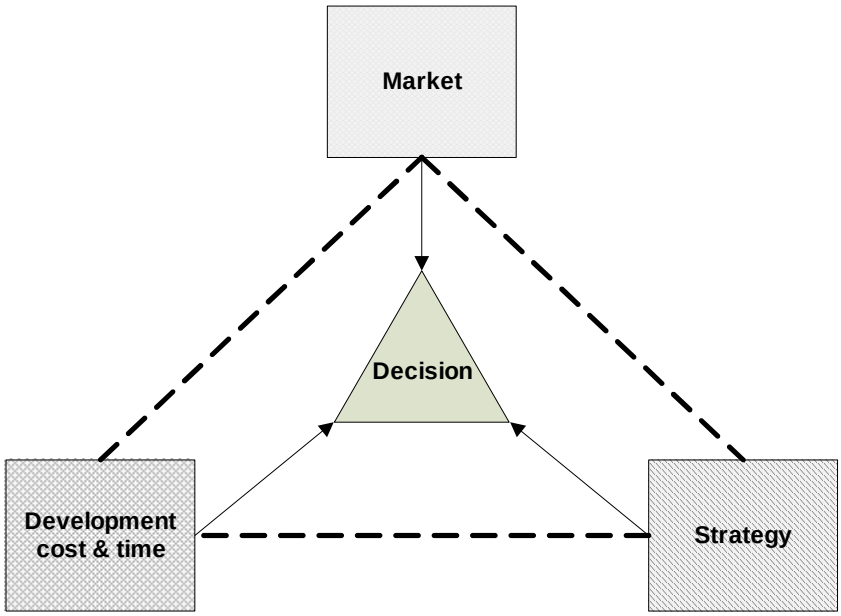



Figure 2.1 - The starting point for the decision model construction.

## 2.2 Process

A literature study was conducted in parallel with the case study at the handset manufacturer Sony Ericsson, a process described in literature as an abductive approach (Chamberlain, 2006). Both the literature study and the case study were aimed at answering primarily which criteria that influence each of the three

dimensions of the decisions. Information on how well these criteria were suited for measuring the dimension they influence was also sought. The relevance of theory and the appropriateness of current practise were weighted against each other in an iterative process in this phase of the project. The theories and practices were also evaluated against the framework established in section 2.1.

## 2.3 Secondary Sources

To facilitate the understanding of the parameters affecting estimation of the three dimensions of the project evaluation framework review articles and other general information sources such as books on the subject were used. This was done to find the most important and relevant theories and decrease the risk of missing any vital research area. By starting general and recent and building a knowledge base based on related research, a broad and extensive review of the research in the field was secured.

Besides the literature database of Lund University and sources of the already read literature, discussions with the tutors at Sony Ericsson and at the university were used to guide the literature study and minimize the risk that important aspects were left out. Also it was important to make sure that the focus was accurate for this specific subset of software development, market and strategy concerns. All articles included in the thesis were peer reviewed and published in well renowned academic journals.

The main target of the literature review was to establish a number of evaluation criteria or cost drivers for software development. The search for and evaluation of the literature was made independent of the specific cases, the goal was to get the broadest possible picture of which cost drivers that *can* be relevant.

The development cost and time aspects where addressed primarily by a review article discussing the dimensions cost, time and cycle-time by Agrawal & Chari (2007). The market dimension, were based on recent articles that specifically aimed at answering why customers want to use a mobile service (Wang *et. al.*, 2006; Luarn & Lin, 2005) as well as examining the underlying drivers of adoption. To find relevant theories regarding the strategic issue of incorporating new services in current and future products, well known tools from strategy studies primarily Grant (2005) was used. Also theories deemed important by experts at Sony Ericsson and by our tutors, both engaged in research in this particular field were incorporated.

## 2.4 Primary Sources

To get a good overall understanding of software development at Sony Ericsson and to find relevant applications for the case study a few preliminary interviews were conducted. Personnel at Sony Ericsson Research Center (SERC) and the Chief Technology Office (CTO) were interviewed to find out about the general

development environment and to get the best possible referrals in the development organization for the following interviews.

In order to extract the relevant information on each of the selected projects without leading the interviewees more than absolutely necessary an agenda was sent out in advance with a number of generic issues. The interview was started by a brief outline of the goal to the master thesis and the aim of the interview. Then the question of how the decision was made was raised, following by a discussion of their working practises. Technical issues and market environment was also brought up if the interviewee didn't bring it up spontaneously. Most interviews were recorded (if we got permission from the interviewee) to be able to go back and verify the information and to make sure no important information were left out. As a part of the agreement with the interviewees the recordings and transcripts will not be made public. The interviews were conducted with a qualitative approach. The specific list of issues in the agenda can be seen below.

- Decision criteria
- General reasoning toward service development
- The technology behind the service(s)
- Cost of development
- Cycle-time and the relation to the general platform development
- Prioritization and resource allocation
- Business model
- Competition
- Positioning (Strengths/Weaknesses)
- Development curve of the product
- Potential market estimation
- Overall process
- Innovation process

## 2.5 Analysis

The theoretical and practical outcome (each a list of criteria) were evaluated and combined in the analysis as a step in the abductive method. The goal was to form a smaller more manageable number of criteria that had both theoretical and practical merits in this particular industry. This methodology was chosen to reduce the bias that could be troublesome if the research starts out in either literature or interviews.

In order to construct a decision model with a manageable number of criteria, a screening for the theoretically as well as empirically most relevant criteria must be conducted. This will be made by discussing the pros and cons from a theoretical and practical point of view for each of the criteria found. The selection was made in a way that minimized the overlap in between the criteria as well. All relations in between

different criteria were also analysed so they could be used in formulating the model to be more distinctive.

## 2.6 Model construction

Following the selection of the criteria, key performance indicators (KPIs) or *drivers* for each criterion were developed. The model, drivers and also the method of evaluating the drivers was submitted to qualitative evaluation by decision makers at Sony Ericsson and improved upon to accommodate their opinions. By giving experts at Sony Ericsson the opportunity to put forward arguments on which drivers that are the best suited the model was ensured to be practical. By evaluating the proposed criteria and drivers against the theoretical framework and the analysis regarding the suitability of the criteria and what they were supposed to estimate, balance in the final model was ensured.

Starting with a rather extensive model with a large number of drivers ensured that nothing was left out; the philosophy being that it is better cut out less suitable criteria and drivers later than creating new ones afterwards. This procedure also gave the professionals at Sony Ericsson a larger influence over the final model and thereby increased its usefulness.

## 2.7 Evaluation

In the final step of the research the model will be used for evaluating two fictive application cases to examine if the constructed model brings usability, ease of use and to compare the model´s verdict to experts' opinion. This allows us to examine if the constructed model makes an equivalent decision and if there are and deviances and the causes of them. In this step a responsible expert will be guided through the process and do the evaluation with our aid. Besides the outcome, the practicality of using the model will be tested.

## 2.8 Summary

The overall process flow for the thesis is illustrated in figure 2.2. Although it is important to remember that this is just a flow chart, the actual model is iterative and uses both empirics, theory and an analytical approach to piece by piece form the understanding of the decision process and make recommendations.

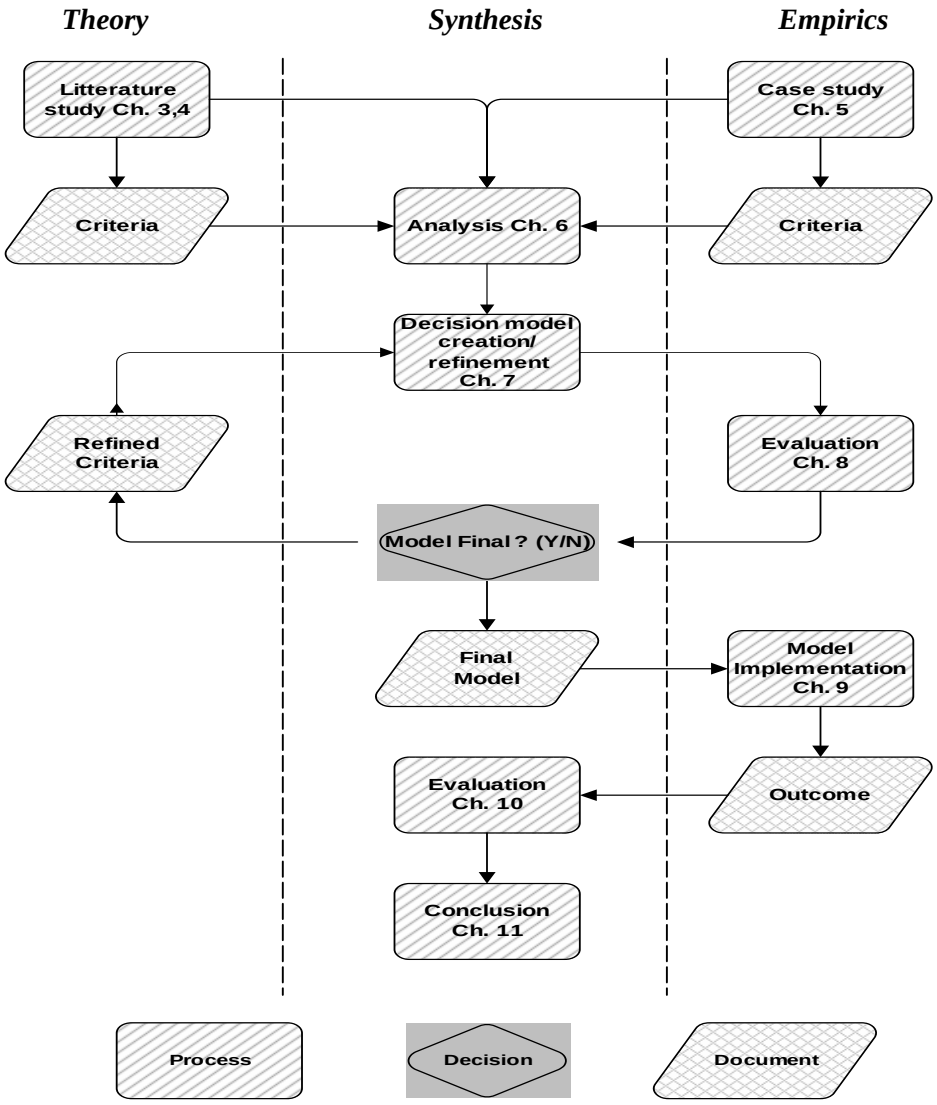



Figure 2.2 - The process flow chart for the thesis work.

# 3 Theory

*A review of the progress in the areas of development estimation, market estimation and the strategic issues related to launching new software based services are necessary as a foundation for further inquires in this thesis as outlined in the method. A summary of earlier research based on scientific papers is presented in this chapter.*

## 3.1 Development Estimations

### 3.1.1 The Development Cost

Kemerer (1987) statues that practitioners have expressed concern over their inability to estimate software development costs and that this problem will be even more pressing as the size of software projects continue to increase. Further Leung & Fan (2001) points out that underestimated costs results in that management approves projects that the exceeds their budgets which leads to underdeveloped functions, poor quality and failure to complete on time. On the other hand overestimating costs may lead to poor resource allocation or loss of new business.

#### *3.1.1.1 Relationship between Effort and Cost*

A software development effort consists of high level design, detail design, coding and different forms of testing. The development project cost is mostly driven by personnel. Effort costs are commonly used as a substitute for the total cost (Agrawal & Chari, 2007).

#### *3.1.1.2 Analytical Methods based on Size & Function Count*

Kemerer (1987) validates four estimation methods empirically to test foremost two important inputs in these methods, the estimated size of the source code and the number of user functions. Size is measured as the number lines in the source code (SLOC *Source Lines of Code)* while the function count are a more macro level measurement counting the number of user functions and adjusting for complexity (*Processing Complexity Adjustment* or PCA*)* giving *Function Points* or FP.

The two methods using SLOC as the key input in Kemerer's article, COCOMO (COnstructive COst MOdel) and SLIM (Software LIfecycle Management) work by fitting a function that describes the relationship between man months of work and the size of the source code. Kemerer (1987) shows that there is a large need for calibration of the estimations to accommodate for the different type of software projects in different sectors, as the results from the SLOC estimates consistently overestimated the resources needed with a mean of several hundred percent in the study. Regression between estimated and actual man months gave a positive correlation although the coefficient of determination ($R^2$) was only 48.5 percent for SLOC. After adjustments the coefficient of determination was 87.8 percent for SLIM and 59.9 percent for COCOMO with cost drivers and 68.0 without cost drivers.

For the function points the correlation was 55.3 percent and for functions counts (unadjusted for complexity) it was 53.8 percent. Kemerer (1987) argues that function point is not only the better indicator of man months but is also easier to estimate before a project is initiated compared to SLOC. But it is clear that no more roughly half of the outcome can be attributed to either of these indicators. The correlations for the different methods are shown in table 3.1.

| ***Method*** | ***Correlation (%)*** |
|---|---|
| SLOC | 48.5 |
| COCOMO | 68 |
| COCOMO w. cost drivers | 59.9 |
| SLIM | 87.8 |
| Function points | 55.3 |
| Function counts | 53.8 |

Table 3.1 - The correlation between size measures and actual effort. (Kemerer, 1987)

Braz & Vergilio (2006) writes that estimations based on size in SLOC are dependent on programming language. Further the function points method is a subjective measurement and that it needs adaptations to be applied in more recent object-oriented programming technologies. As an alternative to function points Braz & Vergilio (2006) suggests a Use Case model (Jacobson, Christerson & Vergaard, 1992), the Use Cases represent functional aspects and are useful in the early phases of a software development project. However the Use Case Points (UCP) suffers from limitations based on the fact that it has a very limited number of classifications and is subjective (Braz & Vergilio, 2006). These shortcomings can be corrected as suggested by Braz & Vergilio (2006) although the empirical evaluation of these modified versions still showed rather bad results with miss predictions in the interval of 10.6 – 67.9 percent, larger than the original Function Points model in this study. The authors attribute the prediction errors in part to a too low adjustment factor due to environmental factors.

#### *3.1.1.3 Mature Processes*

In recent research Agrawal & Chari (2007) points out that the principal benefits of having mature processes for software development are that it seems to reduce the impact of other factors than size on resources needed. Their analysis of 37 projects in four companies with highly mature, CMM (Capability Maturity Model, see section 3.1.4.) level 5 processes showed that size was in fact the only significant variable affecting effort, quality and cycle time. Process maturity also seem to increase productivity, a study made by the Software Engineering Institute (Goldenson & Gibson, 2003) showed a 60 percent reduction in work at one aerospace company while another one had a 30 percent improvement in software productivity. Although

improvements of this magnitude are not always the case, it certainly shows that rather large inefficiencies can exist even in project focused high tech industries.

Harter, Krishnan & Slaughter (2000) found a negative correlation between effort and mature processes as described by the Capability Maturity Model (se chapter 3.1.4) and effort. A one percent improvement in process maturity leads to a 0.17 percent reduction in effort according to the study. Clark's (2000) study on the effects of process improvement on effort shows a 4 – 10 percent reduction in effort per level in the Capability Maturity Model. Krishnan *et. al.* (2000) did however not find any significant improvements on effort as a result of capability maturity improvements, this could be an effect of more planning, management and training activities adding to the overhead and thus lowering the productivity according to the authors.

#### *3.1.1.4 Intuition based estimates*

Maxwell, Wassenhove and Dutta (1999) made a study on effort estimation in software development at the European Space Agency. They found that the practice of guessing or using intuition has been correlated to overruns in the estimated budgets in earlier research.

#### *3.1.1.5 Productivity factors*

Maxwell, Wassenhove and Dutta (1999) found that only [projected] size and a small number of productivity factors were needed in order to develop fairly accurate effort estimations. The productivity factors identified being application category, language, required software reliability, main storage constraint and the use of modern programming practices or software tools. For the individual company (ESA supplier in this case) programming language and start year of the project gave the best estimate of the productivity aspect.

#### *3.1.1.6 Data Complexity & Structure*

Data complexity is defined as the number of data elements per unit of application functionality (Banker & Slaughter, 2000). In an effort to determine the relation between software structure and software enhancement costs and errors Banker & Slaughter (2000) found that higher level of structure is advantageous for complex and volatile software limiting the cost driving effect of these two parameters. Hirota *et. al.* (1994) also found a positive correlation between understandability measured as ripple complexity (a way of measuring how interconnected the nodes in a flow graph of the programme is) and work effort maintaining the code.

#### *3.1.1.7 Analogies*

Analogies based on older cases with similar development projects were found to be effective in estimating effort in a study by Mukhopadhyay *et. al.* (1992). The analogies outperformed several analytical methods including ones based on SLOC and function points. Although the authors conclude that few non-correspondences is vital to effective predictions so the method requires a number of relevant sources for

the analogies to be effective. Shepperd & Schofield (1997) reports similar findings with analogies outperforming algorithmic methods in all nine datasets examined.

### 3.1.2 The Quality of Developed Software

#### *3.1.2.1 Quality definition*

A commonly used definition of software quality is the density of defects in the released software program, measured as the number of defects per line of code (Agrawal & Chari, 2007). The rather obvious size – number of defects relationship is included in this definition. Since defects is the key measurement of quality, it is functional quality (whether a function works or not) that is in focus, as Regnell, Berntsson Svensson & Olsson (2008) points out this is usually the case. However quality can also be non-functional, measuring how well a function works on a continuous scale rather than if it works or not (Regnell, Berntsson Svensson & Olsson, 2008)

#### *3.1.2.2 Size*

The relation between software size and quality has been found by Diaz and Sligo (1997), Gaffney (1984) and Krishnan & Kellner (1999) among others to be statistically relevant. Larger code obviously means a larger absolute number of errors, but the relative number decreases.

#### *3.1.2.3 Scheduling Pressure*

In a study on deadline-setting and quality in the software development industry Austin (2001) concludes that systematic adding of slack to project cycle-time estimates can improve quality by adding more effort, however this comes at a price of lower productivity. Also slack-resources can be taken for granted and tighter deadlines can then lead to shortcut-taking that lower quality. He further states that aggressive deadlines most project managers are not likely to meet gives better results, the environment accepts deadline overruns and managers are more likely to admit quality issues and take the time to correct them.

#### *3.1.2.4 Data Complexity*

Banker & Slaughter (2000) found that increased data complexity increased the number of defects in the software, thus lowering the quality. Khoshgoftaar & Munson (1990) states that there is a direct relationship between some complexity metrics and the number of errors later found in the software. Regression analysis of a sample of projects supported this statement.

#### *3.1.2.5 Volatility*

Banker & Slaughter (2000) defines volatility as the frequency of enhancement per unit of functionality. In their study they find an adverse effect on quality from volatility, an increased number of changes seem to increase the probability of introducing new errors. Even if the developers get more familiar with the structure of

the programme, this effect can't offset the increased error rate leading to deteriorating quality.

#### *3.1.2.6 Process and Management Maturity*

Diaz and Sligo (1997) shows an important relationship between process maturity and quality in a study of software process improvements at Motorola. Higher quality correlates to shorter cycle time, the projects that scored in the highest group according to the SEI CMM model (see section 3.1.4) increased their productivity almost three-fold. The aforementioned projects also shortened their cycle time by a factor 7.8 while reducing the number of defects seven-fold compared to the entry-level CMM projects. One of the reasons behind the dramatic improvements according to the authors is the increase in reuse of old source code and an improved reusability of new source code written in projects at these more mature project. Another factor is the improved ability to detect errors that would become defects while writing the code. Krishnan & Kellner (1999) found that consistent adoption of the practises in the Capability Maturity Model improves quality, even minor improvements leads to significant reductions in the number of errors according to the study.

#### *3.1.2.7 Personal Capability*

Results from Krishnan and Kellner's (1999) study on process consistency suggest that personal capability or technical skills of the members of the project team as a parameter for estimating quality. Krishnan *et al.* (2000) also found personal capability to have significant positive correlation with quality, measuring it with the five point Likert scale using the manager's and two co-workers' opinion.

#### *3.1.2.8 Quality Performance*

In their research at Sony Ericsson Regnell, Berntsson Svensson & Olsson (2008) couples cost to non-functional quality in a continuous non-linear function stating that software within certain limits can be optimized, but if larger improvements are needed a large reconstruction of the product architecture might be needed. These larger investments to improve quality are called cost-barriers and may also include new investments in hardware. Depending on which non-functional quality parameter that is measured (such as speed, accuracy or responsiveness) costs to reach a certain performance can be estimated by looking at where the barriers are and how much optimization that is feasible (Regnell, Berntsson Svensson & Olsson, 2008). Figure 3.1 shows the quality – cost relationship in the quality performance model.

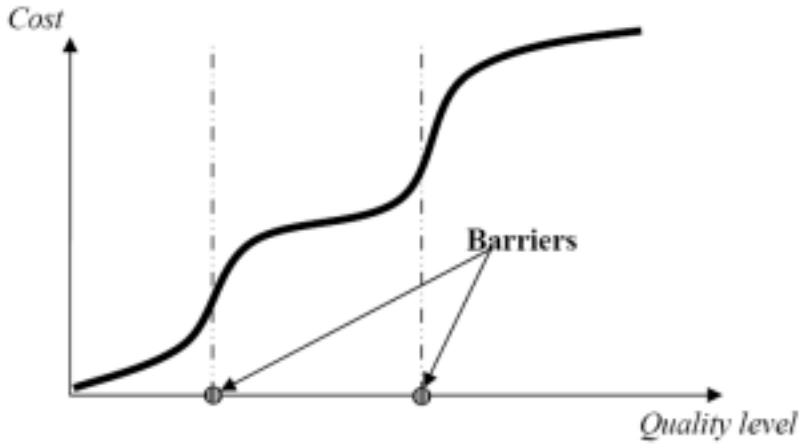



Figure 3.1 - The quality performance model cost-quality relationship. (Regnell, Berntsson Svensson & Olsson, 2008)

### 3.1.3 The Cycle Time

#### *3.1.3.1 Definition*

Cycle time is the time for development of the project (calendar months) and consists of two parts; planned development time and discrepancies from the planned development time (Agrawal & Chari, 2007).

#### *3.1.3.2 Scheduling Pressure*

Brooks (1995) states that adding manpower to a project that does not keep up with its time budget actually makes things worse. Dysfunctional team dynamics, with experienced software engineers working with training their new co-workers instead of working with the delayed project are the main cause of longer cycle times. Schrage (1995) points out that software design is easy compared with managing development.

#### *3.1.3.3 Capacity*

In Genuchten's (1991) study on why software projects are running late, lack of capacity was identified as the single most important factor. The development team were simply busy pursuing other tasks such as prior overruns, unplanned maintenance of earlier products and other activities. Therefore the new projects didn't start on time and couldn't use as much resources per time-unit as planned both contributing to the cycle time overruns.

#### *3.1.3.4 Process Maturity*

Harter, Krishnan & Slaughter (2000) reports a negative net effect of process maturity on cycle time, even though the direct effect is positive (e.g. longer cycle time). When including the effect of increased quality the net effect is shorter cycle times. In their study of CMM process improvements at Motorola Diaz & Sligo (1997) found that the

cycle time was reduced eight times from CMM level 1 to CMM level 5. Diaz & Sligo (1997) attribute the improvements to increased reuse of code and less rework.

### 3.1.4 The Capability Maturity Model

The Capability Maturity Model was developed as a support for organisations to assess the level of their software development capabilities (Centre for Software Engineering, 2002). It contains five levels from a first ad hoc level where an individual employee's commitment and skills are critical to the overall success and few controls are implemented to a fifth optimising level that focus on defect prevention and continuous improvement. For each level a number of Key Process Areas have been defined that has to be addressed before moving on to the next level. A schematic figure of the CMM can be found in figure 3.2.

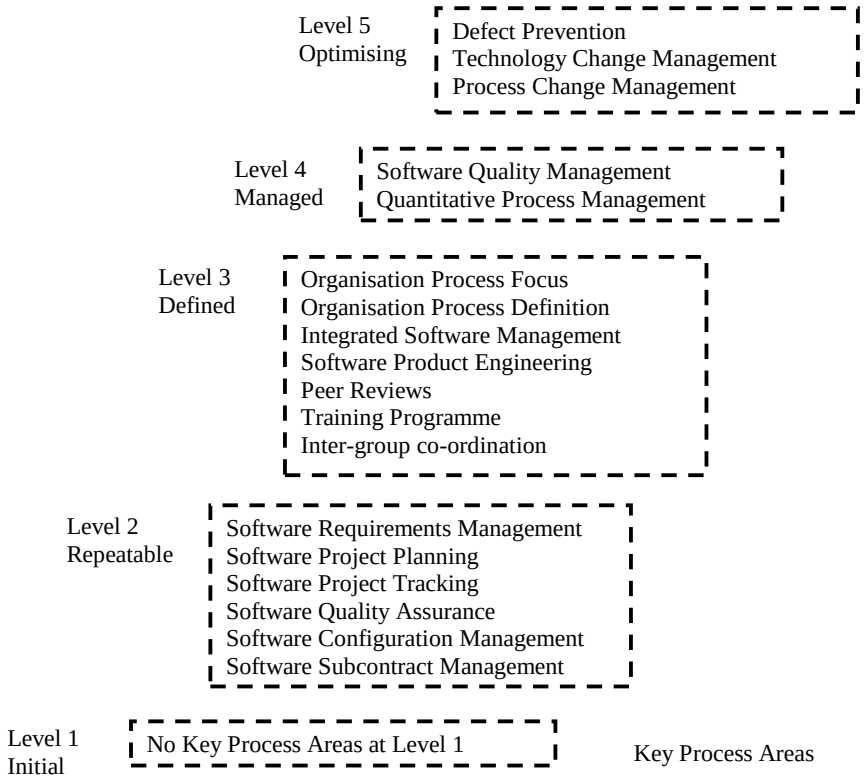



Figure 3.2 – The structure of the Capability Maturity Model. (Centre for Software Engineering, 2002)

## 3.2 Market & Usage Estimations

Wang *et. al.* (2006) points out that even if a service is available and given considerable investments there is no guarantee it will be, or to which extension it will be adopted by the consumers. Wang *et. al.* (2006) and earlier related research tries to

point out which factors that affects consumers intent of using mobile services. The most widely used theories concerning the acceptance of information services are the Technology Acceptance Model (TAM) and the Theory of Planned Behaviour (TPB).

### 3.2.1 The Technology Acceptance Model

Davis *et. al.* (1989) describes the TAM as a model based on the theory of reasoned action (TRA), a well researched intention model used to explain a wide variety of behaviours (Ajzen & Fishbein 1980), meant to explain computer usage behaviour. Basically it uses TRA as a theoretical base for the linking of two beliefs, perceived ease of use and perceived usefulness and user's attitudes, intentions and actual adoption of computer technology. A figure of the model as presented by Davis *et. al.* (1989) is presented in figure 3.3.

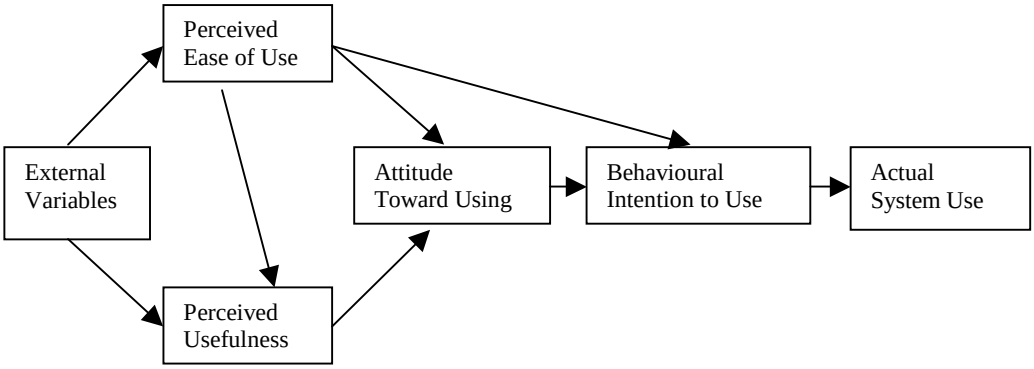



Figure 3.3 - The Technology Acceptance Model. (Davis *et. al.*, 1989)

### 3.2.2 The Theory of Planned Behaviour

The theory of planned behaviour is derived from the theory of reasoned action and its extensions, in order to form a theory that can predict behavioural goals (Beck & Ajzen, 1991; Ajzen, 1985; Ajzen & Madden, 1986). The individual's intention to behave in a certain way is central to the model, as intentions are assumed to capture the motivational factors that influence the behaviour. It captures both how hard an individual are willing to try and how much effort they plan for. The model describes the intention by three determinants attitude, subjective norm and perceived behavioural control, generally a more favourable attitude and subjective norm and a greater perceived behavioural control leads to a stronger individual intention to perform the behaviour (Beck & Ajzen, 1991).

Intentions are then viewed as immediate antecedents to actual behaviours (actions), but other factors such as availability of the necessary opportunities and resources. Together the intentions and non-motivational factors (resources and opportunities) represent the individual's actual control of behaviour. The theory deals with perceived control rather than actual, when the behaviour is relatively unknown to the individual or when requirements or resources have changed the perception will be

rather inaccurate (Beck & Ajzen, 1991). A figure of the theory of planned behaviour can be seen in figure 3.4.

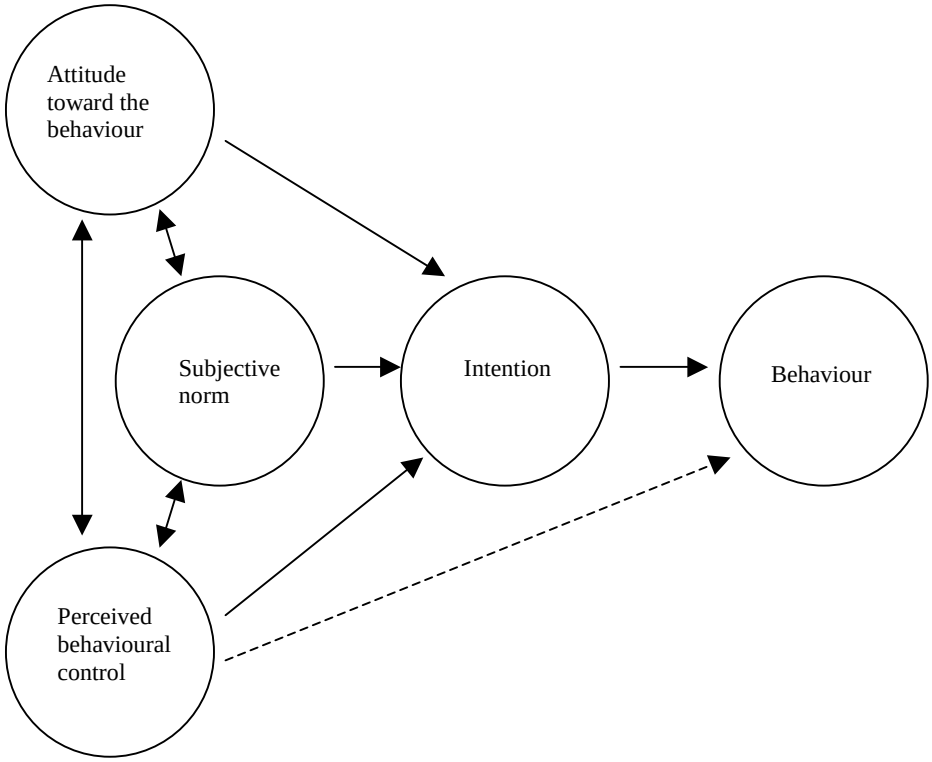



Figure 3.4 - The theory of Planned Behaviour. (Beck & Ajzen, 1991)

### 3.2.3 Value creation through mobile services

In a study of Finnish consumers' attitudes towards mobile services Anckar & D'Incau (2002) states that even though the subject of predicting adoption of mobile services have been widely researched and predictions have been presented both in academic, technology and business press the predictions have been highly contradictory. Many of the optimistic studies have predictions that rely on the penetration of mobile devices (primarily mobile handsets), but Anckar & D'Incau (2002) argues that the popularity of mobile commerce for instance, as the penetration rate of computers aren't related directly to the adoption of E-commerce. Ropers (2001) points out that, currently, internet relies on PCs as access devices, which limits usage to people that afford and know how to operate a PC. If E-business based on mobile devices is easier to operate and a larger number of people are familiar with the devices, especially older people and people in third world countries then penetration could be larger and more rapid. Anckar & D'Incau (2002) further points out that many early investments in internet commerce have had a *technocist focus* neglecting the customer orientation and other factors influencing the purchase behaviour.

In their framework Anckar & D'Incau (2002) stipulates that the winners in mobile commerce services will be the applications where the wireless users are offered an undeniable benefit in comparison to the wired service and the physical service. They break down the value of the wireless channel in two parts: one that relates to the fact the device is wireless independent of the kind of service, *wireless value,* and one that relates to the services being offered in a mobile device, *mobile value*. Benefits identified in wireless value include convenience, cost savings, advantages to consumers that lack proficiency with computers. Tang & Veijalainen (2001) says that convenience and efficiency in performing simple transactions e.g. wireless value is likely to be the main driver for mobile commerce.

The mobile value includes five elements; a time-critical arrangement, spontaneous decisions and needs, entertainment needs, efficiency ambitions and mobile situations. The results of the study (Tang & Veijalainen, 2001) shows that mobile services that offer mobile value in more than one of the five elements are likely to constitute the core of mobile commerce. Services that meet time-critical and spontaneous needs were recognised as the most valuable by the participants. The analytical framework is presented in figure 3.5.

Anckar & D'Incau's (2002) study shows that limited technical skills significantly reduce the willingness to test mobile commerce services while perceived cost does not. They also conclude that prior experience with e-commerce on PCs increases the willingness to use mobile services supporting the theory that mobile commerce does not expand total e-commerce. The customers seem to see mobile internet and commerce primarily as a supplement to their computer based wired counterparts. Age was also a factor although the older age groups showed a surprisingly high interest younger people are likely to form the key consumer segments for mobile services. It should also be pointed out that this study tests a mass market approach so niche applications should be tested in their respective market segment, also Finland is not representative for the rest of the world, internet penetration rates for example are far higher than in other countries.

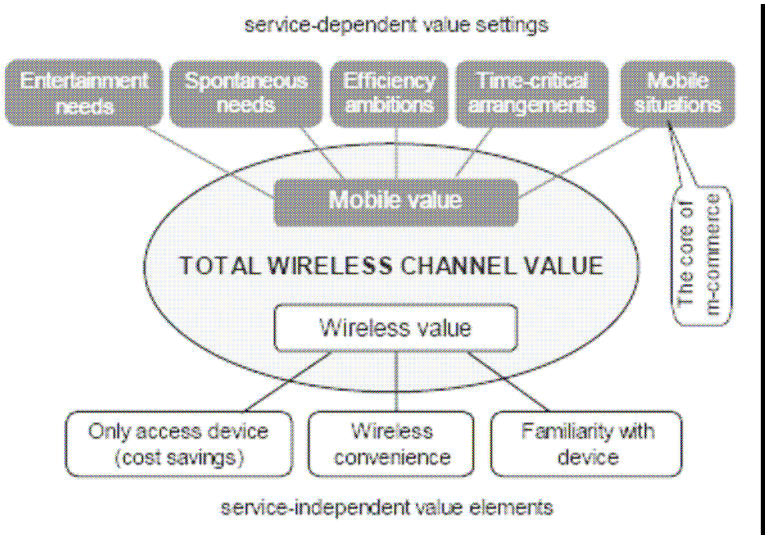



Figure 3.5 - The framework for value creation through mobile commerce. (Anckar & D'incau, 2002)

### 3.2.4 Prediction of consumer intentions of using mobile services

Luarn & Lin (2005) suggest that the behavioural intention to use mobile software depends on the factors self-efficacy, perceived financial resource, perceived usefulness, perceived ease of use and perceived credibility in a TAM and TPB-derived model in a study of the adoption of mobile banking. Wang *et. al.* (2006) expands this theory to mobile services in general.

The credibility factor is introduced since earlier research has shown a positive influence on behavioural intentions for services that are perceived as free from security and privacy threats (Luarn & Lin, 2005; Wang *et. al.*, 2003). Self-efficacy is suggested to both enhance the perceived ease of use and the behaviour intention of using it. The perceived financial resources factor is suggested to increase the behavioural intention to use, the perceived usefulness and the perceived ease of use of the service (Wang *et. al.*, 2006). Wang *et. al's* (2006) model is presented in figure 3.6, all arrows represent statistically significant correlations. In total 69 percent of the behavioural intention was explained by the model, Wang *et. al.* (2006) also concludes that perceived financial resources and perceived credibility had a stronger effect than the traditional TAM variable perceived ease of use. Luarn & Lin (2005) explains 82 percent of the behavioural intentions in their study, although it's limited to mobile banking.

Further Wang *et. al.* (2006) suggests that these findings could be used as input to create a business model that attracts new customers through low costs. Customers who have overcome the financial barriers are then likely to continue using services from the same provider and try other more expensive services. Generally Luarn & Lin (2005) concludes that the trust-based perceived credibility and the two perceived

behavioural control factors do not only help companies to construct more user-accepted services, it also gives insight in how to promote these services.

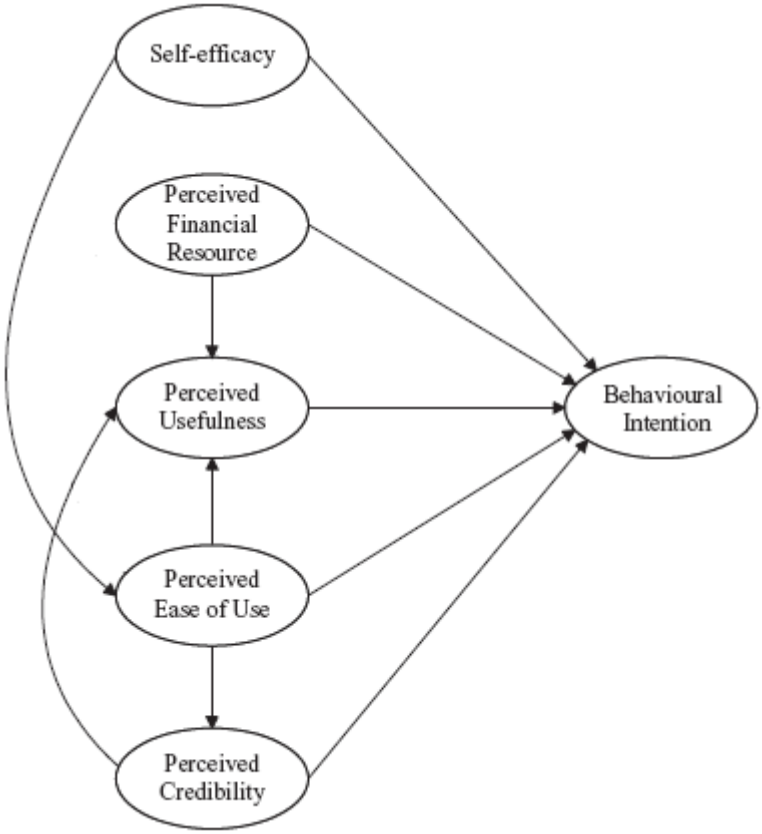



Figure 3.6 - Wang *et al's* (2006) model for prediction of adoption of mobile services. Luarn & Lin's (2005) model is missing the correlations between financial resource and usefulness and credibility and usefulness otherwise they are identical.

### 3.2.5 Quality Performance

Regnell, Berntsson Svensson & Olsson (2008) links non-functional quality to customer benefit in a model where benefit ranges from useless to excessive. A certain quality of relevant parameters is needed for the consumer to feel that is beneficial to use the software. At a higher level of quality the product starts to differentiate from competition and at extreme levels of quality improvements no longer has any practical implications to the customers.

In the spectrum the useless-useful breakpoint and the competitive-excessive breakpoint improvements in quality rapidly improves the experience. However it's crucial that the right parameters or indicators of quality are used, depending on market segment, use case and hardware (Regnell, Berntsson Svensson & Olsson, 2008). Figure 3.7 shows the quality level – benefit graph.

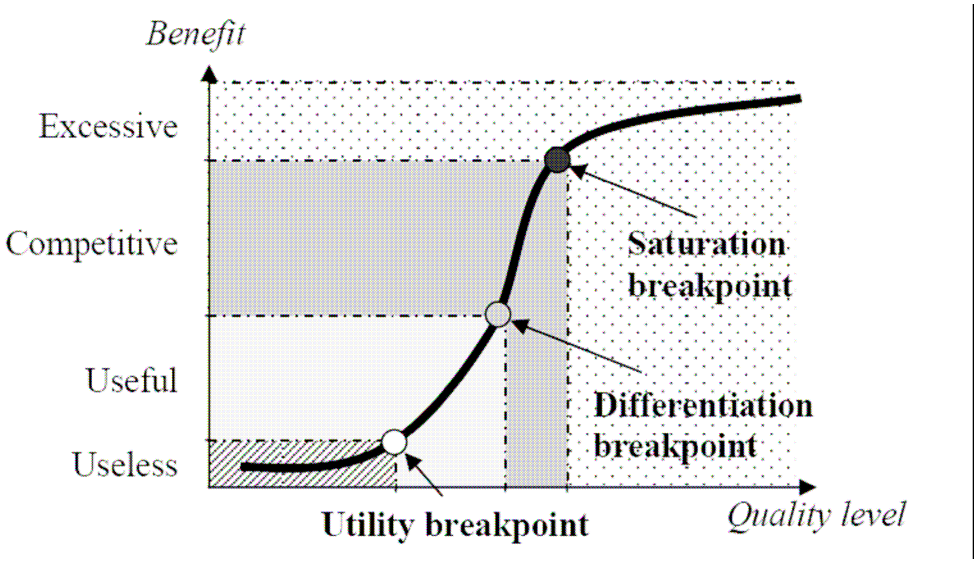



Figure 3.7 - The quality performance model's quality level – benefit graph. (Regnell, Berntsson Svensson & Olsson, 2008)

## 3.3 Strategic & Business Model Concerns

### 3.3.1 Innovation

Along with the development of fast-changing technology intensive markets the understanding of the term innovation has radically changed among leading actors. Today few players need to be reminded of the substance /relevance of innovation and as being an essential factor for staying competitive in the business; the question is no longer if companies should work with it, but how. Innovation can be divided into two elements which state situations in which innovation opportunities are more likely to be identified. These opportunities can be categorized as shown below: (Drucker, 1998)

*Internal (within a company or industry):*
Unexpected occurrences
Incongruities
Process needs
Industry and market changes

*External (outside a company and its extended social and intellectual surroundings)*
Demographic changes
Changes in perception
New knowledge

Drucker (1998) states that being successful in the search for innovation is more about applying the appropriate tools and being diligent, committed and persistent (engaging in disciplined work) rather than having an entrepreneurial character.

A common opinion among executives based on the hypothesis that all organizations face common barriers when developing new services, states that the innovation rate can be improved by easily searching outside the company for ideas and best practice. In real life however, the nature of challenges linked with innovation differ from company to company creating a situation where adapting general recommendations to a great extent can be associated with risk and in some cases lead to destruction. This fact enlighten the importance of a company actually developing their own model for building innovation instead of importing best practice into the company regardless the nature of the company. (Hansen & Birkinshaw, 2007)

#### *3.3.1.1 Successful innovation*

Being successful in creating innovations takes more than adopting the latest advices and more important, innovation must be seen upon as a comprehensive phenomenon rather than a single part process. For example a greater effort focusing in how to generate ideas will not alone be helpful in the long term if the overall system innovation process is ineffective. Instead a company must reflect on their present processes for creating innovations and from these pin down the company's unique challenges and expand paths to tackle theses individual issues. One way of obtaining an effective perspective of the innovation process is by using the frame work "The Innovation Value Chain". (Hansen & Birkinshaw, 2007)

#### *3.3.1.2 The Innovation Value Chain*

With the Innovation Value Chain framework Hansen & Birkinshaw (2007) describes innovation as a chronological process which includes three phases; idea generation, idea conversion and the diffusion of developed concepts.

For each phase managers must take action on six significant tasks, internal sourcing, cross-unit sourcing, external sourcing, selection, development and companywide spread of the idea. All six of these constitutes a link in the overall chain, some of these tasks the company might fulfil with excellence, becoming the company's strongest links in the chain and some task might be hard fulfilling, making them to a weak link. The framework supports executives in their decision regarding which practices to apply in order to improve performance attached to innovation as well as help them to identify the actual critical part of the chain that needs to be improved. The hardest part in the innovation process, characterized by the relevant model is usually described as phase number two, were decision regarding the idea generated has to be done. (Hansen & Birkinshaw, 2007)

#### 3.3.1.3 Idea generation

To achieve quality in the creation of innovation most executives agree that the process should be initiated by a couple of good ideas, the question is however where (in which environment) and how to best catch these ideas. Due to the fact that mangers often believe themselves to have a sense about what's lying ahead, a natural first step is to start by looking for trends, ideas and inspiration inside the own organization. They soon observe that the ideas with the best potential are created when pieces of inspirations are put together such as when people collaborate cross functional or when external parts are screened for ideas. Combining experience and knowledge from different units within a company through cross unit collaboration is effective but is by far however organized without difficulties, facing complexities such as decentralized organizational structures as well as geographical spreading. Enterprises furthermore have to consider whether an adequate amount of high-quality ideas are sourced exterior to the company and even exterior to the industry, such as screening knowledge and experiences of competitors, universities, entrepreneurs, investors, inventors, suppliers, customers and end users. Not taking part in this kind of information can end up in missing opportunities and lower innovation productivity. As an example Sony can be mentioned, a company which during the 1980´s had a striking track record developing radical product innovations such as the Walkman and PlayStation. During the 1990´s the company however suffered from engineers becoming gradually more narrow-minded developing a mindset dominated by the "not invented here syndrome". Sony missed opportunities related to early development of flat-screen TVs and MP3 and instead developed less successful products such as cameras etc. (Hansen & Birkinshaw, 2007)

#### 3.3.1.4 Idea conversion

Generating a great number of ideas is not enough to create successful innovation, what's even more important is how and which process the company uses to further develop the new born ideas, which ideas should money be spent on and which should be killed. Lack of efficient selection methods as well as mechanism guarantying financial support will transform the most promising ideas into organizational bottlenecks. Other idea killers are tight budgets and conservative thinking which often affect the employees resulting in the number of ideas quickly decreasing. While all ideas in the end must be revenue generating insufficient commercial ability is announced as another great threat. It is therefore essential to put accurate resources on the projects making sure people have the time and effort needed. The criteria of an idea's overall strategic fit towards the company must also be taken into account. (Hansen & Birkinshaw, 2007)

#### 3.3.1.5 Idea diffusion

Idea diffusion concerns the final part in the process of commercializing an idea. Significant stakeholders including customers as well as actors within the organization must support and spread the product through selected channels to reach attractive target groups and thereby getting buy in. (Hansen & Birkinshaw, 2007)

### 3.3.2 Components of Technology-Market Linking

To be successful in the work of Technology Market linking it's crucial to first be aware of problems that may occur as well as to realize what that linking includes. According to research done on the subject technology-market linking contains a process and a content component. The process side entails the creation of new knowledge regarding the product and the market. Henderson & Clark (1990) state that non routine innovations require new "architectures" in which trendsetters break out of current procedures and know-how to reconfigure elements of design and procedure into an innovative framework. Freeman (1982) refers to product innovation as a "complex coupling" between market needs and technologies. There are a number of challenges in linking technological and market opportunities since choices concerning design options etcetera have to be addressed, each pushing the outcome in different directions. Another challenge may constitute of the fact that the market is brand new making it difficult to verify who the most likely clients are and what this target group in fact want to consume (Clark, 1985).

In terms of content, linking implies the gathering and bringing together a range of explicit insights. Research claims that successful new product developers have more knowledge in users' applications, market segments, technological trends and distribution systems (Dougherty, 1990). Urban & von Hippel (1988) implies that developers establish key trends in both the area of technology and market, and then seek out "lead users" who can identify feasible design specifications. The integration of R&D and marketing facilitate both the evaluation of commercial capability as well as the optimization of design characteristics. Knowledge required for new invention is hence multi-levelled, multi-faceted and detailed. (Bonnet, 1986)

### 3.3.3 Business models

To fulfil the overall goal of a product or service the developed opportunity has to be linked to a business model describing how the service can return an acceptable cash flow. Although the literature reveals an increasing highlighting concerning the significance of business models there has been strong requirement on how to explain and define what a business model should include. (Kallio, Tinnilä, Tseng, 2006) Three types of business models have been classified in the literature by Osterwalder *et al.*, 2002: revenue and product-based (Rappa, 2000), business actor and network-based (Trimmers, 1998), and marketing-based (Petrovic *et al.*, 2001).

The definition of a business model differs depending on author and according to Rappa (2000) a business model can be described as the means by which a company makes money. Referring to Amit & Zott (2000), a business model is "the manner in which a firm coordinates and combines the flow of information, products and services among parties to enable transactions". Amit & Zott (2000) identify the substance of value creation (such as activities, branding, customer service and reach) as well as the revenue logic.

To be able to understand the underlying drivers of a business model modern literature on defining business models have focused on breaking down the model into smaller components. According to Osterwalder *et al.* (2002) a business model consist of four components: the services a firm offers, the infrastructure and network of partners needed to create value, the relationship the firm creates with its customers, and the financial characteristics.

#### *3.3.3.1 Future business model in the mobile handset industry*

With the intensive growth of customers in the mobile handset industry, at current exceeding 1 billion users, there is no doubt that the future challenge within the mobile telephony is to be found within data communication services. Defining this future scope also brings a large number of challenges connected to software engineering, service evolutions, user acceptance management as well as engineering of appropriate business models. As the mobile technology progressively have been integrated into the everyday life, contributing for an essential part of communications, the demand from end users also increase with time, creating a large pressure on the software engineers. As customers demand content and interface more similar to the PC-internet interface the software engineers struggle with the trade off between satisfactory web experiences and the existing constraints regarding resources. (Yamakami, 2005)

The future business models within the handset industry are constructed to bring revenue from data communication services. Limitations existing today can be identified in limited display size, user interface restrictions and factors constraining, battery life, memory and CPU power. (Yamakami, 2005)

To be able to develop tomorrow's mobile services it is important to fully understand and analyze the past development within the industry. The evolution within the mobile internet service is exclusive due to the fact that it is determined by a combination of the hardware, platform and content. Two main characteristics of relevance, which both have had impact on the development can be identified when analyzing the evolution, these are platform evolution over a long span of time as well as relations between the three stakeholders; carriers, end-users and content providers across a period of time. (Yamakami, 2005) Referring to past studies (Yamakami, 2002) the development of business models has followed a pattern where enhanced programming features along with improved dialogue towards end users as well as hardware, based on media features, appear in turns driving the evolution forward as shown by figure 3.8 below.

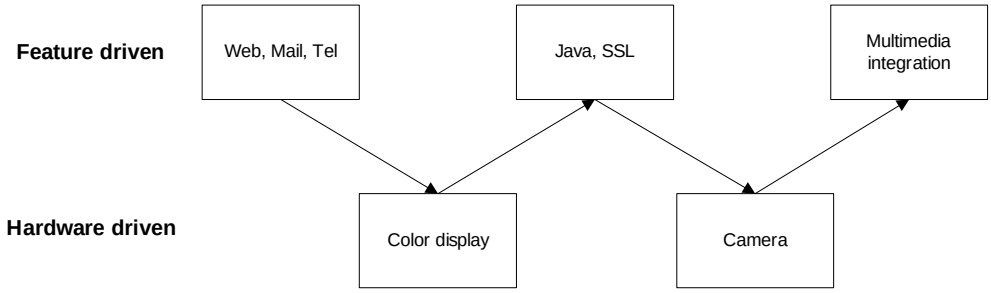



Figure 3.8 - The mobile service evolution. (Yamakami, 2005)

Each momentum has duration of 6 to 18 month which means it requires significant education cost to implement a wide scale Internet service evolution. This fact creates a situation where the handset features are disclosed to the content providers in advance. A critical factor determining the pace of evolution is user participation which plays a significant role in the refinement of the use process defining best-fit content. The creation of top-quality content therefore requires a certain amount of time. This time period should be used for feedback concerning the content and research regarding the next phase evolution. The four most common business models for software platform development can be summarized in the following number of patterns (Yamakami, 2005):

*Intellectual Properties:* This category is represented by the intellectual property protected assets such as image encoding and security.

*Bundling:* Bundling is a well used technique for easy integration of applications and services.

*Convergence:* The convergence business model applies a strategy using the existing lock-in effects

*Inside-client integration:* Describes the strategy to take advantage of the know-how and porting pains.

Yamakami (2005) suggests a few new business models applicable in the near future that is highly dependent on the potential trend-shifts involving software engineering. Below the models likely to be used are listed:

*Open source business model:* Among strong candidates for the upcoming operating systems regarding 3G handsets Symbian and Linux can be identified, which is a challenge that mobile handset software platform suppliers need to cope with.

*End-to-end IP application business model:* The author states that applications like Skype, also known as end-to-end applications may well substitute some of the

network infrastructures. Though this technique offers great possibilities wireless-telephony requires intensive investments and completely diverse business models.

*System-in-chip business model:* The suggestion is that chip-bundle strategy is useful to penetrate global markets by engaging a deal with chip vendors without mutual deals with different transporters and retailers.

### 3.3.4 Branding

The mobile handset industry is often described as high technology businesses were actors frequently push each other by developing state of the art technology and thereby constantly reinventing the industry. The essential question which still remains and therefore need to be addressed to be able to form future strategies is however; what does technology mean to consumers when they can't use most of the features on the handsets? Clarifying and enlighten the consumers of the services and belonging benefits and usefulness are put on telecom player's marketing functions, explaining the relevance of assigning the marketing function the sufficient amount of resources. Still research discloses that providers within the telecommunications industry fail in effectively communicating to consumers, resulting in potential revenue lose. (Cansfield, 2007)

A great number of studies have been conducted concerning both successful and unsuccessful cases to be able to determine the probability of developing successful products/services. (The term successful will in this thesis be referred to as products which in the end generate profits and thereby increase the firms overall long term result.) According to these studies approximately 50-75 percent of all products developed are unsuccessful. The result is affected by the character of business, product type, technological complexity and customer maturity. The essential is though that the probability of failure is higher than the probability of succeeding when developing a product or service. (Karlsson, 2003)

When addressing the market it is critical to apply an appropriate strategy to obtain the aimed market position. The choice of strategy has an impact on which channels the company should use for market communication and affect how the company wants to be recognised among potential and existing customers as well as determents what core values the company wants to communicate. By using market differentiation a company can apply parameters as design, performance and quality to differentiate its products towards competitors and thereby increase the perceived value among customers compared to opponents. To further reach out and increase brand recognition on the market it is central that the enterprise strive to position its products in a preferable way. The market position determines how the products are recognized by customers and what impact the brand has in people's perception in contrast to competitors. (Kotler, 1999) According to Ries & Trout (2001) primarily three strategies for market positioning are applied, these are first to strengthen the brands current position towards customers perception and second to find new market

positions by filling gabs in the market. The final strategy is to try to reposition the competitors through attacking.

### 3.3.5 Network externalities

Network externalities are defined as the phenomena where the utility that an individual user gains from using the service increases with the number of consumers using the service. (Katz & Shapiro, 1985) Due to the growing relevance of emerging information technologies the understanding of the underlying causes and parameters which influence their adoption has become an important question (Venkatesh & Morris, 2000; Green & Hevner, 2000; Luo *et al.,* 2000; Van Slyke *et al.,* 2002) The drivers of adoption, increasing the network, therefore include the features of the chosen technology as well as the network characteristics. (Strader, Ramaswami, Houle, 2007)

According to Katz and Shapiro three sources of network externalities can be identified, describing one source as the direct physical effect between the number of consumer and the value of the service. (The value of a mobile handset to one user increases as more handsets are purchased and exploited by others). An additional source is described as an indirect effect where the utility of a product increases with the number of clients for the reason that the quality of the service is higher or the fact that there are more complementary products available. (Katz & Shapiro, 1986; Farrell & Saloner, 1987). (As the user base for a product or service increases there should be a consequential growth in compatible software which adds additional value to the hardware). The third source of network externalities can be found in environments where increasing sales of a product or service creates superior quality and ease of use of aftermarket services related to the product. (The greater the number of customers using a certain product, the greater the probability is that a service for the product will be supplied).

### 3.3.6 Prioritization of Development Projects and Requirements

The outcome of which features in a product that will be found relevant by the consumers is unknown before the product's development. A way of estimating which features that should be included and which should be dismissed is therefore necessary in order to have a satisfactory list of requirements at the start of development. Regnell, Karlsson & Höst (2003) propose a decision matrix (figure 3.9) that has four fields in two cases a correct decision is made (proceed with a good requirement, dismiss a bad requirement) in the other two cases the wrong decision is made.

| Decision | | Negative | Positive |
|---|---|---|---|
| | Positive | A bad service is developed | A good service is developed |
| | Negative | A bad service is not developed | A good service is not developed |
| | | Actual outcome | |

Figure 3.9 - Four different outcomes of a development decision. (Regnell, Karlsson & Höst, 2003)

To handle a large number of ideas on new features or other requirements the authors propose a screening and an evaluation before implementation to improve the ratio between correct and incorrect decisions, these steps obviously need to be performed in a time-efficient way to be beneficial. Higher ratio of good requirements to bad requirements initially and/or better decision making in screening gives a better ratio in the final requirements (Regnell, Karlsson & Höst, 2003). The process from elicitation to release is shown in figure 3.10.

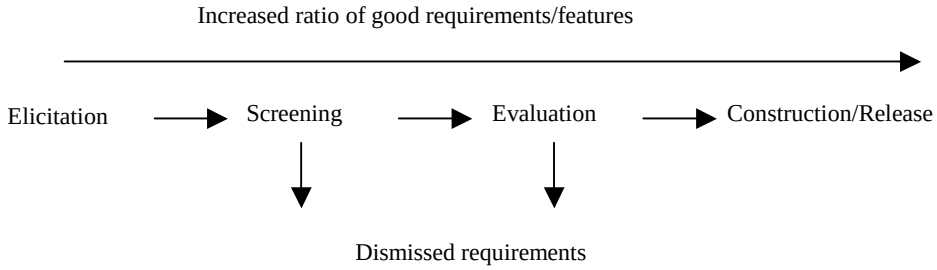



Figure 3.10 - The requirement selection process. (Regnell, Karlsson & Höst, 2003)

#### *3.3.6.1 The Analytic Hierarchy Process*

Karlsson *et. al.* (1998) describes the Analytic Hierarchy Process (AHP) as a decision making method based on the comparison of all unique requirement pairs, giving one on them higher priority on a sliding scale. AHP and other techniques based on relative comparison have been found to be both faster and more reliable than absolute measurements (Karlsson, 1996). One major drawback with the technique is that the

number of comparisons needed grows with the square of the number of requirements, making work with large number of requirements tedious.

However since all requirement pairs are compared the method allows for internal consistency checks. If requirement A is found more important than B and C more important than A then C should be more important than B otherwise it would be difficult to draw any conclusions from the pair-wise comparison. If the data is consistent a relative priority of each requirement can be calculated.

Introduction of hierarchy levels to the AHP with the most general requirements on top and the more specific below can reduce the number of requirement pairs needed to be evaluated (Karlsson *et. al.*, 1998). Another way of minimizing effort in the AHP is to use a *minimal spanning tree* meaning that all redundancy is removed and minimal interconnectivity is used to produce the prioritization using only *n-1* comparisons for *n* requirements.

#### *3.3.6.2 Bubblesort*

Bubblesort compares two requirements and prioritizes them without saying anything on how big the difference is (Karlsson *et. al.* 1998). If the higher priority requirement is above the lower priority requirement in the list they are switched, when all comparisons are made the requirements are listed in an ordinal scale from the least prioritized to the most. Bubblesort uses the same number of comparisions as the AHP but uses easier determinations and the sorting of the requirements is automatic (Karlsson *et. al.* 1998).

#### *3.3.6.3 Priority Groups*

In some development projects there is possible to divide requirements into different groups, typically high, medium and low priority to avoid having to prioritize between low and high priority requirements with a high effort method like AHP. An ordinal scale approach can then be used to prioritize within the groups if not all requirements in the group can be implemented (Karlsson *et. al.*, 1998).

### 3.3.7 Industry Analysis

In order to determine market size and growth of the service and the service (software) developer's ability to appropriate from the value created some insights in the industry structure and environment is necessary. Grant (2005) summarizes the key models in the area of industry analysis.

#### *3.3.7.1 PEST-analysis*

Grant (2005) states that an analysis of political, economic, social and technological factors (PEST-analysis) *related* to customers, suppliers and competitors (e.g. the industry environment) is vital for the ability to estimate future trends and act in a strategically effective way. Figure 3.11 presents the model.

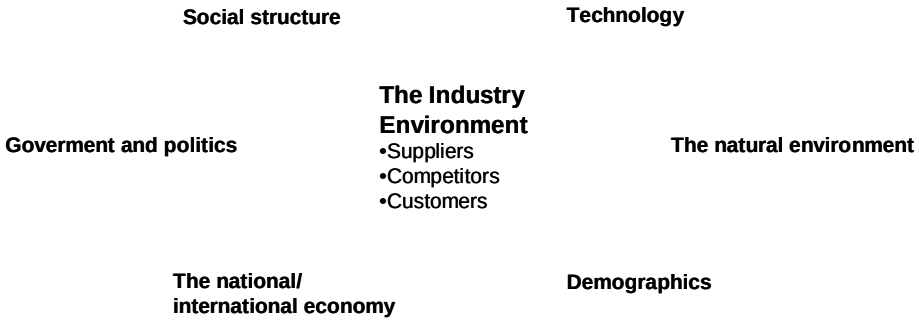



Figure 3.11 - The PEST-framework. (Grant, 1995)

#### *3.3.7.2 Five Forces of Competition Framework*

The five forces of competition framework was developed by Porter (1980) as a way to estimate the profitability of an industry balancing the power of buyers, suppliers, substitutes, possible entrants and existing competitors. Brandenburger & Nalebuff (1995) introduced a sixth force in their *value net*, suppliers of complementary products (complementors). The structure of the model and important determinants for each force is presented in figure 3.12 (Grant, 2005).

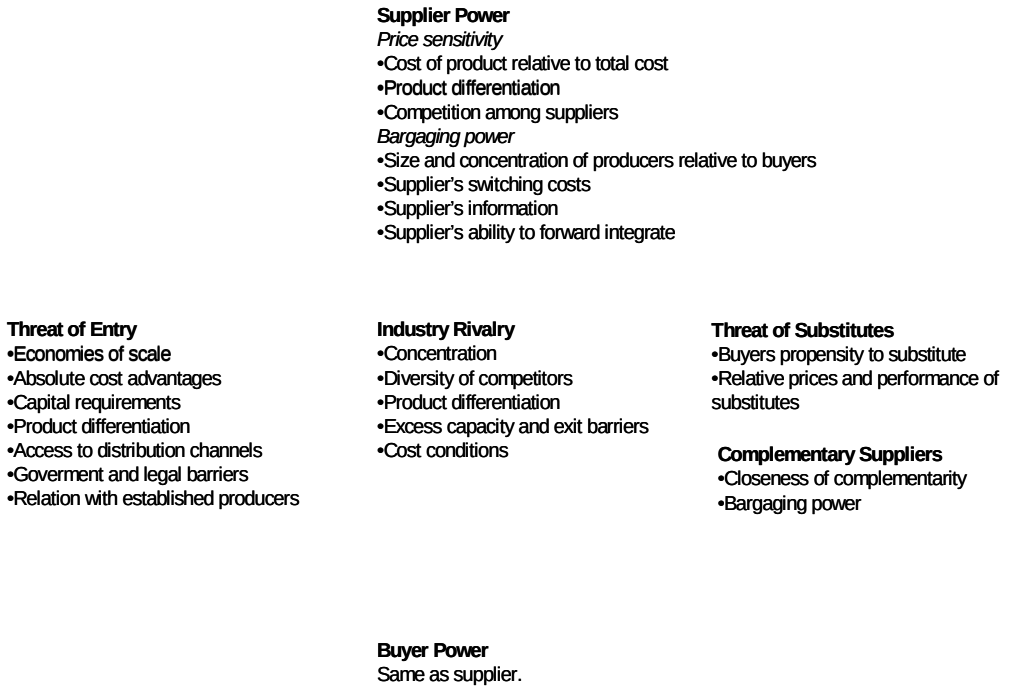



Figure 3.12 - The expanded Five Forces of Competition model including complementary suppliers. (Grant, 2005)

### 3.3.8 Disruptive Technologies

Bower & Christensen (1995) presents a theory on disruptive technologies that tries to explain why many industry leading corporations dismiss upcoming technologies that later becomes the dominant industry standard as irrelevant, inferior or simply too small to make an impact in their revenues. The basic question is why an inferior technology can be chosen over the current better performing technology and secondly how to discover these technologies in time in order to stay competitive. It should be noted that the authors make a distinction between disruptive technologies and emerging technically superior technologies according the prevailing performance metrics, which are viewed as the natural evolution that leading corporations adopt and pursue. See figure 3.13 for a figure of the theory.

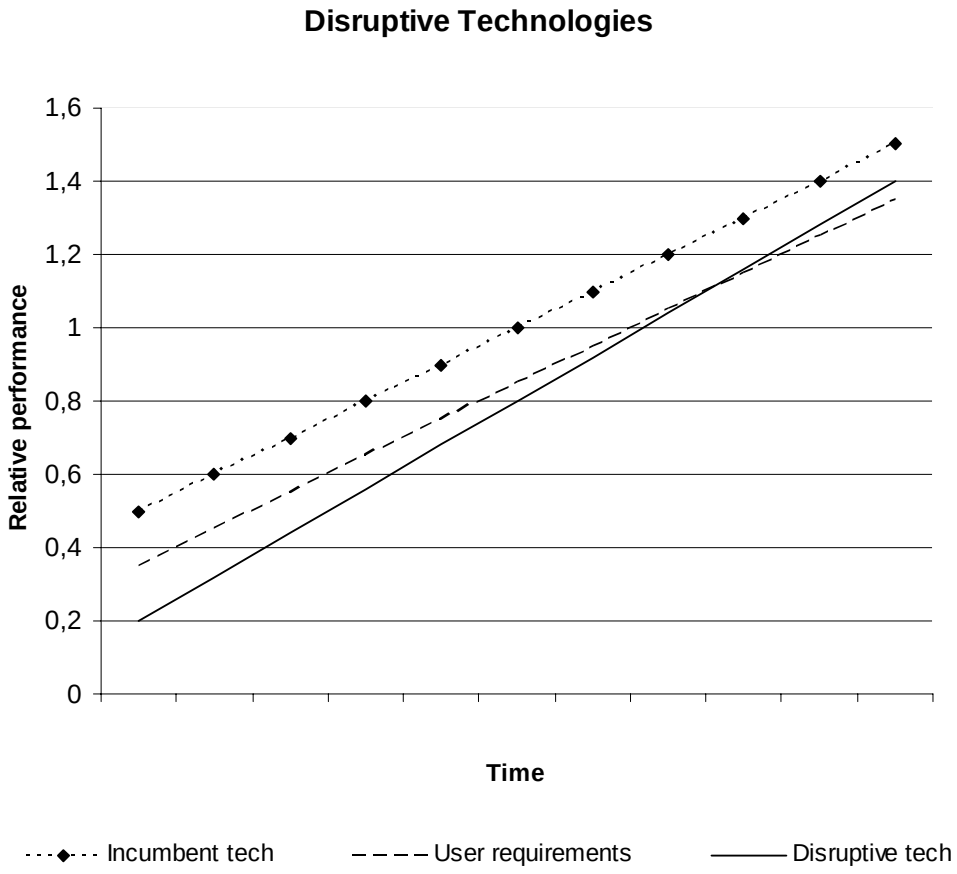



Figure 3.13 - The disruptive technology eventually reaches the required level, starting to compete with the dominant technology in the market segment and switching consumer preferences to other factors such as price or other performance indicators.

Bower & Christensen argues that when performance has risen to a satisfying level, the consumer's focus shifts to other aspects such as price or other performance dimensions. Their example of the hard drive industry states that absolute storage capacity or cost per storage capacity, the traditional performance indicators, wasn't enough. Given that their basic storage needs were met, consumers wanted drives with smaller physical size, weight and energy consumption (Bower & Christensen, 1995). In a more recent study on the matter of disruptive technologies Adner (2002) tries to explain under which circumstances disruptive technologies emerge, he argues that absolute cost rather than cost relative to performance is the decisive factor given that the performance demand is being met. Thus unit cost and not size or energy consumption should have been what made de industry switch to smaller drive sizes as soon as they reached acceptable storage capacities.

In order to spot these disruptive Adner (2002) presents a model where technologies that are initially isolated starts to overlap each other as performance rises and a technology from another market segment provides that requested performance of several segments. He argues that if one of the technologies overlap the other while the other doesn't combined with a unit price advantage makes the overlapping technology disruptive. If the overlap is mutual the technologies tend to converge and if no overlap emerges they will continue to be isolated. To illustrate the asymmetry Adner (2002) suggests that a notebook computer satisfies a desktop computer user to a much larger extent that the other way around, therefore notebooks could be an example of a disruptive technology replacing desktop computers.

Adner (2002) argues that the net utility of increased performance decreases as the performance increases hence the room for differentiation and a price premium from still having the highest performance of the incumbents quickly diminishes.

## 3.4 Summary

The literature review helped finding a quite large number of drivers of cost, market adoption and strategy, a list of the drivers are presented in list 3.1. It's important to recognise that all these drivers *can* be relevant for evaluating software service development projects. Even though building a decision model using all these drivers is theoretically possible, the model would be too difficult and effort intensive to ever be of any practical use. To find the most relevant criteria for the handset industry and the network based services this thesis focuses at, real world cases of old and current development projects at Sony Ericsson are used.

| **Development Estimation** | | |
|---|---|---|
| ***Effort*** | ***Quality*** | ***Cycle Time*** |
| Size | Size | Scheduling Pressure |
| Function Count | Scheduling Pressure | Capacity |
| Mature Processes | Data Complexity | Process Maturity |
| Intuition | Volatility | |
| Productivity Factors | Process & Management Maturity | |
| Data Complexity | Personal Capability | |
| Analogies | Quality Performance | |

| **Market & Usage Estimation** | **Strategic & Business Model Concerns** |
|---|---|
| Perceived Ease of Use | Innovation |
| Perceived Usefulness | Technology-Market linking |
| Mobile Value | Business model |
| Wireless Value | Prioritization |
| Self Afficacy | Network externalities |
| Perceived Credibility | Branding |
| Perceived Financial Resource | Industry analysis |
| Quality Performance | Disruptive technologies |

List 3.1 - The criteria for evaluation of software projects found in the literature study.

# 4 The Mobile Handset Industry

*The market, competitive environment, trends in usage and market segment sizes are all important in deciding on which services that is to be developed. By using two rather common industry assessments methods and some data on current market shares clarity can be brought to these issues and facilitate the selection of the most prominent criteria for the decision model.*

## 4.1 PEST Assessment

### 4.1.1 Political

Some nations such as Finland limit the coupling of handset hardware and network subscriptions by legal means (Svennarp, interview 2008-03-04). The European Union has also put forward legislation to regulate the rates of international voice calls and is contemplating a similar measure on data transfers (Sliva, 2007).

### 4.1.2 Economic

According to Nokia's report for the fourth quarter 2007 the total market volume for mobile phones during the quarter were 336 million units, with an estimated growth of 16 % year to year. Sony Ericsson estimates the total market volume for 2007 to more than 1.1 billion devices; Nokia's estimate is practically the same at 1.14 billion units (Nokia, 2008).

A tendency of higher growth in the emerging markets compared to the established markets is a shifting demand to entry level low cost phones (Accenture, 2006). This has resulted in a decrease in average selling prices for the manufacturers. Sony Ericsson has seen the average selling price falling from 182 € in 2002 to 146 € in 2006 and 125 € in 2007 (Sony Ericsson, 2008; Ericsson, 2007), Nokia have seen a similar development going from 153 € in 2002 to 82 € in 2007 (Nokia, 2003; 2008).

A compilation of statistics from the major manufacturers' annual reports shows that the industry has enjoyed a growth of between 12 and 44 percent annually since 2002 based on the number of units sold (Ericsson, 2007; Sony Ericsson, 2008; Nokia, 2003-2008; Motorola, 2003-2008, Samsung, 2003-2008, LG, 2003-2008). The number of handsets sold worldwide annually can be seen in figure 4.1. In fiscal year 2002 Nokia reports that China accounted for 2802 million € in sales compared to three major western countries (UK, Germany & US) which accounted for 9625 million € in sales. Four years later the same numbers are 4913 million € for China and 7300 million € for the three western countries, India not even accounting for 500 million € in 2002 were practically tied with the US for second place at 2713 million € in 2006 (Nokia 2003; 2007). Even if these numbers only apply for Nokia it gives a clear picture of the transformation of the industry. Figure 4.2 shows Nokia's total sales in these countries from 2002 to 2006.

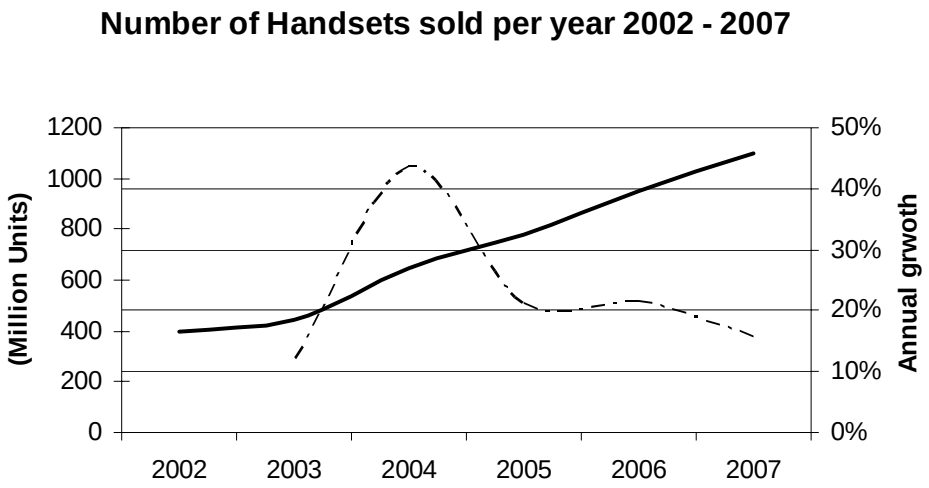
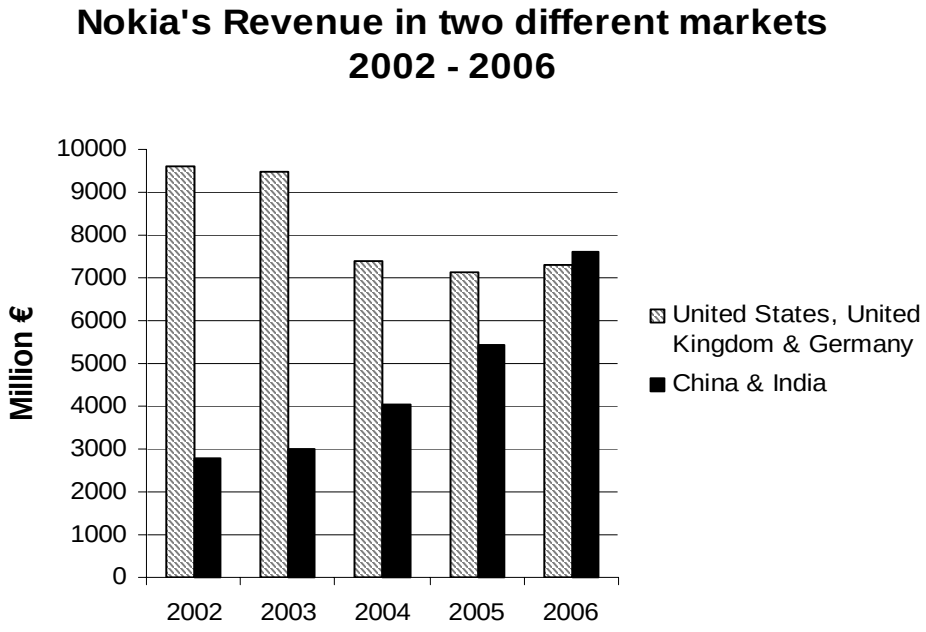



Figure 4.1 - Total worldwide handset sales. Solid line represents the number of units sold, the dashed year-to-year growth. (Sony Ericsson, Motorola, Samsung, LG and Nokia 2003-2008)

The transformation can also be shown in macro economic statistics (World Bank, 2008; US Federal Reserve, 2008). Converted to Euro-currency the economy in the three major western countries actually declined one percent in the period 2002 – 2006, in the same time span India & China grew 37 percent cumulatively as can be seen in figure 4.3.

Although still growing strongly it's inevitable that growth slows as the industry matures, and lately the growth rates have come down less than 20 percent also the trend points downwards. Accenture (2005) points out that the handset industry is likely to be more cost focused and consolidate after 2008, even if further convergence of devices can offset this time point.



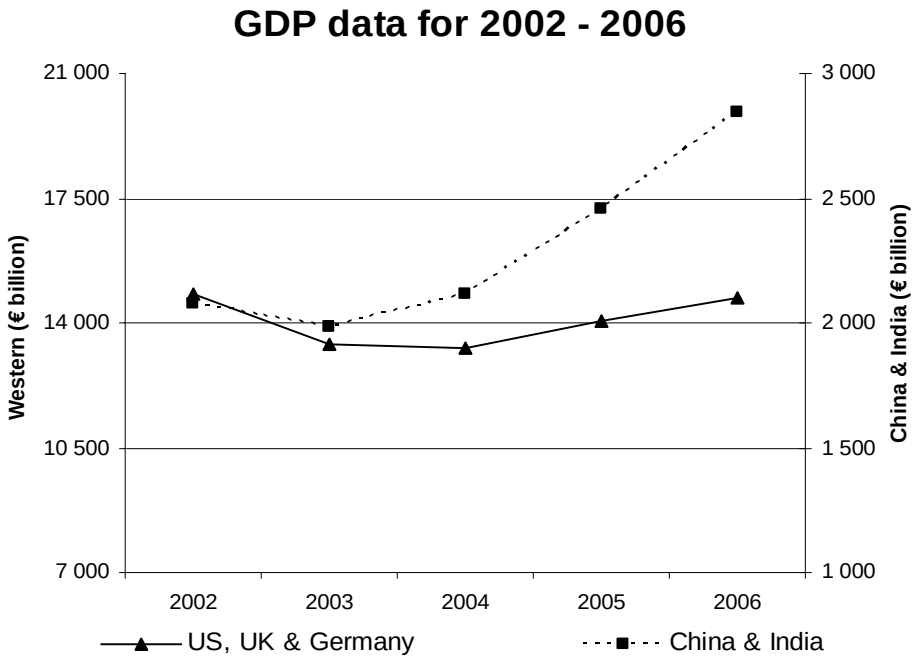




Figure 4.2, 4.3. It's clear that the revenue from developing & newly industrialized countries is becoming increasingly important in the mobile handset sector (Nokia, 2003 – 2007) and in the world economy. (World Bank, 2008)

### 4.1.3 Sociocultural

According to an industry analysis by Accenture emphasising total cost of ownership not only the purchase value needs to be lowered but also the costs of using services in order to increase market size and total revenue by tapping in to potential new customers (Accenture, 2006). In these low income countries the potential new customers views the handset primarily as a status symbol, therefore flashy but low cost features and functionality can appeal especially to the youth segment of these markets (Accenture, 2006).

On the other end of the spectrum, the high segment is expected to grow by handset replacements driven by adoption of more advanced services. Accenture (2006) also predicts an increased standardization and an unbundling of hardware and software decreasing development of handset specific applications and giving the consumer an increased number of customization alternatives.

On the other hand one could argue that only two cellular communications services ever have become mainstream, circuit switched (regular) voice calls and short message services (SMS). Even though technologies such as instant messaging, video calls and multimedia messaging services (MMS) have been technologically available for quite some time they have failed to become socioculturally mainstream (Bengtsson, interview 2008-02-11)

### 4.1.4 Technological

Implementation of new technologies disrupting the operators' traditional business model of assigning a cost per time unit and distance of calls by using Voice over Internet Protocol (VoIP) would lower cost of using voice service but at the same time force the operators to move to a flat rate business model lowering their revenue which risks alienating them. Other new techniques such as Instant Messaging (IM) and Wireless Local Area Network (WLAN) hotspot capability for both data and voice services further lowers or even bypasses the operators (Accenture, 2006).

In another study by Accenture (2005) predicts that the handset industry eventually will become like any other consumer electronics industry, the mature markets will then be driven by branding, device design and user interface rather than advanced software and operating systems. Although software will become increasingly important to differentiation steering away from the earlier hardware focus and allowing increase intelligence and usability in the devices.

## 4.2 Five Forces Assessment

### 4.2.1 Competition

Sony Ericsson delivered 103 million handsets or slightly over 9 percent of the world market last year (Sony Ericsson, 2008). Market leader Nokia had a market share of

about 40 percent. Both these companies as well as the industry as a whole experience falling average selling prices as a result of that more volume shifts over to emerging markets. Sony Ericsson traditionally has a stronger position in the higher priced segments with an average selling price of about 125 € compared to Nokia's 82 €, Sony Ericsson has a market share of 39 percent of all music enabled handsets sold to date (Nokia, 2008; Sony Ericsson, 2008). As Sony Ericsson's President & CEO Hideki Komiyama is committed to make Sony Ericsson the world's third largest handset manufacturer by 2011 an continued expansion in India, China and the United States is to be expected (Andrew & Parker, 2008).

The price pressure increases the need for economies of scale in the manufacturing and development, one way to achieve this for software services is to use common software platforms, enabling cost-sharing and more generic solutions. Sony Ericsson works with two different Java platforms in its current portfolio, allowing developers to focus on a common platform rather than unique models, newer versions of the platforms are backwards compatible increasing the potential number of users for older applications (Sony Ericsson, 2007). Other platforms such as Google's Android (Gartenberg, 2008) or Microsoft's Windows Mobile also makes software compatible across various handsets even various manufacturers (Taylor, 2008).

### 4.2.2 Suppliers

In 2006 when the analysis were made software already accounted for more than 50 percent of the development costs in the high end segment. Currently four of the five major handset manufacturers (Samsung, Motorola, LG and Sony Ericsson) has or have announced products running Microsoft's proprietary Windows Mobile operating system, Sony Ericsson being the latest with its Xperia X1 announced at the World Mobile Congress in Barcelona February 2008 (Taylor, 2008). Google's open source platform initiative Android has generated much support in the industry, free of charge and with optional free complementary software (Gartenberg, 2008).

Another important group of suppliers is the owners of intellectual property used in software such as codecs, the costs coupled with using this IP can significantly alter the unit cost of the application especially if the software is installed in large volume (Blomkvist, interview 2008-02-21).

Obviously also the hardware suppliers are of great importance, especially the platform providers controlling and licensing the communication technologies with the cellular networks (Ericsson Mobile Platforms, 2007).

### 4.2.3 New Entrants

Under the current convergence paradigm Accenture (2005) suggests convergence from companies currently making standalone devices that are being included in the cellular phones, giving their products cell phone functionality. One current example of this is Apple's iPhone. Other possible entrants of the same reason could be camera

manufacturers or companies such as Nintendo as their business in handheld game consoles are converging with the cell phone industry.

### 4.2.4 Substitutes

The most obvious substitute is wired phones, but VoIP using wired or wireless internet connections and computers or standalone phones are also viable. Other non-voice computer based communication such as chat, video links and web based communities. Internet service providers (ISP) and cable companies are two examples of major substitute providers (Accenture, 2005).

### 4.2.5 Customers

Since neither of the handset manufacturers sells directly to consumers, there are three major direct customers; Mobile Network Operators (MNO) such as AT&T and Vodafone, Virtual Mobile Network Operators (service providers who don't own any network hardware) and retail stores. In some markets such as Japan the MNOs have a dominant position while the retail channel have a larger market share in other countries such as the Republic of Korea where subsidies on handsets from the operators are illegal (Kallio *et. al.*, 2006). While the retail phones are branded and configured only by the manufacturer, the MNOs co-brand and customize the software in their phones (such as Vodafone Live!). In markets where MNOs hold large markets shares they hence also control which software that is pre-installed, making software that challenges their business model, for example IP-based chat and voice harder to reach the consumers. Although they can't stop the technology from eventually replacing their current revenue sources voice-minutes and SMS (Bengtsson, interview 2008-02-11).

## 4.3 Market Shares & Volume

Market shares have only changed slightly between the major players since 2002, all but Motorola have managed to increase their market share giving these five players an increase combined market share of 86 percent up from 75 percent in 2002. The market share distribution globally can be seen in figure 4.4 and the market shares of the major players over the last five years can be seen in figure 4.5. Growth rates over the latest five year period have stayed in double digits for all major players except Motorola every year. LG Electronics tops the group with 506 percent growth over the five year period slightly ahead of Sony Ericsson at 448 percent. The yearly growth rates for all actors are shown in figure 4.5.

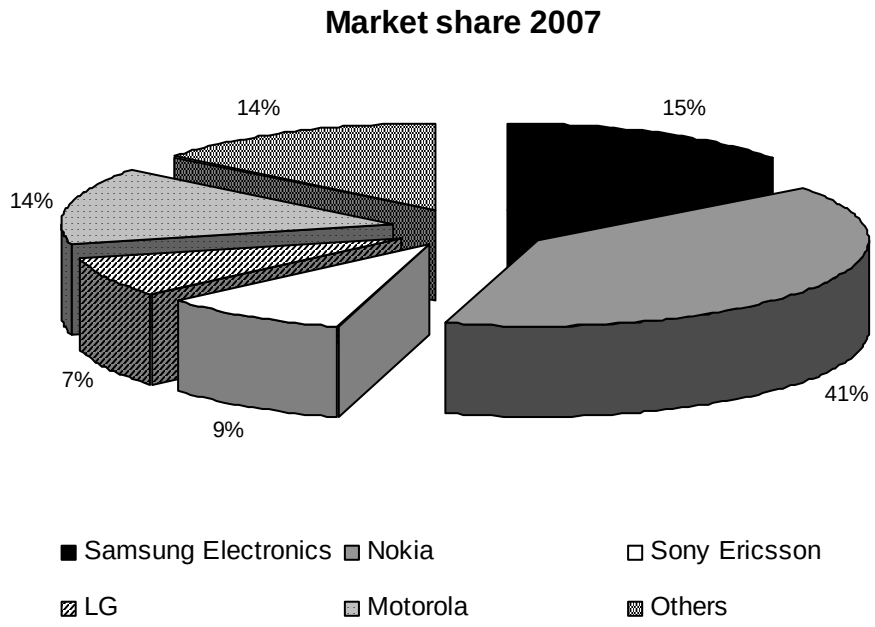



Figure 4.4 - Market share for the major vendors in 2007. (Sony Ericsson, Motorola, Samsung, LG and Nokia 2008)

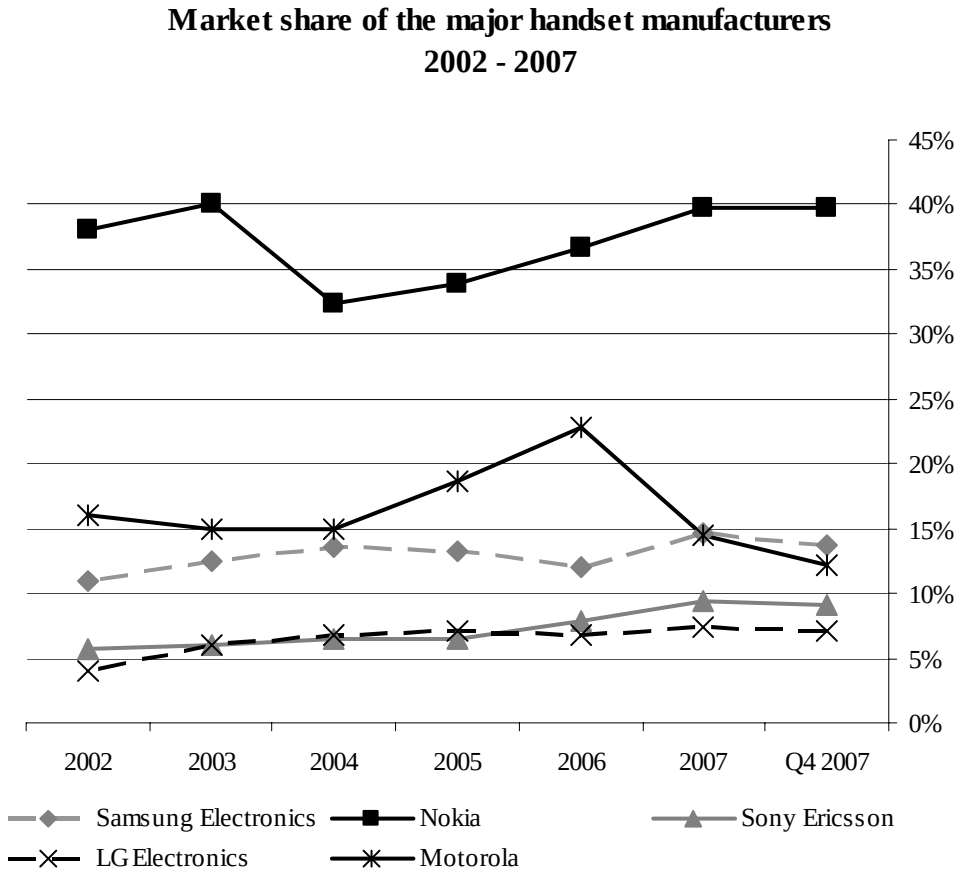



Figure 4.5 - The market share of the major vendors since 2002. Sony Ericsson (2008), Ericsson (2006), Motorola, Samsung, LG and Nokia (2003-2008)

# 5 Empirical Findings

*All the information presented in this section is based on the interviews listed in the reference list. No specific references are made in order to encourage the interviewees to speak more freely, without having to think of internal politics. The most important criteria for the decision process are highlighted in **italics** below.*

## 5.1 Development Organization

### 5.1.1 Organisation Structure

The general decision processes at Sony Ericsson are cell phone centric and software plays a subordinated role, the most important aspects of the phone projects are volume, hardware functionality and shape. Application planning the division responsible for providing content to the handsets creates application briefs and oversees the application creation process. The process typically includes a research, prototyping, pre development and development phase handled the organisational units SERC (Sony Ericsson Research Centre), prototyping and SAG (Sony Application Group). There is also a possibility of outsourcing some or most of the development. The process is depicted in figure 5.1.

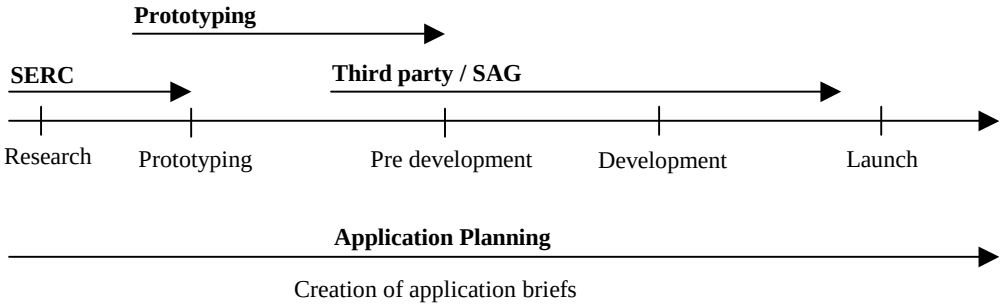



Figure 5.1 - The application creation process.

According to the developers we interviewed organizational issues seems to be the underlying common bottleneck causing a rather inflexible development process being extremely dependent on the overall platform development process, Heartbeat. The enterprise lacks an organisation structure designed to manage projects where short cycle times are required. There are considerable differences in areas such as planning and development lead times between handsets and applications. Handsets normally require lead times of approximately 18-24 months and software applications require substantially shorter lead times. This makes it unbeneficial to adapt and tie the application development process to the Heartbeat process in the extent which is done today. The applications development process which is described as an ad hoc intensive process would definitely benefit from being cut loose from the overall process for example by developing the services in java environment instead of highly dependent of the platform.

### 5.1.2 Sony Ericsson Research Centre

Projects developed within SERC (research projects) are allowed to follow a set of less rigorous criteria compared to criteria used in pure product development projects. These projects require closer feasibility studies and the ideas are backed up by solid business cases. In order to form a common process attempts have been made to develop projects on equal grounds, following an equivalent process independent of the nature of projects. This however turned out to be difficult due to the SERC unit's unique role within the overall organisation, often working with technology and projects related to gains in a longer future perspective. Projects are often run separately, and to some extent apart from the more structured parts of the organisation. The purpose of the SERC unit is to maintain a strong technical know-how preparing Sony Ericsson to meet competitor's solutions as well as requirements from tomorrow's customers.

### 5.1.3 Application Planning

The organizational unit responsible for content in the handsets have a few overall criteria they use in evaluation of new application ideas. The focus is on the consumer experience and not on technology; the application shall be relevant, easy to understand, aspirational and convenient. The focus is on what to achieve rather than how to achieve it, employees regard technology push projects (software developed just to make use of new hardware) as likely failures. The unit is responsible for planning of the future Sony Ericsson unique applications. The applications are developed and integrated into all handset platforms and the unit has developed applications such as TrackID, Sense me and Shake control.

The other major organizational barrier to planning high performance application brought up during our interview sessions is the link between the platform development and internal development of applications. Since the cycle time is much longer for the platforms and it has more rigorous test procedures market opportunities will likely be lost. The option is to plan for development of Java-based applications running on top of the platform which in most cases works flawlessly, but in some specific cases (for example VoIP) the APIs (Application Planning Interface) needed to access functions in the platform are not available in other cases the Java-layer is simply to slow.

## 5.2 Case study SERC IM

### 5.2.1 Background

Actors within the mobile handset industry are today struggling with issues familiar to the ones that Nicklas Zennström gave answers to through the successful development of the Skype software. By establishing a direct IP-connection between two computers through broadband he proved it possible to transfer voice over IP communication and

thereby also proved a great number of non-believers within the industry wrong. This way information was sent using networks supporting data transferring via package technology. The fact that current networks available for mobile traffic, UMTS and GPRS, offer maximum uplink bitrates of 64kbps and 40 kbps respectively (although EGPRS is faster) makes the resulting voice quality to poor using the technique especially when far away from a base station. Problems are also caused by the fact that the existing communication system integrated in the mobile networks does not disclose the user's IP-number nor offers an opportunity to fix an explicit user to an IP identity.

In order to develop the technology concerning the establishment of direct IP-communication between mobile clients the research unit within Sony Ericsson independently has formed a development project named SERC IM. The solution offered by Sony Ericsson allows the subscriber to connect to another subscriber through the establishment of an IP-connection. The technique requires the user to download a java client and when installed the java client enables a connection towards the SERC IM server. It is also noted as a step towards a broader technology shift toward an all IP-based communication solution developed by Ericsson among others called IMS (Internet Protocol (IP) Multimedia Subsystem).

### 5.2.2 Business case

SERC IM offers a chat service which is unique since the underlying technique makes it more *easy to use*. One of the main advantages compared to competing programs is the *functionality* which allows subscribers to be reachable without being logged on to a server. As mentioned the program has to be downloaded to the phone but can then be turned off and the user would still be reachable. The instant messenger software today available on the market requires the user to be connected to a server which generates *extra battery power drain as well as data traffic*.

The benefit of being able to reach people whether they are offline or online the technique is based on phone numbers that are used to establish the connection via a low cost SMS. After the initial SMS an IP-connection is established which incurs only a *very low cost* for the data sent and received, typically an SMS-sized chat message cost 0.03 cent.

### 5.2.3 Decision process

The decisions regarding development of the SERC IM project was formed on the SERC department's general grounds used for research projects and consists of criteria within significant areas such as *current and future trends, areas of fast paced technical development* and *areas were gaps has been identified in the company's technology portfolio*. If the gut feeling concerning the mentioned areas is found to be right the project are interesting enough and development will be initiated. SERC IM was primarily created by one key developer within SERC, a *relatively small development cost* to be able to evaluate the concept and gain more knowledge. The

approach reassembles *a real options strategy* and the following larger development cost of improving the software has been outsourced to Poland for cost reasons.

### 5.2.4 Summary

A number of criteria were identified both new and reoccurring from the theory section. The rather small initial size of the project is important to take notice of, so is the primary aim of the project; it is not a finalized product but a technology test application that later can be incorporated in products. The important criteria for the business and the decision process are summarized in table 5.1.

| **Development** | **Market & Usage** | **Strategy & Business Model** |
|---|---|---|
| Quality Performance (Data/Battery) | Ease of use | Technology trends (IMS) |
| Cost (Low initial cost) | Functionality | Real options |
| | Cost of usage | |

Table 5.1 - The important criteria found in the SERC IM case interviews.

## 5.3 Case study SERC POS

### 5.3.1 Background

From a market perspective the interest and demand for services related to GPS technology have been relative low during the past ten years. Within the mobile handset business the technology though has been put into focus throughout the last decennium. As the technology gradually has become more used in e.g. cars, customers have discovered the functionality. Interest in phones offering GPS services are expected to burst out within the coming years.

Due to the current underlying technology needs, the service requires a lot of battery capacity, has insufficient service range (especially indoors) and can only perform at a slow speed. The later issue is mainly caused by the time which today is required to fix the satellite signals needed to locate the initial position. This only confirms that there are challenges linked to the development and improvement of the GPS technique; both practical and future strategic nature. By using additional data to support the initial GPS signal screening (assisted GPS) Sony Ericson will be able to decrease the GPS lead times from up to five minutes down to fifteen seconds. The data from an assistance server enabling the assisted GPS is required to offer a state of the art GPS application, the question is though how to obtain this assistance server data in the best way.

### 5.3.2 Business Case

The development *costs related to SERC POS were rather low* and through the *prior development work* by a third party software developer the overall project development

cost where able to be estimated with only small variations. In view of the low development costs the SERC unit decided to move on for further research.

The data which today enables the crude positioning (positioning based on location a base stations in the cellular networks) needed for (full) assisted GPS support is provided by operators or other third party companies such as Google. This result in that Sony Ericsson is currently dependent on suppliers providing the accurate data on the cellular network based location. In turn this is linked to some technical issues of keeping the data up to date and bureaucratic administration. By building their own data base, saving coordinates (cell data) on servers within the company the *appropriation of value is transferred from operators to Sony Ericsson*.

The advantages of *controlling the user data* also consists of the fact that Sony Ericsson do not have to pay operators to access the information which during current conditions is very expensive. Controlling the cell data adds *future business opportunities* and the potential business model of selling the user data to other companies. This way Sony Ericsson could offer companies a direct market channel where users could be targeted with personal commercial and information. By building their own cell data consumers using the application will gain from a faster GPS technique and remaining users (which has no GPS receiver) will *gain the possibility to get a rough positioning* based on which network cell they are currently connected to.

### 5.3.3 Decision process

Sony Ericsson was initially contacted by a third party software company with the expectations that Sony Ericsson would show interest in their positioning service application. The product was based on GPS technology and its unique selling point was that the application allowed the user to find his/her friends by showing their position on a map. The SERC unit identified the service as an interesting option to locate base stations and also acknowledged the possibility of using the application within the SERC IM project, adding value to the already existing concept. The decision initiating the project was motivated both by the fact the application would *create value when integrated* in the SERC IM project as well as the future gains by using assisted GPS. The latter reason was backed up by strong *strategic benefits*.

The continued development and adjustment of the application was performed by programmers from the supplier and SERC bought their services on a floating basis adding *flexibility into the development process allowing for quick decisions*. According to the decision makers there *were no formal decision criteria* concerning the development of SERC Pos project but rather an attitude which was driven by the mindset; let´s try and see what happens (*trial and error*).

When the demo software was finalized a contest was initiated within the SERC team in order to put some excitement in the necessary process of collecting cell data by

reporting the position of unexplored base stations. Theoretically the technology could be used when tagging location of pictures shot with the cell phone and other forms of integration or *convergence*.

### 5.3.4 Summary

SERC POS is clearly regarded as a technology investment that will support new features in other programmes rather than as a block-buster stand-alone application. The outsourced development organization allows for flexibility and consumes only a small amount of internal man power, making the scheduling and prioritization arguments irrelevant. Several strategic benefits can be pointed out the most important being creation of new knowledge of the users but also the service's possibilities to create value in Sony Ericsson's key business segment of camera phones. The complete list of identified decision criteria can be seen in table 5.2.

| **Development** | **Market & Usage** | **Strategy & Business Model** |
|---|---|---|
| Cost (Low initial cost) | Functionality | Value appropriation |
| Flexibility (from sourcing) | | Information on users |
| | | Real options (future business) |
| | | Convergence |

Table 5.2 - The criteria identified during the SERC POS study.

## 5.4 Case study - Blogger

### 5.4.1 Background

Blogger was developed to offer consumers a smart way to actually benefit from their mobile camera as well as the power of communicating expressions through pictures. Blogger a as a service makes is possible for the users to take a photo or record a video and then blog/upload it on the web to share live experiences. When blogging the media the user fills in a title and a description and the blog item is sent to a server and published on the web allowing any user to view it. The service also will, in the future, enable the user to add geo-tags to pictures showing the location where the picture was taken. The application was launched in connection to the cyber shoot handset.

### 5.4.2 Business case

The goal was to develop applications that *fit in* and naturally can be *related to the existing company value propositions* such as imaging, music, games. In the case of blogger (connected camera) there was an obvious link to the existing cyber shoot handset (imaging) which facilitated the decision making. Blogger adds a *unique value* by enabling and stretching the current cyber shoot brand by expanding the brand from the pure camera functions to also include services that are dependent on the camera being connected. The business case was build upon the advantages in *connectivity*

gained from offering a connected camera compared to the current service and thereby increasing the value and usefulness linked to the existing cyber shoot.

### 5.4.3 Decision process

The process regarding blogger was, similarly to applications of comparable nature, quite ad hoc. The process focus has decreased within the unit and most of the effort and focus are today put on finding attractive applications with a high ease of use, rather than following rigid processes. The main criteria is based on that the applications has to create value to the consumers and to achieve this the application planning unit works in close connection with areas such as user experience and product planning. The work is about inventing promising applications based on extensive research were actual and future trends as well as competitor's behaviour (Apple and Nokia) are studied closely and function as essential input. By studying relevant blogs, attending conferences and using internet as a tool for discovering innovation and behavioural change among consumers new ideas are born. When the application/need is identified, the idea must be presented and communicated to colleagues in order to secure an organizational buy-in. The actual decision regarding whether to continue or not is made later in the process and becomes a result of how well the idea is rooted.

The fundamental question when developing new unique Sony Ericsson applications are; whether the user buys SEMC products and in that case why? Understanding who the users are is crucial for successful application development and by asking questions such as what are the elementary needs and in what segment to these consumers belong, the user can be pointed out. As in the development of blogger the question addressed was who will really use this application? The initial answer was users who on regular basis writes diary but after doing further research they realised that this segment wasn't really the actual target group. They identified a new target group, picture bloggers.

A couple of years ago most of the services were developed by programmers within Sony Ericsson but today third part developers are being used whenever possible. As examples of applications that have been developed by external resources TrackID (Gracenote) and blogger can be mentioned and the underlying strategy is *to take advantage of already developed code*. Within application planning unit the common opinion is that the future trend will head against an even greater use of external resources when developing new applications and that the process would gain from this development.

Business cases are especially applied on hardware basis and it is hard to actually evaluate and calculate the actual value added by the development of a specific application. The basic criteria when initiating the development process is, as mentioned earlier, that the application shall *add a unique value* to the customer as well as *be corresponsive to the company strategy* and company propositions, music,

imaging... Some services have great impact in terms of marketing (valuable when introducing a new product or strengthening the communication of existing propositions) while other services are developed with a more long term motive. As an example of the prior the first shake control can be mentioned and as example on the latter PlayNow.

### 5.4.4 Summary

The blogger application's close connection to the cyber shoot brand as well as the application's enhanced effect on level of connectivity was crucial to the development of the application. As in the development of SERC Pos the outsourced development permitted a high level of flexibility and little internal resources. The fact that blogger was aligned to both the company strategy and the imaging proposition supported the decision making. Except the strategic benefits market potential and usage was identified through extensive market studies. The criteria found important are summarized in table 5.3.

| **Development** | **Market & Usage** | **Strategy & Business Model** |
|---|---|---|
| Flexibility (allocation of external resources) | Connectivity | Convergence |
| Extensive research mission (most relevant small projects are developed) | Value to users | Strategic fit |
| | | Branding |

Figure 5.3 - The criteria found most important to the Blogger project.

## 5.5 Case Study - Track ID

### 5.5.1 Background

As the music proposition within Sony Ericsson has become extremely successful the development of the track id application was a natural step. To further enhance the company's position within the music area and thereby further strengthen Sony Ericsson brand recognition in the area of music. Track ID today statues a great example of what within Sony Ericsson is defined as *wow service* giving the user a unique and value adding experience. Although tracking music is not revolutionizing and unique as a service the idea of providing the service via a handset was groundbreaking.

### 5.5.2 Business case

The track id application adds value to the customer by providing the user with track relevant information such as title and artist. The data will appear in the display after recording a fragment of the requested song and the recorded information has been compared to a music archive. At the time, similar services existed but were only available on the internet. Developers within the application planning unit however estimated that putting the application in the handsets and thereby *making the service*

*wireless* definitely would bring benefits to users. From the perspective of Sony Ericsson a great number of potential users could be addressed by distributing the service through their handsets and *synergizes between Sony and Ericsson* could be taken advantage of in the very best way.

For the majority of application projects the application planner responsible for TrackID states that it primarily due to three reasons would be difficult to motivate the development of the application by merely putting numbers to it. The first reason is that in general terms it is hard to get an estimate reliable enough to be worth using. Secondly when having put together an adequate case built solely on figures it is unlikely that the case actually can support further development from a business case point of view. Third an application as TrackID will, if it is successful generate increased credibility in the perception of Sony Ericsson as being a competent player in the music / handset business as well as increase the company's brand recognition. Most services simply does not have a solid standalone business model, they rely on creating increased value (and thereby price) on bundled hardware. The potential level of *gains in perception and brand recognition* is difficult to estimate and putting numbers on these soft values allowing them to show trustworthy facts becomes even more complex.

### 5.5.3 Decision process

As explained above building a decision using a traditional business case would not take all aspects into consideration. Instead criteria such as *strategic fit* (*described as DNA-correlation*) towards the overall company strategy, level of *uniqueness and look and feel* and *consumer perception* related to the service was taken into account. Questions like can the application support *the organisation's current value propositions* and which *emotion is communicated* had to be addressed. Other criteria that is of general importance when developing Sony Ericsson unique applications is *ease of use, relevance, convenience and aspirational effect*, these criteria all have in common the fact that they focus deeply on the *user experience*.

The application planners ask themselves the questions, what do we want to achieve and what performance do we need to deliver? If the application unit reach the conclusion that they lack the resources to be able to *guarantee a certain level of quality* or customer value they step back and wait for the *technology to mature*, timing is important. This is a priority/decision process which is aligned in the corporate strategy and separates Sony Ericsson from other large players within the business. Other players employ a strategy that includes communicating technology leadership independent of the quality of the user experience aimed at early adopters.

Of great importance in the decision process of track id was the fact the application could be used to improve Sony Ericsson's bargaining power when negotiating with operators (when selling SEMC hardware). Also, using the application would most

likely enable later revenues streams both for SEMC and the operator, generated from the PlayNow application due to their close connection.

### 5.5.4 Summary

TrackID was developed with an imaging focus; the product has no mean of building network effects or generating income from direct use. Its main purpose is the increase the value of primarily the music oriented phones by enabling a "wow" service. The only mechanism identified for the product to generate a cash flow is through coupling with a music store, at the same time use of the service costs Sony Ericsson money which has to be considered an investment in the Walkman brand and to enable increased revenue from hardware sales. The identified criteria in the decision making are listed in table 5.4.

| **Development** | **Market & Usage** | **Strategy & Business Model** |
|---|---|---|
| Quality performance (Technological maturity) | Uniqueness | Synergies with Ericsson / Sony |
| Quality | Ease of use | Branding |
| | Relevance | Strategic fit/Support of current value propositions |
| | Convenience | |

Table 5.4 - The criteria considered while developing the TrackID application.

## 5.6 Case study - PlayNow

### 5.6.1 Background

To enable distribution of downloadable content such as music, ringtones, games, themes, movies and wall papers the planning of a portal, PlayNow was initiated. From one perspective the development of the service was considered as a brilliant an innovative *strategic move*, but yet from another perspective it was a necessary step in order to stay competitive against other actors.

### 5.6.2 Business case

PlayNow was in contrast to most other services unique in the way that the underlying structure allowed the application to *independently generate income that could be traced directly to the level of consumption*. The payment system coupled to the service covers a variety of alternatives depending on the characteristics of the media, were the main alternatives include purchasing, subscription, and rental systems. The initial issue when examining the business case is the actual excessive price that the end consumer has to pay when downloading the media content from the web. This is

however unfortunately often the outcome in cases where *the service requires involvement of powerful intermediaries* such as content owners and operators. .

There has been marketing campaigns exploiting synergies in between Sony Ericsson and Sony's record company Sony BMG. But the synergy effect isn't as strong as other synergies such as Walkman and Cyber-shot since those are mutually exclusive. Neither Sony Ericsson nor Sony BMG wants to be exclusive.
Reklamkampanj med Sony BMG artister.

### 5.6.3 Decision process

PlayNow was developed internally and due to the complexity of the service, including questions within areas such as DRM (Digital Rights Management), mean of payment and the operators' role lots of resources where put into the process. Because of the *existing market conditions* where the operator's hold an extremely strong position, both as *service provider (or enabler)* and as a particularly important *distribution channel*, it was in the case of PlayNow hard to settle a favorable agreement and thereby develop an efficient and beneficial solution offering end consumers a competitive price. Operators providing the infrastructure are aware of their value and normally cut shares of 40-50 % which off course stretches the download payments. *Trends* in the mobile handset industry although pointed out that more and more handset actors were initiating development of their own portals, underlining *the importance of Sony Ericsson not falling behind*. Within Sony Ericsson the opinions where split in two parties where one party supported the development while the other side had a rather unenthusiastic stand point regarding putting further resources on the project.

### 5.6.4 Summary

PlayNow was initiated on strategic brand incentives but also as way to bring revenue streams from downloading. The purpose and underlying ideas and effort to create a useful media portal was completely aligned with the company proposition strategy. The result followed by the intern development process however has a lot to prove both in terms of customer usefulness/ease of use and in terms of charging rates. By using a business model that forces the content price up to about ten times the cost of competing alternatives the benefits and excess value probably just don't make the offering reasonable most users. From a short term strategic point of view the question is relevant whether the launch of PlayNow in fact does not damage Sony Ericsson music brand to a greater extent than it strengthens it. In the long term though PlayNow probably will gain a better public perception, but the future development is strongly correlated to the progress of the operators as well as costs of digital rights and intellectual properties. The identified criteria in the decision making are listed in table 5.5.

| Development | Market & Usage | Strategy & Business Model |
|---|---|---|
| Technological Complexity (DRM related issues) | Trends towards in house services | Follow trends |
| Business Complexity (Infrastructure related issues) | Ease of use / usefulness | Value appropriation |
| | | Revenue generating business model |

Table 5.5 - The criteria found important in the PlayNow case study.

# 6 Analysis

*The aim of the analysis chapter is to perform an initial screening of the material from primary and secondary sources and synthesize a number of criteria for the three dimensions of the decision model. As stipulated in the method chapter this constitutes the first step in the process of building the decision model, in chapter 7 we will build the generic model. Chapter 8 & 9 will focus on adjusting the model for use at Sony Ericsson.*

## 6.1 Development Estimations

### 6.1.1 Cost

Starting with the cost estimates the literature suggests effort, size, function count, mature processes, intuition, productivity factors, data complexity and analogies in order to estimate cost. Effort has a clear correlation to cost, and can be used as a substitute for cost but it doesn't help estimating cost. It just transfers one estimation problem into another one; one scenario where this criterion can be useful is sourcing of development projects where an external cost substitutes an internal effort. Estimated internal effort corresponds to an internal cost which can be compared to the price of sourcing, but otherwise this isn't a viable criterion for estimation of cost.

The interviews indicate that a fairly large fraction of the projects are developed externally or will be developed externally in the future. This transforms the development estimation problem to a sourcing problem and might be a good way of benchmarking the efficiency of the internal software development. It might also help the organization to make better estimations knowing third party estimates which works as independent experts.

Size as described in the theory chapter is naturally correlated to effort and hence cost, but as stated earlier size is hard to estimate in advance and the studies have focused on statistical comparison between known efforts and sizes. In order to use this as estimation tool, first a thorough understanding of how to estimate size is needed. A relation between size and effort in projects of similar difficulty, quality demands and programming language are also needed. The case interviews suggest the best way to predict size is by comparing the specification to already completed programmes with similar functionality, but this process is best described by analogy estimates in the theory.

Function counts or use cases are a theoretically and practically more viable way to go than source code size. Especially since the first estimates are easier to make, when the specification is somewhat complete it's possible to estimate the number of use cases or functions somewhat accurate. The case studies showed that the handset applications are usually rather small and most of the effort to develop them is not related to implementing the basic functionality which often can be done by a single

programmer in a matter of months. The largest effort lies in compatibility across all different phone models and platforms, bug fixes and securing consistent high quality of service. Therefore function count can be of some assistance but mainly the approach will be analogy based, accounting for the effort unrelated to the number of functions as well.

Most small projects, that are estimated to have a low budget and are deemed relevant are run without any more detailed review if they can be staffed as a part of the real options based strategy to not miss out on opportunities that will be discussed later. This is described as a part of building a broad knowledge base or to *fulfil an extensive research mission*.

Most of the research regarding mature processes is related to a different kind of projects, much larger than those in the handset industry. The theory section on mature processes at Motorola (Diaz & Sligo, 1997) doesn't concern their handset business, it concerns large defence related projects. One of the case interviewees made a parallel to the manufacturing industry, measuring and refining processes to tweak productivity and quality makes sense if you have large volumes, but if each product is new and unique it will not help. Mechanisms for improving both consistency and productivity by process maturity like reuse of code, isn't likely to be possible in this environment. Probably improvements of process maturity have positive effects on mobile handset software development as well, but the correlation needed to use CMM maturity level as an input in estimating total effort seems farfetched. Also this indicator being an *organizational* parameter doesn't help in the selection in between two internal development projects as they share all organizational factors. But it might improve the accuracy of analogies with development projects in other organizations. Quite in the opposite flexibility in the development organisation and sourcing of development efforts are considered as important to decide on committing resources to development.

Intuition based estimates or guesstimates have been shown to be unreliable and to underestimate development costs, still the interviewees indicated that guesstimates were used especially in research projects, coupled with *a real options based approach*. Since the effort to develop the basic functionality is relatively small, an estimate error is likely to be minor. After the initial development the uncertainty has decreased and a better guesstimate can be made. Experts' opinions have an apparent risk of being biased, especially if giving an optimistic estimate on how much effort that will be required grants green light for an expert's pet project. Transparent expert intuition-based estimates by several independent experts (e.g. not working with anything related to the project in question), with peer reviewing of the assumptions made has been suggested a possibility. It isn't without drawbacks but combined with the real options like approach and tracking of earlier miss predictions it could be a viable criterion, minimizing the risk of large miss predictions.

Another way of viewing especially the SERC projects is to view them as broader research efforts in order to ensure that Sony Ericsson stays up to date on new trends and technologies. Even if the specific application fails the effort will be worth something to the organization, options for further development and knowledge would still be acquired. Building knowledge and thus minimizing risks on a portfolio-level and making sure to follow all trends in the industry are seen as sound investments. Although some level of prioritization and focus are vital to not spread the company's resources to thin therefore these broad arguments of creating options and minimizing risk cannot be included as a decision criterion.

The group of criteria assorted as productivity factors including application category, language, required software reliability, main storage constraint and the use of modern programming practices or software tools can be divided into two categories, application dependent and organisation dependent. The application dependent factors category, required reliability and storage (or other) constraints can be useful in evaluation processes, especially when coupled with the quality performance framework. The organization dependent factors can only be of value when comparing the other organizations since these factors is equal for all projects.

The application category and the hardware the software will run on helps determining the constraints and requirements on reliability. Services that lack immediate alternatives obviously have lower demands on quality performance than applications competing with alternative applications or methods of satisfying the same need. Converging of formerly separate devices drives the need for "check box" features, with somewhat lower demands on quality at least initially. This foremost puts technical constraints on the hardware, but as pointed out in the case studies it's important to have APIs in the platform to support the functionality of the new hardware and the converged features it brings.

Later when evaluating the strategic criteria questions of what Sony Ericsson aims at achieving with its brand this will be important. Prioritizations in the platform development set limits for the higher level applications. Examples illustrating this are SERC IM which theoretically could achieve more functionality like VoIP and SERC Pos which could reach better non-GPS positioning using more information on signal strength and found not currently active cells. In these cases it's not the hardware itself that is the delimitation; it is prioritizations in the available resources in development of the Java platform.

In other cases the constraints are of a more technical nature, like the time needed to transfer files or playback time under a given memory size, or maybe the hardware lacks computing power to perform seamless playback without time consuming optimizations of the software. The other possible trade off, lower quality to reduce size and computing power needs might also be unsatisfactory, given what Sony Ericsson wants to communicate to its consumers. Both these types of application

dependent productivity and/or quality factors are viable evaluation criteria, at least in the short term.

Data complexity is considered a cost driver in the literature that can be countered by increased structure especially if the code is volatile. In the case study service complexity in the nature of services that incorporates multiple interacting systems located in multiple companies, for example banking services are considered problematic. Even though these criteria aren't identical they point at a similar problem, services which employs applications and databases that are hard to understand the interconnections in between tends to be costly. The same can be said for applications that set high demands on the Java-platform needing new APIs or needs a high level of optimization to run smoothly, adding complexity to the internal software structure. Also there seems to be an opinion that complex services including other companies that needs to build complementary systems (such as a handset based payment system which needs new payment terminals) often ends up with a too long cycle time.

The last point in the cost estimation part, analogies, seems to be the single most important factor, much of what the interviewees call *gut feeling* and have a difficult time explaining and sometimes defines as experience are actually *implicit* analogies. The experience is based on earlier projects of similar nature, so structuring the analogies criteria can make a significant contribution in improving cost estimates. Even though many projects are of a one of a kind nature, other companies have made similar applications and perhaps other good parallels to earlier internal projects can be made as well if those projects solved a similar problem with another purpose.

### 6.1.2 Quality

As mentioned in the theory chapter two different types of quality are suggested in the literature, functional and non-functional. The functional quality that essentially measures the number of defects in an application is suggested to depend on the criteria size, scheduling pressure, data complexity, volatility, process and management maturity and personal capability.

Since size is a rather obvious driver of defects the thesis chooses to include it in the definition of functional quality. Scheduling pressure is an interesting driver since studies indicate that there is an optimal scheduling pressure, too much slack resources sub optimizes productivity while to tight deadlines tends to sub optimize quality. In the larger context of a handset manufacturer, the software based services must be coordinated with important hardware and/or platform launches. Therefore it's important to recognize this factor when choosing projects to pursuit at any given time; even if the service has merits on its own it must be able to get reasonable resources in order to not compromise quality.

The complexity and volatility have already been discussed in the cost section, but it's important to stress the effects on the perceived usefulness and non-functional quality. Endless updates on rather slow and often costly mobile internet connections that are needed to provide critical safety and error correction are detrimental to user experience. As discussed later it also lowers perceived credibility and ease of use, if a service needs constant updates the consumer will get the impression that he or she initially and probably still is using a somewhat flawed application.

Even though both process & management maturity and personal capability are important determinants for the quality of an actual project these parameters are equal for all internally developed projects so they can't be used as a selection criteria. Although they can, as mentioned in the cost section, be used as a benchmark when service development is being outsourced.

Quality performance as described in the theory is of fundamental importance in deciding which projects that shall be developed of foremost two reasons; first on the market the perceived usefulness is linked to how rather than if a programme can perform a given task and second it links effort to competitiveness. The framework can hence be used to determine the quality of service that can be provided given a set of criteria such as resources, hardware and competitive situation. Take the SERC Pos project as an example, a purely technical functional quality would focus on the absolute positioning error and time consumed to lock on the coordinate, while the cell positioning assistance probably could be overlooked. But besides providing a faster mean of positioning and downloading the correct map at an earlier stage it also serves less sensitive positioning needs such as tagging of photos or giving a location to chat or internet community services. In these cases the user is satisfied with the city rather than the exact coordinate or address. Besides the quality performance needs some strict quality concerns are raised, the software must be in line with what Sony Ericsson wants and stands for even to the general state of the technology is unrefined. If a technology can't deliver on these "sanitary" quality targets the case study finds it better just to wait with launching the technology. This criterion can although be considered to be included in the quality performance and branding criteria.

Our opinion are that functional quality or "check box" features rarely is the foundation of any differentiation or long term competitive advantage so therefore it's more profitable find ways to satisfy more ambiguous needs such as the experience aspect of non-functional quality.

### 6.1.3 Cycle Time

Scheduling pressure and capacity are obviously important since the case studies show that the list of features that the organization wants to include in the platform is about ten times the capacity, the capacity problem is obviously important on an application level as well. Therefore application development must coincide with prioritizations in

platform and hardware development in a way that makes the services developed of as great value to the consumers as possible given the constraints in available resources.

### 6.1.4 Conclusion

In the cost estimation dimension analogies, intuition, complexity and productivity/ quality/technical constraints were identified as the most suitable decision criteria. As both intuition and analogies are based on the work of experts and their experience and knowledge these two are joined together in a *cost & time* driver. The *complexity* criterion is also selected as a cost estimate in the decision model since it is mainly a technical issue. The constraints criteria are interconnected with the usage and strategy dimensions so these concerns will be introduced later.

### 6.1.5 Definitions

The cost & time criterion is defined as a transparent best estimate of the development effort by an unbiased expert based on implicit knowledge of earlier projects and is the only criterion that estimates the extent of the project effort. Complexity is defined as technical issues related to the number of companies involved in supporting the service and the complexity of the data structure. The other criteria will be considered in the other dimensions as suggested by the text. Figure 6.1 shows the development aspect of the model and its interconnections.

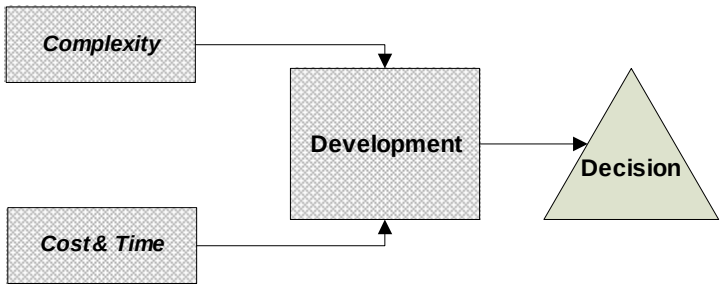



Figure 6.1 - The development dimension of the decision model with the two selected estimation criteria, cost & time and complexity.

## 6.2 Market & Usage Estimations

The literature study a number of criteria suitable for estimating usage and total market for new software based services. The approach is basically to look at two factors; the customer's perceptions of the product (ease of use, usefulness, credibility and

financial resource) and the value that is created through the services mobility and wirelessness.

The ease of use factor is supported by the case study, every additional button that needs to be pressed loses half of the users is a common perception. But several employees also stresses the financial aspects, especially young users who would be the first to adopt new technology is very price conscious. Primarily the concern is the pricing of data transfers in the networks. This constitutes two problems, first the price might be too high and second lack of information regarding the price or how much that currently has been used might scare people from using the service both ultimately decreasing usage.

But there is more to the financial resource criteria than cost of the transferred data, if the application has some form of revenue generating purpose the cost of buying, subscribing or using the service is of uttermost importance. Currently the price of buying music via the PlayNow application is prohibitive for a larger market. Paying 20 SEK (about 3.30 USD) for downloading a song that costs 0.99 USD on Apple's competing iTunes service (Apple, 2008) will lead to that very few people thinks it is worthwhile using it. The pricing will also make a purchase of the actual album on CD more economical, and this is before any costs of the data traffic the transfer will generate. Actually under Swedish operator Telia's pricing scheme (Telia, 2008) of 20 SEK per MB or 69 SEK per day a single song could end up costing the user 89 SEK (about 14.80 USD). If the current pricing scheme had been anticipated when estimating the adoption (and not just the feature or installed base) the prediction that almost no music would be bought through the service would have been obvious and hence it should have been a clear indicator not to develop.

The cost of usage aspect were pointed out as an important factor for the SERC IM business model, which practically lets users exchange text messages without incurring the cost of a new SMS for each sent message. Besides that the concept aims at lowering costs for media sharing; for instance a normal MMS picture (40 Kb) will be priced equally in the most expensive use case and be free of charge or significantly cheaper to transfer via SERC IM in other use cases.

Experience from the business model of viral propagation in the SERC IM project stresses another of the perception dimensions, security. As the handset needs to download the application from the internet and install it, the user is asked if they want to install the application even if the system can't verify that it's safe. Users who are used to download material on their PCs may not be deterred by this but less IT proficient users wanting to avoid any problem they cannot solve are. This is somewhat linked to the theory's self afficacy, or one's individual belief about her ability to perform well in a given situation.

A correctly developed service with good information should be able to minimize the credibility issue as well as the concerns of self-afficacy and costs of usage as long as

agreements with content providers at fair rates are possible. For example flat rate on usage, understandable download instructions and certificates that avoid safety questions or even better, preinstalled software. The other two perception dimensions ease of use and usefulness are more critical since they concern the design and idea of the application itself. In order to be perceived as something a customer really wants and intends to use (in turn a prerequisite for actual adoption) the product must fill a need or desire of the consumer, in a way that is convenient enough to be perceived as valuable. In the cases the usefulness aspect was described in terms of *relevance* and *functionality* and is in one or another way highlighted in four of five cases. In this terminology a focus is put on need fulfilment.

As suggested in the literature the two primary ways of adding value through a handset is mobile and wireless value. If the service can't add either of these it's probably no need for this particular service in a cellular phone. This issue can be linked to the issue of general convergence of devices in the industry and the need for new services based on this. Most of the convergence adds mobile value since most users carry their cell phone with them anyhow, but it also leads to questions regarding the value creation of some possible convergence areas starting to become increasingly possible from a technical point of view. For example even if you could create support for most PC applications in a handset it would likely not be perceived as a reasonable interface for working with somewhat complex documents, spreadsheets or other files. This sets limitations for what users perceive as valuable especially if the theory is combined with the quality performance theory. This will account for the relative value in relation to stand alone devices or PC-based applications but also to the relative performance of competitors.

The interviews actually pointed toward this aspect, both Blogger and SERC Pos that uses integration of new hardware (convergence) coupled with the added value of being wireless. Also the interviewees pointed at integration with other applications as a major reason for developing the SERC Pos software in the first place, adding new mobile value to features such as instant messaging, online communities and photography through adding location information. The case study of blogger brings up connectivity in the sense of integration of different devices (that are converged in the cell phone) and the internet as a decision criterion. The TrackID case brought up convenience as another way of describing the value created by integration and internet access to the range of devices the handset represents.

The last factor in the market and usage dimension is the installed base, or the total number of devices that comes with the software factory installed, or at least with a platform that enables running the software if it's downloaded. The total number of users will be the fraction of the installed base that has the behavioural intention of using the application.

### 6.2.1 Conclusion

The usage dimension consists of the criteria (1) perceived financial resource (total cost of usage), (2) installed base, (3) perceived usefulness, (4) perceived ease of use, and (5) quality performance. The latter three describes the value the software provides in comparison to alternative products or ways of serving the same need. These aspects consist of mobile or wireless value and are merged into a single criterion, *perceived value added*. The two other criteria *total cost of usage* and *installed base* are added as decision drivers as is.

### 6.2.2 Definitions

Total cost of usage is defined as all costs for the mean end consumer to acquire, subscribe for and use the service (or other way of estimating expected cost). The installed base can either be defined as the total number of handsets that can download and run an application or the total number of devices estimated to be shipped with the application pre-installed. And perceived value added is defined as the combined value for the consumer from mobility and wirelessness. The market dimension with the criteria is illustrated in figure 6.2.

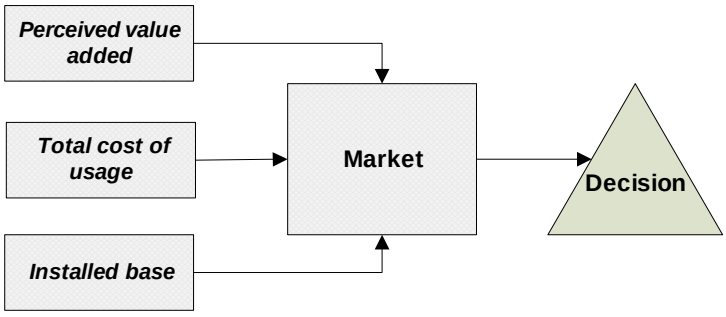



Figure 6.2 - The market dimension of the decision model with the three selected estimation criteria, total cost of usage, perceived value added and installed base.

## 6.3 Strategic & Business Model Concerns

The innovation aspect of the strategic & business model evaluation should primarily answer the question of whether the idea a service is based on is truly innovative. If it is innovative it should also evaluate if it fits with the company's current strategy. This evaluation is closely linked to the prioritizing processes suggested and the very core of the decision model this thesis aims at developing.

Ideally good, innovative ideas that strengthens the brand should be encouraged to grow into viable services while less innovative either should be developed as a pure *me too product* or skipped entirely. The non-innovative products tends to difficulties providing value, if not a pure low-price strategy is used. If the idea is new or is easy to evaluate, a simple competitor analysis should be sufficient and if it fits with the brand and strategy of Sony Ericsson is also quite simple to determine. The tricky part is to evaluate the market potential of truly new ideas, in order to sort out the ones with potential. Basically a new successful technology-market link must be established for each successful service, as suggested in the theory chapter.

Needs and trends in the market place must be understood and matched with technical possibilities. Data from Ericsson Consumer Labs on needs and trends different markets can be useful in estimating the total potential market for a service. Both the SERC IM and the PlayNow case pointed at the strategic need to follow the bigger trends of the industry to stay competitive and don't risk to miss out on opportunities. Coupled with some industry insights on hardware performance and capability developments and the cost and viability of sufficient optimization of the application serving the need, as discussed in the quality performance theory this can give an important indication on when a service should be developed.

As a historic example of this Nokia's N-gage can be mentioned, it filled a known need, handheld gaming devices had been available since the 80-ies and it was innovative to drive convergence between handheld gaming and cell phones, but still the N-gage never became successful on the market. Lee (2004) provides some insights on the N-gage debacle in an editorial, pointing foremost on the trade-offs between cell phone and handheld gaming device. Providing enough performance for the games made the device to large to be a convenient cell phone and the screen had a disadvantageous form factor. Another major drawback was the lack of competitive edge over competing gaming systems since almost all games were ported from other platforms N-gage's rather good performance never gave any advantage.

An evaluation shows that even though both market and technology existed for this innovation it simply couldn't compete in terms of quality performance in the relevant dimensions. The technology was not mature enough to be incorporated into a cell phone in a convenient and cost efficient way and as a result the consumer experience in both gaming and general use was dissatisfactory. Yamakami (2005) addresses this issue in the business model section by looking at consumer needs in relation to technical feasibility, suggesting that understanding of the past industry evolution is of importance in predicting what will be possible in the future. In this thesis a *technology maturity factor*, or relative feasibility accounting for customer expectations, trade-offs in performance and relative quality performance is used as an indicator of this aspect.

From the case study the technology maturity driving the SERC IM feasibility, data transfer cost and capacity can be used as an example of this phenomenon. Launching SERC IM as a data traffic intensive service and asking the users to stay connected to the server to use it would not be feasible. Instead the focus is the service's low cost of text messaging and relatively low battery drain provides realistic launch expectations. Delivering these services with high quality, a voice over IP implementation would be unfortunate based on this line of reasoning as the cellular networks aren't ready for it and neither are the phones. The same is true for the PlayNow service, since the costs of data traffic and payments are much too high to generate a widespread adoption also the storage capacity and network bandwidth was limiting factors at the time of the launch, but with higher capacity these limitations have been eased.

The *branding* and *network effects* tackle the question of user awareness of a feature and the possibility of spreading for increased benefit to all users. Branding is coupled to overall strategy, the question of whether the company wants their brand to be associated with certain features is crucial. Large network effects and new standards can normally only be achieved by opening up the technology to all players in the industry, for example would SERC IM never stand a chance to become widespread if it didn't support other manufacturers' phones. Also as mentioned earlier cost is detrimental to adoption and thereby network effects, so especially marginal costs is important.

The TrackID application is a good example of a service that relies on a branding or imaging effect. It actually costs Sony Ericsson money to provide a networked service for identifying song titles while the service does not have a way of generating neither income nor widespread use. But it does deliver perceived additional value to the Walkman phone that carries the software if marketed correctly. Thereby driving sales and possibly giving room for a price premium.

### 6.3.1 Industry Analysis Concerns

The industry analysis with PEST and five forces shows that patent- and other immaterial property holders together with owners of digital content such as music and video play a very important role in enabling a reasonable cost structure of the service. The operators hold an equally important role, if one of these actors doesn't want to enable a service by pricing usage or purchase of it too high it will never be more than a niche product.

As the case studies show the logic is naturally such that in the long run customers will get the services they want if it is feasible even if one or several players in the industry wants to stop it. The troubling part is timing; a service that is considered of poor performance or too expensive at launch will have a hard time getting consumers to change their opinion later. As an example the potential of developing an all IP voice call service were discussed, and even if it would be technically possible on Symbian based phones there are two drawbacks that stops it. First it's hard to guarantee an

acceptable quality of the service at all places and at all times and secondly the competitive dynamics in the industry were the operators draws large revenue streams from their circuit switched voice traffic and controls a large part of the phone sales through subsidies of the devices. Actually the products currently marketed as VoIP phones “Skype phones” in Sweden (by Tre) are circuit switched in the device-network interface as well. Until the major markets get established “internet service providers”, operators will control the supply of mobile services and it will be difficult to preinstall and roll out a service that competes with the voice or SMS services.

The case study brought up value appropriation as a problem when designing the business model for new services, since several companies are involved in enabling a service and currently the operators seems to take the largest cut of the revenue from usage. This leaves Sony Ericsson with the ability to generate revenue through the hardware business only. Synergies with owners and reinforcement of the strategic positioning through cooperation that takes advantage of strengths and brand names of the parent companies are brought up several times in the case studies and are considered important for the decision.

We consider a total cost of provision, dependent of the industry structure and appropriability to be a critical driver in the decision making. Especially as the industry overview shows that total cost of ownership is of crucial importance and that an increasing part of the industry’s revenues come from emerging markets and low cost products. However the cost of provision is already accounted for in the model as the total cost of usage and the cost of development are incorporated and redundancy would not only lead to unnecessary work in the decision process it would also tilt the balance towards the redundant factors.

### 6.3.2 Conclusion

The four criteria from the strategy and industry analysis; innovation, technology maturity, total cost of provision and network effects (and branding) and included in the strategy dimension of the decision-making. *Technology maturity* includes the aspects of productivity/quality/technical constraints as the maturity of the technology measures if the industry as well as the market is ready for a new software or technology convergence e.g. if the constraints are easily overcome. Innovation is an important driver of perceived value; if the product is innovative it should serve a new need of an existent issue in a better way, so therefore this aspect is merged into that driver. *Network effects & branding* are considered of great importance and interconnects the strategy dimension with the installed base and perceived value added drivers.

### 6.3.3 Definitions

The important criteria for the estimation of the strategy dimension are *the technology maturity factor* and *network effect and branding*. The technology maturity factor is defined as the market readiness of the technology the service is dependent of in terms

of cost, stability and performance. The network effect and branding dimension concerns public opinion of the usefulness and status derived from advertisements and popular use. The strategy dimension can be viewed in figure 6.3.

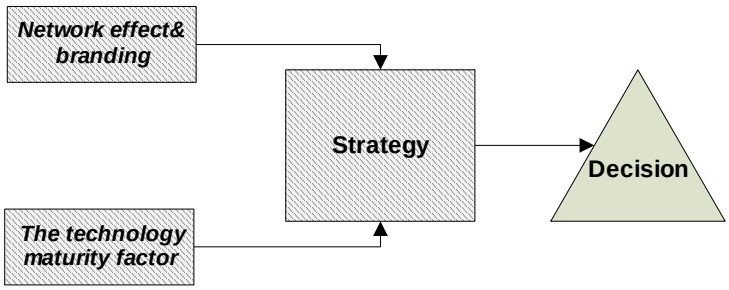



Figure 6.3 - The strategic dimension of the decision including the criteria; technology maturity factor, and network effect and branding.

# 7 The Rapid Model for Holistic Application Evaluation (RaMHAE)

*As outlined in the method three main dimensions of the decision-making are considered in this thesis; development, market and strategy. As the most relevant criteria for the estimation were identified for each of these three dimensions in the analysis chapter the construction of a basic decision model is straightforward. The remaining issue is how to estimate or measure the criteria; each criteria needs to be assigned at least one key performance indicator or driver. The following section starts the work of creating such drivers; the work will be followed up by qualitative interviews to ensure that correct and measureable drivers are selected in the implemented version of Rapid Model for Holistic Application Evaluation (RaMHAE) for Sony Ericsson. The definitions of the criteria and suggested drivers are the work of the authors of this thesis and are based on the analysis chapter.*

## 7.1 The Generic version of RaMHAE

Combining the three dimensions in the analysis chapter and the internal dependencies gives us RaMHAE in figure 7.1. It is important to create a level of balance between the dimensions and criteria. RaMHAE is structured in a way that lets two or three criteria define each dimension, to provide a fair level of balance. Also some criteria have implications on more than one dimension which is commendable since a holistic approach is sought for.

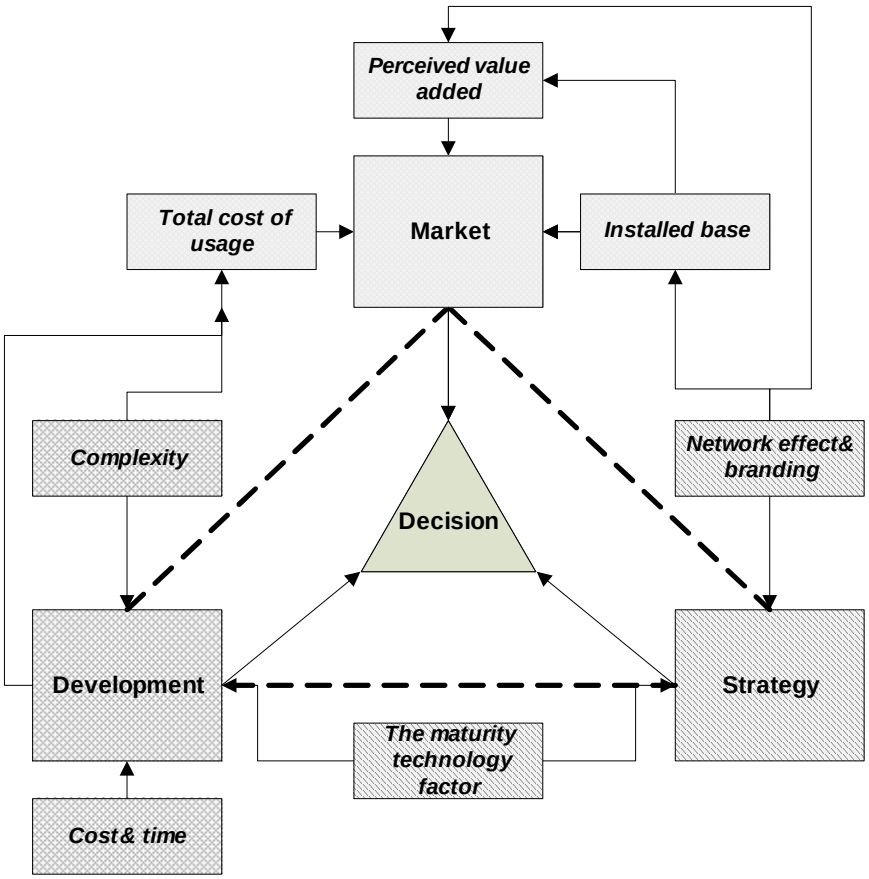



Figure 7.1 - The RaMHAE after the initial analysis.

## 7.2 How to measure the criteria

In order to estimate the criteria universal drivers are needed, our explicit goal is to develop drivers based on ordinal scales where it is possible since it is a good way to make the indicator context neutral. Also the drivers need to be transferred to some sort of grading system that enables comparison between different drivers. Since it is difficult to generate an exact estimate and therefore a precise grade a system of a three staged grading scheme are chosen; red (unacceptable), yellow (questionable) or green (acceptable or better).

### 7.2.1 Cost & Time

The cost & time criterion is defined as a transparent best estimate by an unbiased expert based on implicit knowledge of earlier projects. Even if the completely unbiased cannot be achieved the notion of bias is important to consider in order to ensure a degree of fairness in the estimate. The criterion can be evaluated by comparing the project in question to former projects within the corporation or similar

software from other manufacturers. The driver can be specified in a few different ways and by putting estimates in relation to benchmarks in an ordinal scale the extent of the project can be comprehended.

- Total cost compared to other internal projects or external projects
- Unit cost compared to other internal projects
- Time-to-market compared to competing software

The ordinal scale used with some prior data can then be used to grade the driver relative to other projects, red denoting the most resource-demanding projects, yellow midsized and green the smaller projects.

### 7.2.2 Complexity

Complexity is defined as technical issues related to the number of companies involved in supporting the service and the complexity of the data structure. To estimate this criterion the driver must either put a number on the complexity of the business model or the internal (technical) complexity. The business model estimation is rather straight forward a process flowchart should reveal how many businesses that are involved in enabling the service. The technical complexity is less obvious to put a number on, the number of APIs needed in the handset platform or the level of optimization required for the application to run flawlessly.

- Number of participants in the service offering (compared to other internal services)
- Number of new APIs needed (compared to other internal projects)
- Level of optimization needed (compared to other internal applications)

An ordinal scale is used to estimate the relative complexity, higher complexity gives a red indicator, the least complex gets a green indicator while those in between gets a yellow one.

### 7.2.3 Total cost of usage

Total cost of usage is defined as all costs for the mean end consumer to acquire, subscribe for and use the service. In order to estimate this cost two aspects are of relevance; costs incurred by using the cellular network operator's services and costs based on intellectual properties. To put a number on these cost aspects the total cost of an estimated "normal" consumer's usage can be estimated.

- The cost of data traffic, subscription and/or payment-systems compared to other ways of servicing the same need.
- The cost of procurement of digital content and intellectual properties to install and use the service compared to other ways of servicing the same need.

Since it is hard to come up with a satisfying number of alternative services filling the same need an ordinal scale is not viable, therefore a ratio scale is better suited to

grade this driver. By defining a relevant cost interval for differentiation (e.g. the current cost of usage with a leading alternative service or an expectation of this cost) and giving cost significantly higher than average a red score and lower to equal costs a green score. A cost three times higher than the benchmark mean gives the application a red score, a cost about equal to or lower than the benchmark mean gives a green score. Costs outside of this scope are considered not to influence the user's determination to use the specific service any further.

### 7.2.4 Installed base

The installed base is defined as the number of handsets that will get the application, providing the service in question pre-installed. As an alternative the number of handsets on the market that can run the application with full or almost full functionality. A good measure of the installed base driver is market penetration or the ratio of installed base divided by all handsets on the market, alternatively all handsets running any form of equivalent software. A third potentially interesting way of measuring the installed base is the number of users that are compatible with the service. For instance a VoIP-client can have benefits when being compatible with regular circuit switched cell phones increasing the actual network effect.

- Number of devices shipped with the software pre-installed compared to other internal applications.
- Total number of devices capable of running the software compared to total number of devices on the market.
- Total number of devices compatible with the software as a fraction of all relevant devices.

Naturally this gives software projects in segments were the corporation currently has a strong brand a higher percentage helping to enforce currently held strategic advantages and giving these core groups of consumers an even better experience. In order to assign a grade to an installed base fraction an ordinal scale comparison to competing applications or other internal applications can be used. Acceptable or higher potential percentage of the market would give a green indication, quite low potential a yellow and unsatisfying potential a red.

### 7.2.5 Perceived Value Added

Perceived value added is defined as the combined value for the consumer from mobility and wirelessness. The value is added by mainly three factors, ease of use, usefulness and quality. These aspects are rather hard to estimate or measure but in general the subjective evaluation of some sort of test panel could be useful. An ordinal evaluation scale is preferred, by comparing the ease of use, usefulness and quality to competing services a relative value can be assigned and translated to a grade.

- Relative ease of use compared to competing services

- Relative usefulness compared to competing services
- Relative quality compared to other internal applications

The red/yellow/green indicator system can be applied rather straightforward if the service are estimated to be easier to use, more useful or of higher quality than average (for the benchmark) a green indicator is graded and so on.

### 7.2.6 Technology Maturity Factor

The technology maturity factor is defined as the market readiness of the technology the service is dependent of in terms of cost, stability and performance. In order to put a number on these aspects drivers such as affordability and quality of service becomes relevant. Another factor that could be relevant to estimate are the timing, the product should be launched when it can be delivered without too many compromises. On the other hand, launching to late would give the opportunity away to a competitor, although timing will be very difficult to evaluate in advance.

- Price per relevant performance estimate compared to competing solutions.
- Percentage of usage functioning correctly compared to competing solutions.

Price per performance can be evaluated in a similar way to total cost of usage, letting the current mainstream level of price per performance be a yellow grade and letting a three times better performance for the same price grade as green and three times worse price per performance grade as red. The usage percentage functioning correctly is more straightforward to grade using an ordinal scale.

### 7.2.7 Network Effect & Branding

The network effect and branding dimension concerns public opinion of the usefulness and status derived from advertisements and popular use. Fraction of the public that recognise the brand of the application or feature, to which extent the brand is known for the “right” properties and the fraction of the public that associate the concept to something positive are all interesting measures of this aspect. However since the product isn’t known to the public at the time of the decision making estimates of the public reaction must replace the actual response. A qualitative estimation of one (or more) of these aspects compared to currently available applications can still be helpful in determining the criterion.

- Fraction of the public that recognise the brand or feature compared to other internal applications.
- Fraction of the public that recognise the brand or feature for the reasons internal wants compared to other internal applications.
- Fraction of the public that have a positive image of the product compared to competing products.

Once again an ordinal scale is preferred as it neutralizes errors in the estimation since both the application under evaluation and the benchmarks are subjected to the same estimate. The suggested grading is according to the standard.

# 8 Qualitative Evaluation at Sony Ericsson

*The RaMHAE and drivers presented in the previous section were used in a series of assessment interviews to increase our understanding of the validity of the model and to be able to make necessary adjustments. To obtain the broadest possible picture the test panel used consisted of personnel from different parts and different levels of the organisation.*

## 8.1 Assessment Interviews

A general aspect the research manager pointed out was that not all drivers necessarily are applicable for every product, hence a not applicable option has to be included in the RaMHAE implementation.

### 8.1.1 Cost & Time

An assessment interview with a research manager pointed out a number of relevant issues. First, our definition and argument concerning an independent expert was considered unrealistic since it likely would be impossible to find such. Another interesting finding was that also the biased expert were probably more likely to be opposed to the development than in favour of it due to the presence of the "not invented here syndrome" within the development unit. Organizational resistance could stem from several reasons; own agendas that stakeholders want to pursuit, internal political opinions or resistance against ideas simply based on the fact that it wasn't your own idea. The same interviewee considered time to be a more important parameter than cost, especially for projects that need to be implemented in the platform; a process likely to take about two years. This could of course be due to the limited effort (and thus cost) that the SERC projects incur. It´s obvious to involved parts that the current organization form is not designed to meet the actual requirements in the most efficient way, but this is the way it works today.

Further input from a senior researcher concerning the cost & time criteria was to try to better define and explain the meaning of the "total cost" driver in order to increase the understanding of the RaMHAE. It has to be clear to the user that it is the development cost that is relevant when looking at the first driver. The unit cost driver is dependent on (inferior) to the estimation of the total cost. When estimating the unit cost driver it is actually the number of units that is relevant based on the assumption that the total cost has to be divided with number of units. When then adding the marginal cost for each unit (license cost) to the fraction from the prior sentence the estimation of the second driver is complete.

The same senior researcher definitely confirmed the importance of taking both the estimation of the unit cost as well as the estimation of total cost into account. It could also be interesting to divide the cost into different groups depending on the character of the application such as if the application can be used in products, product families

or platforms. The classification of services into different groups could be useful when calculating project specific net present values based on the grounds that the investment horizon differs from approximately two years down to two months for current openings in the market window, depending on the characteristic of the project.

The senior researcher states that timing in relation to the market is of great importance and underlines that the ability to fit development with the market opportunities is even more important than the actual cycle time. It is also essential to be aware of the differences in estimating future market capabilities and estimating the company´s capabilities. In the generic RaMHAE the estimation of time concerns the organisation´s ability to bring a service to the market compared to competing software estimated as a time difference. But during the interviews we received feedback concluding that it would be better to actually estimate the organisation´s ability to meet the window of opportunity and exclude the comparison to competitors concerning pure lead times.

According to an executive the development cost is usually estimated in terms of effort *man months*. Using this driver gives a relevant estimation concerning a project´s total cost. Time has an important correlation to complexity, the longer cycle time the greater is the complexity. He also points out the possibility of fast tracking projects in cases where the idea seems promising and the total cost can be estimated to less than one man year. In these cases further criteria for continued development are not necessary and a future decision model can be replaces by pure gut feeling due to the low stakes involved. In general it is less complicated to make decision regarding applications that are stand alone from the underling platform. The same source underlines the importance of timing, "*timing is everything"* and the overall gains of putting a product on the market in time is on the whole worth more than strictly following the development budgets.

### 8.1.2 Complexity

The business part of the complexity criterion (the number of businesses/stakeholders involved in the service offering) was found to be a relevant driver. The business part is about estimating the complexity of getting all involved actors lined up behind the technology. Except being relevant in the actual service offering the driver would also be applicable during the development process as the number of errors and delays increase with the number of companies involved in the development supply chain. As in the case of Sony Ericsson this is relevant when for example working towards stakeholders who hand over independent deliverables towards the next party in the development process for example: Symbian hands over to UIQ who delivers to Sony Ericsson. The other component of the complexity criterion, the technology part with the two drivers focusing on internal complexity could be used in the cost & time criterion as an effort estimate, according to the research manager. This is motivated by the fact that choice of technology affects the level of complexity which in turn affects the cost & time. Costs are also affected differently depending on if required

competence can be located in-house or have to be sourced from outside the organisation.

The level of complexity is highly dependent on if the project requires involvement of additional industry actors and what requirements that are linked to the programming of the application. Whether the software issues easily can be solved or not is in turn decided by the structure of the system. An example of this brought up by the executive during the evaluation is UMA (Universal Mobile Access), a technology to transfer voice conversations between different radio technologies (such as Wireless LAN, UMTS and GSM) seamlessly. This technology needs low-level interaction in the communication software which is an extremely complex task to implement which is one of the reasons why this hasn't been done to date.

Input received during additional interviews with developers confirms the initial statements and thereby motivates the choice of number of participants in the service offering and number of new APIs needed (or more generally the abstraction level required in the programming) as reliable drivers when estimating complexity.

### 8.1.3 Total Cost of Usage

Concerning the total cost of use criterion the researchers agree upon that both drivers identified are accurate but their opinions as to which of the two drivers that is most important differs. The total cost of usage criterion covers the cost of consumers to use the service. Until today the cost of data traffic, subscription and/or payment-systems have been the driver with the highest influence in a development perspective. But as a market situation where data traffic are a flat rate service becomes the norm in a growing number of markets this is likely to change. The future driver influencing total cost of usage will most likely be associated to digital rights management. Another input from the research manager was that the cost of licensing should be included in intellectual property cost in an explicit way. Most applications don't use any digital media but still has cost related to either licensing of the entire application or some intellectual property used in it, as a codec or proprietary protocol.

When developing applications intended for future use there is an underlying awareness of an upcoming scenario where prices of transferring data will drop and thereby drive consumption of services like PlayNow. Sony Ericsson is currently putting resources to increase the user value linked to PlayNow. The public preconception among customers is that data is expensive why a decrease in this particular driver probably will have great impact on PlayNow as well as comparable services. From the perspective of Sony Ericsson the current primary concern is the cost of transferring data and the secondary focus lies on intellectual property rights.

The feedback we received did also emphasize the fact that when developing an application the choice of payment system (ex. subscription or price per song) may affect the revenue streams. The development of some kind of alternative scenario

model followed by different payment alternatives would be one way to structure and illuminate the options. For example PlayNow using subscription or without using subscription. After some discussion we also identified a new relevant driver, superior to the two existing ones; *the concrete need for data traffic*. The answer to this question will influence and even determine additional inferior drivers, such as cost under different pricing models. During additional interviews the idea of using the definite need for data traffic as driver (amount of data (in kB) transferred) though was meet with objections based on existing market conditions where operators naturally charge more than the actual data transfer cost. The amount of data transferred in a SMS would for example be priced at substantially lower levels if based only on the pure transferring of data, why the means of payment regarding the specific service have to be considered in the evaluation process.

### 8.1.4 Installed Base

As the initial drivers differed in how inclusive they were, the research manager found number of devices capable of running the application to be most relevant. The choice was based on the upcoming business models of viral distribution in social networks. The spreading mechanism is crucial for continued distribution and can be explained in terms of evolutional terminology, were humans beings is defined as herd animals with a strong demand for interpersonal relations. In these terms it is vital that the applications easily can be spread and thereby reach a certain level of user permeation. The interviewee underlines the choice of driver by the argument that when the number of people using the application exceeds a certain level people in their social networks will start using the application (the service gains critical mass or momentum).

The most inclusive driver, total number of devices compatible with the software as a fraction of all relevant devices is aligned with the risk of being caught in a situation where the service is recognised as too undifferentiated towards competing alternatives. If the application development is driven by level of compatibleness to other devices alone, a relevant question to address should be, why should we actually develop this application and what needs are we trying to fill.

An executive believes that preinstalled applications are important, but also confirms the viral distribution (and thus compatible hardware) as central to accelerate the distribution of the application. SERC IM is at current distributed by viral spread, a distribution that would most likely be more successful if the user wasn't obligated to answer a number of questions before actually entering the installation. This would increase both the usability and the ease of use.

### 8.1.5 Perceived Value Added

The ease of use driver are crucial to the penetrate a mass market, on the other hand applications that are not considered to be useful will only be used a few times after the purchase. The value in the *wow features* that do not add any real useful functions

are primarily coupled to branding and marketing and add perceived value before and directly after the purchase. The research manager also mean that in order to estimate perceived value added the quality of the application must be taken into consideration. Instead of relating it to other SEMC applications the quality though should be compared to the quality of competing services to acquire a useful driver.

According to the same interviewee it is important to keep in mind that the opinion of the public market is of greater value than the actual technical performance. It may be close to the truth that customers put larger expectations on a Sony Ericsson handset than compared to other brands but to refer to this phenomenon as perceived value added would be to stretch the terminology a bit too far. The quality of a Sony Ericsson product should be characterised by the standards within the organisation, why the quality of the product should be evaluated on characteristics that lie beyond the usual expectations.

When developing an application realistic estimations have to be done regarding usability performance, the outcome being either *thumb up* or *thumb down*. One relevant measure could be the number of buttons that must be pushed to get the application running. According to a senior researcher, it would be relevant to combine the criteria perceived value added and installed base. This could be done by looking at the number of users who theoretically can run the application and the number of customers who practically would be able to run the application. A correlation between penetration and the level of usability was suggested, if such a correlation exist it would be important to determine the underlying dependency. The level of marketing will also affect the customers perceived value experience and Apple has showed the rest of the market what can be done within this area by being successful in the way the strategically design their experiences.

The quality aspect is relevant in terms of the application actually working when people expect it to work; otherwise the project will not survive. Releasing applications characterized by poor performance is also associated with the risk of hurting the general impression of the application but also the entire brand. For applications coupled to hardware features like a camera or other integrated peripherals the ease of use is extremely important otherwise people won´t bother to use them.

The point in time where the specific service/feature adds value are important to consider, some services has a clear effect before the purchase such as the shake control while others arguably more useful features´ perceived value increases as the user learns to use and appreciate them. This aspect is described by the user experience curve (Ux-curve) and can be of great value as service offerings needs to be fitted with the overall strategy. The overall package should provide high perceived value at all time horizons.

### 8.1.6 Technology Maturity Factor

As the generic RaMHAE uses a price per performance and a usage functionality estimate they capture different parts of the market according to the SERC researcher. Price per performance are relevant to especially late adopters, while functionality are more important to less price sensitive consumers such as early adopters and experiencers. To use the driver "percentage of usage functioning correctly/satisfactory compared to competing solutions" alone, could create an organisation that will focus on having a low rate of bugs rather than focusing on continuous improvement which impede development.

When discussing the technology maturity factor and market readiness it is important to understand and be aware of the conditions that actually have the greatest impact on the development of market maturity. Within in the industry it is very rare that a single player comes up with an idea out of the blue and then must influence remaining actors in order to succeed, these ideas are in general killed based on high costs. The common scenario in the business is that a certain technology can be realized first when a group of relevant companies have obtained a required level of technological competence. Another set-up consists of a scenario were companies merge and thereby reach a level where they can push the development forward.

When the technology development has been enabled a market must be identified. In cases where the market does not exist, companies, if they are big enough, in some cases actually are able to develop and create their own markets, such as Apple and Google. The main reason why the technology maturity factor is of importance is that it is both difficult and expensive to develop handsets.

The senior researcher here states the technology maturity (if that´s a correct definition of what you would like to describe) is less about price and therefore prefers to exclude the price from the drivers. Instead he proposes that this factor could be estimated more accurately by a quality performance linked to the usability and utility break-point index (as in the previously described QUPER model especially the benefit view). If the performance is below a predefined level there is no point in continuing the development. The same researcher also points out that the RaMHAE implementation should be clearer on the meaning of "performance", as it is what the users gain from the technology rather than any physical performance measure (like memory density, processing power etc.)

An executive adds that when comparing SEMC to other players in the mobile handset industry (Nokia) SEMC is recognized for not risking the usability to the same extent as some technologically leading companies. There is an important trade off between usability, price and performance. When using for example GPS services people will stop use the service in the long run if the application needs ten minutes each time to fixate a coordinate. Without the application delivering value to customers it will not

survive and when customers are the ones deciding, one failing parameter can be enough to kill the application.

### 8.1.7 Network Effect and Branding

The balance in this criterion is tilted towards branding, either the network part can be estimated more directly by one or more of the drivers otherwise it could be left out entirely and transferred to the installed base criteria. Either way the interdependence between these criteria should be lifted in the evaluation process according to the research manager.

The Sony Ericsson brand has very strong brand recognition and our interviewee confirms that issues regarding the Sony Ericsson brand are of highest priority when problems occur. Each product should be followed by a criterion; hurt our brand, which is deeply evaluated in order to avoid damage linked to the brand according to the executive.

## 8.2 Analysis

Overall the evaluation seems to verify that most of the important criteria are included in the decision process in one way or another. Therefore the basic RaMHAE framework is left intact. Most of the input also pointed at the appropriateness of using more than one driver for each criterion, to give a better idea of the status of the criteria. Given the rather straightforward evaluation of each driver the decision process would not be too complicated using a pair of drivers for each dimension. We will review each of the criteria briefly and make definitions of the drivers considered to be most suitable. The standard scoring is kept from the generic RaMHAE, red (unacceptable), yellow (questionable) or green (acceptable or better).

### 8.2.1 Cost & Time

Starting with the cost & time the interviews pointed out that especially time was important from an economic point of view, although time was connected to a market opportunity and not to a benchmark of the competitors' time to market. This poses a problem in the evaluation since both time to market and market window has to be estimated. Since the goal of this driver is to reach the market at the correct point in time and the market must be built first, a benchmark against the competitor's offerings will prove fruitful. Although as a measure of when the market will turn profitable, the goal is not to beat the competitors to the market. It is to reach it when the pioneers have developed the market and before being considered as technologically behind. A good or acceptable launch time will score green, while an early or late launch date will score yellow or red depending on how much off they are in the timing. The market shall be somewhat developed but it is important to not be late when the service/technology has turned into a commodity.

**Market timing**: *Estimated timing of the market opportunity evaluated by an ordinal scale.*
Scoring: Standard (timing)

On the cost side the development cost criterion is included in the unit cost criterion, as it is defined as the estimated cost of the development effort divided by the estimated volume plus the marginal cost of each unit (if there are any). Therefore the latter criterion is selected for the implementation.

**Unit cost**: *Estimated cost of development effort / estimated number of users + estimated marginal cost of each copy, evaluated by an ordinal scale compared to other SEMC services.*
Scoring: Standard (cost)

The fast track option for projects that have an estimated development cost that are less than one man year suggested in one of the interviews have merits, as the effort of finding information and making decisions should be kept at a minimum. If the smaller projects can be approved by gut feeling larger projects get more management time.

### 8.2.2 Complexity

Since both business and technical complexity where considered highly relevant in the assessment interviews both are included in the model. The business complexity can easily be evaluated by estimating or even knowing the number of actors involved in bringing the service to the market.

**Business complexity:** *Estimated or decided number of businesses besides the developing company involved in enabling the service.*
Scoring: Green (0-2 companies), Yellow (3 companies), Red (> 3 companies)

The technical complexity was initially estimated based on the need to make adaptations to the platform (operating system) of the phone, adding application programming interfaces. But after the evaluation other types of technical complexity linked to abstraction layers were brought up, also the number of API's that need to be included isn't a very good way of grading complexity, if one API is needed another one wouldn't add much complexity. As the example with UMA showed there are many abstraction layers in a handset, therefore we choose to base grading on that. The evaluation is simple in this case, if changes are needed at a certain level the corresponding complexity score is assigned.

**Technical complexity:** *Lowest level of abstraction required in the application development.*
Scoring: Green (Application), Yellow (Operating system/own platform), Red (third party platform)

The reason behind the separation of when support is needed in the own platform(s) and third party is similar to the argument behind the business complexity. Other organizations have other goals and prioritizations than enabling support for features that Sony Ericsson needs. Even if the internal process of adding support is handled between different organizational units they share common leadership and goals and that should reduce the complexity.

### 8.2.3 Cost of Usage

As the evaluation confirmed the importance of both the cost of traffic and the cost immaterial property we include both in the implementation. Although the opinions on which one is the more important weren't consistent, both sides had good arguments and ultimately the situation will decide which is the most important. The trend however will decrease the importance of the data traffic cost since more and more operators around the world introduces flat rate services for an ever decreasing fee.

One critique that had to be corrected was that the generic RaMHAE suggested that the cost of the consumed data traffic should be used as a measure of the network operator related cost. A more general estimate was needed according to the input from the interviews, first the amount of data traffic was suggested, however since there are cost of network usage that are not always related to actual amount of transferred data it is more appropriate to estimate the incurred cost referable to the operator. Examples of this could be subscriptions of specific kinds of data and SMS. Therefore we decided to go with a broader definition: the operator related usage cost, the uncertainty connected with the operator setting arbitrary prices can't be avoided as they control the networks.

**Operator related usage cost:** *Estimated cost generated from usage of the cellular network on average. The driver should be evaluated by an ordinal scale compared to other SEMC services.*
Scoring: Standard (cost)

On the intellectual property side the obvious price to benchmark against is the alternative ways of achieving the same material. It can also be beneficial to look at more than one business model, dependent of the type of service and how much material that will be bought. Since licenses for applications like codecs usually are included in the phone price, only the cost generated by usage is considered.

**Intellectual Property cost:** *Estimated cost of buying media and licenses under one or more business models, evaluated by an ordinal scale compared to competing services.*
Scoring: Standard (cost)

### 8.2.4 Installed base

As the generic RaMHAE suggested three different ways of defining the installed base the interviews focused on finding out which of them that were the most important. Since different interviews pointed out both the preinstalled base and the number of compatible devices as important, these two are included in the decision model. The preinstalled base is important to make an extremely well integrated service and to drive use in groups less technologically proficient. The compatible base is important for all applications that uses viral spreading techniques and are also considered important as a vehicle for marketing. The preinstalled base is best benchmarked against the total number of produced Sony Ericsson handsets while the compatible base is best compared against the number of handsets estimated on the market.

**Preinstalled base:** *Estimated fraction of handsets that are shipped with the application preinstalled, evaluated by an ordinal scale compared to other SEMC applications.*
Scoring: Standard (fraction)

**Compatible base:** *Estimated fraction of the handsets (hardware) on the market that can run the application with full or almost full functionality, evaluated by an ordinal scale compared to other SEMC services.*
Scoring: Green (higher than average), Yellow (average), Red (lower than average)

The third; all compatible devices are not included since this driver were identified as a bad argument for developing a new service. If compatibility is a main feature one has to ask way not just use the system the new service is compatible with in the first place.

### 8.2.5 Perceived Value Added

The usefulness and ease of use are important to different target groups there both of them are included in the RaMHAE implementation. Although we got input on the value of quality we decided not to include quality as a driver for this criterion. The reason being that the aspect of quality that are technical will be included in the technology maturity factor and the softer aspects (such as user interface) are included in the ease of use and usefulness drivers. Both drivers should be benchmarked versus competing services.

**Ease of use:** *Estimated or required need for learning to be able to operate the service, evaluated by an ordinal scale compared to competing services.*
Scoring: Standard (need for learning)

**Usefulness:** *Estimated ability to satisfy the relevant customer need, evaluated by an ordinal scale compared to competing services.*
Scoring: Standard (satisfaction)

### 8.2.6 Technology Maturity Factor

As the evaluation pointed out cost of the software itself is already accounted for in the model, the cost intended is the cost of hardware support of the service. This criterion tries to answer if the service can run on current hardware or if the investment in hardware with satisfying performance is acceptable. Another way of putting it is to estimate what level of perceived benefit the user can expect at a given price (or with no hardware investment at all). Since quite a few services don't require any extra investment in hardware at all the latter driver seems more applicable. This driver is closely connected to the benefit view of the QUPER-model presented in the theory chapter and we use the same classification as Regnell, Berntsson Svensson & Olsson (2008).

**Quality Performance:** *Estimated level of performance of the service on given hardware (old or estimated new). Evaluated by assumptions on user preferences and (estimates) benchmarking of competing services.*
Scoring: Green (excessive - useful), Yellow (possibly useful), Red (useless)

The other side of this criterion deals with the maturity of the software (and possibly the dedicated hardware) and the level of functionality it's estimated to deliver. This is as our evaluation interviews indicate dependent not only on the internal stability of the software it also depends on industry support. Take Voice over IP as an example, the data transfer rates in the networks in certain areas dictate if the service will be possible to use or not.

**Technological Maturity:** *Estimated level of functionality as a fraction of the use cases (geographically, indoor – outdoor, during transport etc.) where the service works properly, evaluated by an ordinal scale compared to competing services.*
Scoring: Standard (functionality)

If the evaluation finds out that it would be expensive to reach a reasonable level of functionality, in terms of better hardware being needed this should work as an indicator to kill or delay the project without further evaluation. If a single service significantly increases the price of the hardware it is unreasonable to believe that the total business case could be favourable. So just as small projects can get a fast track approval, projects that have high hardware demands can be disapproved with a fast track mechanism to save management time.

### 8.2.7 Network Effect and Branding

As the evaluation indicates that essentially the current criterion deals with branding only we rename the criterion "Branding". The network effect side of the decision is already taken into consideration under the installed base criterion; the figure of the RaMHAE already indicates this interdependence.

As for branding, the most important aspect seems to be that the new service does not damage any of the connected brands. Therefore it is important to find out what people will recognise the service with if they don't connect the service with positive aspects the product can do more harm than good. This is likely to be especially important for software that can be spread to non SEMC hardware via viral spreading mechanisms. We suggest two drivers, one positive the fraction of the public that are estimated to have a favourable opinion of the service compared to competing services. The negative driver being the fraction that are estimated to connect the service with something negative and thus lets the service be a reason to not purchase Sony Ericsson hardware. An example of the latter could be if SERC IM are spread virally and doesn't work satisfactory, then it would work as a deterrent for those with the negative experience hindering them from purchasing a Sony Ericsson handset.

**Favourable rating:** *Estimated fraction of the public that will have a positive opinion of the software compared to competing solutions, evaluated by an ordinal scale compared to other SEMC services.*
Scoring: Standard (fraction)

**Unfavourable rating:** *Estimated fraction of the public that will have a negative opinion of the service, evaluated by an ordinal scale compared to other SEMC services.*
Scoring: Standard (fraction)

# 9 Implementation of the RaMHAE at Sony Ericsson

*As the model has been improved and equipped with well defined drivers the last obstacle for implementation is the lack of a usage process. Based on the balance which has been a something of a mantra for this thesis as well as the requirements of fast tracking that has been pointed out in section 8.2 a process has been constructed.*

## 9.1 The Process

In order to be able to carry out the evaluation it is important to establish the prerequisites for the actual implementation of the service. It is especially important to define when the product should be launched (including choice of platform), which markets the service is intended for (relevant markets) and the means of payment (if any). Also it is helpful to in advance determine which the most important competing services are in order to have a consistent benchmark for the ordinal scale evaluations. Further specific choices concerning functionality and technological solutions should be made in order to give each evaluation an unequivocal definition. Our recommendation is that multiple versions of the launch case are created to also assess when and how to launch the idea, for example which platform(s) to launch on and different payment structures.

As the process should incorporate two fast track possibilities the first evaluation step must be the fast track disapproval followed by the fast track approval, for obvious reasons. The negative fast track is triggered if an economic or technological "show stopper" is identified such as excessive cost or excessive cost of hardware support. The positive fast track if the project are considered to be cheap enough to give it a shot right away, typically costing less than one man year's worth of effort.

The rest of the decision process is divided into the three dimensions and given equal importance (in spite of the fact that they have a different number of drivers). All drivers coupled with a dimension are evaluated and then an overall evaluation for the dimension is made based on the drivers.

Since the initial evaluation is bound to be subjective, a positive decision must be verified to ensure that the assumptions or implementation/business cases are reasonable. The effort estimate in the fast track approval should also be verified to ensure the resource consumption is estimated correctly. The chart over the RaMHAE for Sony Ericsson is shown in figure 9.1.

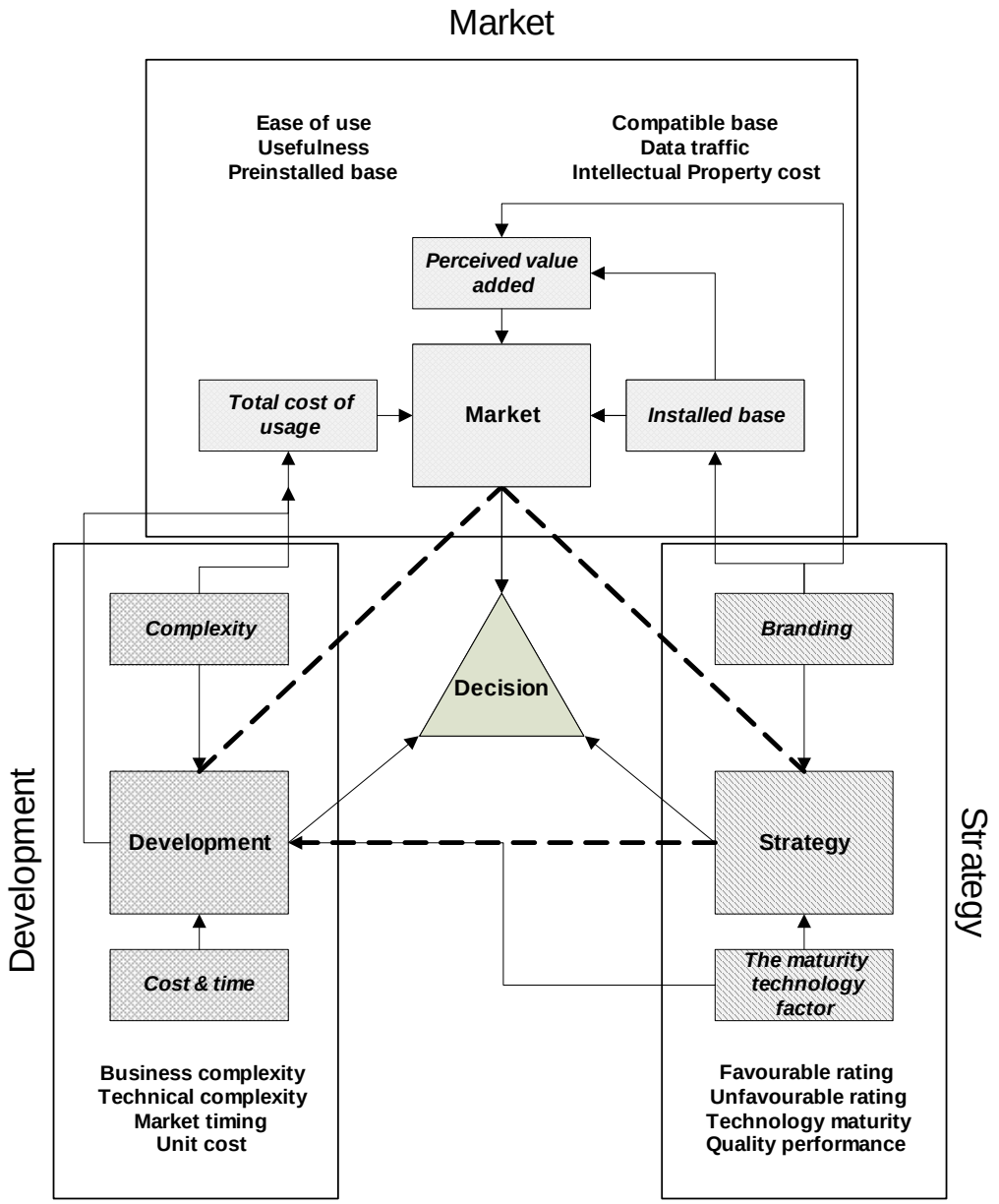



Figure 9.1 - The RaMHAE at Sony Ericsson with the drivers, the three main dimensions are highlighted.

There is no specific order in which the dimension should be evaluated, although the dimension which can be assessed best or easiest is a good starting point. If the overall assessment of the three dimensions is negative (mostly red grades or for other reasons considered too weak) the process can stop in a disapproval decision. If all three are somewhat positive a positive decision are indicated, no “show stoppers” and dominantly green grades are considered positive, although exactly what to be

considered as positive is not obvious. The most reasonable approach is to use an ordinal scale and benchmark versus all the previously evaluated projects. Other potentially beneficial methods are to use the analytical hierarchy process, bubble sort or any other prioritization model on the projects that score above average. The suggested process is depicted in figure 9.2 and table 9.1 presents a template for the evaluation process scoring sheet.

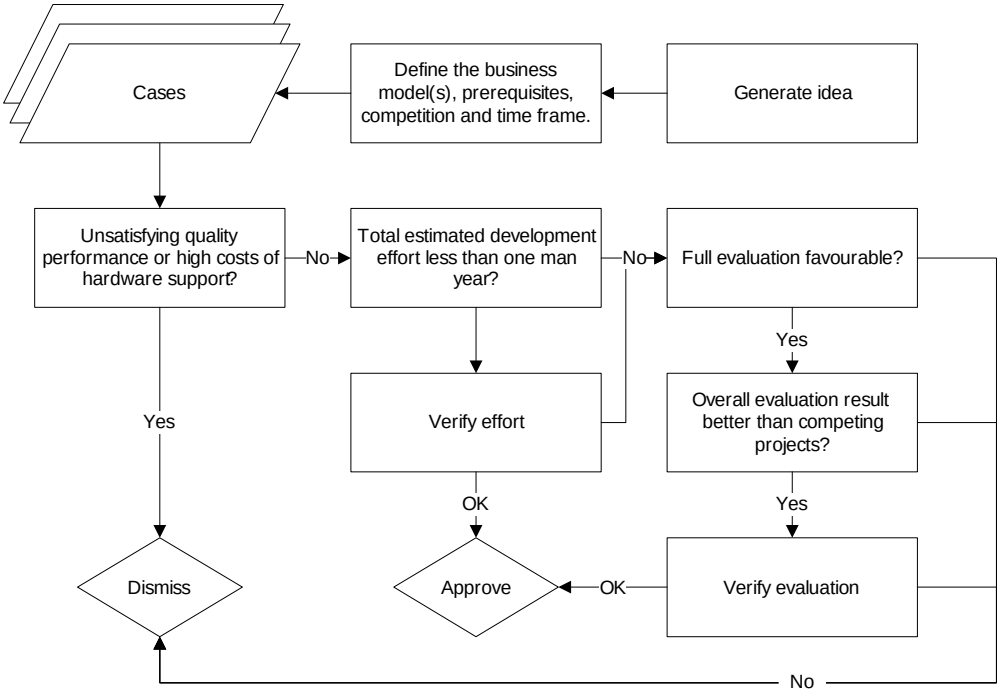



Figure 9.2 - The suggested decision process.

| Dimension | Criteria | Driver, definition & evaluation method | Green | Yellow | Red | N/A |
|---|---|---|---|---|---|---|
| Strategic | Branding | **Favourable rating:** *Estimated fraction of the public that will have a positive opinion of the software compared to competing solutions.*<br>Ordinal scale compared to other SEMC services | | | | |
| | | **Unfavourable rating:** *Estimated fraction of the public that will have a negative opinion of the service.*<br>Ordinal scale compared to other SEMC services | | | | |
| | Tech. maturity | **Technological maturity:** *Estimated level of functionality as a fraction of the use cases (geographically, indoor – outdoor, during transport etc.) where the service works properly.*<br>Ordinal scale compared to competing services | | | | |
| | | **Quality performance:** *Estimated level of performance of the service on given hardware (old or estimated new).*<br>Ordinal scale compared to competing services | | | | |
| | | **Strategic dimension total** | | | | |
| Market | Value added | **Ease of use:** *Estimated or required need for learning to be able to operate the service.*<br>Ordinal scale compared to competing services | | | | |
| | | **Usefulness:** *Estimated ability to satisfy the relevant customer need.*<br>Ordinal scale compared to competing services | | | | |
| | Installed base | **Preinstalled base:** *Estimated fraction of handsets that are shipped with the application preinstalled.*<br>Ordinal scale compared to other SEMC services | | | | |
| | | **Compatible base:** *Estimated fraction of the handsets on the market that can run the application with full or almost full functionality.*<br>Ordinal scale compared to other SEMC services | | | | |
| | Cost of usage | **Operator related usage cost:** *Estimated cost generated from usage of the cellular network on average*<br>Ordinal scale compared to other SEMC services | | | | |
| | | **Intellectual Property cost:** *Estimated cost of buying media and licenses under one or more business models.*<br>Ordinal scale compared to competing services | | | | |
| | | **Market dimension total** | | | | |
| Development | Complexity | **Business complexity:** *Estimated or decided number of businesses besides the developing company involved in enabling the service.*<br>Green=0-2, Yellow=3, Red=3+ | | | | |
| | | **Technical complexity:** *Lowest level of abstraction required in the application development .*<br>Green=Application, Yellow=OS/own platform, Red=Third party platform | | | | |
| | Cost & Time | **Market timing***: Estimated timing of the market opportunity.*<br>Ordinal scale, Green=Good - acceptable timing, Yellow=Early or Late, Red=Too Early or too Late | | | | |
| | | **Unit cost***: Estimated cost of development effort / estimated number of users + estimated marginal cost of each copy*<br>Ordinal scale compared to other SEMC services | | | | |
| | | **Development dimension total** | | | | |

Green=acceptable or better, Yellow=questionable, Red=unacceptable

Table 9.1 - The dimensions, criteria and drivers summed up in a table.

# 10 Case Evaluation

In order to attain an impression of the practicality of the RaMHAE at Sony Ericsson two fictive services were made up and a decision regarding these were made using the model. A Sony Ericsson employee was introduced to the cases and RaMHAE implementation and asked to make the decision with our assistance. Afterwards the use of the process was evaluated according to the criteria specified in chapter 10.2.

## 10.1 The Cases

### 10.1.1 A Voice over IP Service

As data traffic becomes increasingly affordable with the introduction of high speed networks and flat rate pricing structures VoIP solutions becomes increasingly attractive, especially for long range calls. The suggested service is a VoIP implementation in JAVA running on an upcoming platform with the necessary APIs to enable the service. It's based on a protocol from a currently operational VoIP service and is supposed to offer a quality of service comparable to the current circuit switched calls.

The business case is simple; provide a cheap and reliable way of making voice calls to lower the total cost of usage and therefore make the hardware more attractive. It is required to work flawless under normal signal reception strengths. Strategically it is supposed to enforce Sony Ericsson's strategy to provide developing markets with cheaper phone solutions to gain market share.

### 10.1.2 Subscription Music Streaming Service

This service is based on streaming of media in real time; a server-client IP connection enables the transfer of digital content from the server at request from a customer. The customer pays a monthly fee to gain unlimited access to a predefined library of copyrighted material. The quality of the stream is dynamic to optimize quality under good reception conditions and enable basic low quality service under poor reception conditions.

Strategically Sony Ericsson follows a concept pioneered by Apple but with two major competitive advantages; first no docking will be necessary to download music neither will any storage space be necessary, secondly one of Sony's subsidiaries Sony BMG holds a vast music library that synergies can be drawn from.

From a market point of view the "unlimited storage", no wait for downloads to be completed and a pricing strategy that are considered as fair by the consumers make the service attractive. At the same time as the content provider's worries on illegitimate use are minimized since the songs actually never are downloaded and thus are difficult to make illegal copies of.

## 10.2 Outcome

As stated earlier in this thesis our purpose was to construct a model that is holistic, rapid, rational, transparent and useful to the organization, the model should also support decision makers in their work (be easy to use). According to a research manager RaMHAE especially contributes with value in terms of that the selected criteria address vital questions and thereby form a high quality decision foundation, thus fulfilling the aim of making a holistic model.

During the evaluation the proposed business cases took well under an hour to evaluate even though most drivers where discussed extensively to find out which use cases that were reasonable and the implications of changing the use case. Our opinion is that a full review of a reasonable number of cases/markets/business models for a professional that have good knowledge of the technology and competition could be completed in less than an hour.

Applying the RaMHAE on to the fictive cases resulted in two interesting patterns where both cases in the end where dominated by the green scores and thereby passed the initial decision process. This result was in line with the decision that the research manager would have done without any support of RaMHAE, indicating that the model makes subjectively rational decisions. It was proven, the downside of the model, lies in the fact that it is possible for the user to plot down the answers he wishes to find. This was though immediately neutralized by the fact that the credibility in the answers can be challenged by any counterpart at any time.

The RaMHAE was accepted without any observable difficulties and using the model was described as a straight forward procedure. It was pointed out by the test person that the purpose of using the RaMHAE must be communicated to the users in a very clear way to prevent users from feeling narrowed or controlled. Another input was how to handle a theoretical situation (choose among projects) where the outcome from the model would show a number of entirely green-scoring projects? The tests however indicate that the model is functioning according to plan. The overall finding from the test runs can be concluded with the fact that RaMHAE fulfills its basic purpose by supporting and functioning as a ground for decision making. This by simultaneously using the existing know-how incorporated within the organization and among employees to reach better informed decisions.

One critique is that RaMHAE just applies the current strategy to a certain extent, it does not answer if a particular business area is right for Sony Ericsson. Applications developing market segments Sony Ericsson already has invested in scores higher than others, reinforcing these segments. The lack of a clear mechanism to follow the lead of other companies was also pointed out as a weakness. Although some of the aspects of the model, technological maturity, market timing and the cost measures indirectly addresses this issue.

Overall the RaMHAE implementation could be considered to score positive in all of the aspects mentioned in the purpose, although there are several weaknesses there seems to be some checks and balances built in to the model controlling them.

### 10.2.1 Example Subscription Music Streaming Service

Initially we decided to assume that the product would be developed for Heartbeat HB08-1, the upcoming platform for 2008, it was also assumed that a flat rate data traffic service was to be used. The benchmark group of products was limited to other streaming services using equal fundamental technology. Based on these assumptions the outcome of the evaluation of the music service can be seen in table 10.1.

All three dimensions score only yellow and green grades making the service feasible, although if this particular product would score good enough to actually be chosen for development depends on the competition from other ideas using the same development resources. The strength of redundancy in the different drivers can easily be seen in the evaluation sheet, for example if the project is chosen to be developed internally unit cost in development dimension would score lower and the IP cost score in the market dimension higher and vice versa. Another example of this is the choice of platform, if an older platform e.g. the current was chosen market timing would score higher and technical complexity lower.

| Dimension | Criteria | Driver, definition & evaluation method | Green | Yellow | Red | N/A |
|---|---|---|---|---|---|---|
| Strategic | Branding | **Favourable rating:** *Estimated fraction of the public that will have a positive opinion of the software compared to competing solutions.* Ordinal scale compared to other SEMC services | X | | | |
| | | **Unfavourable rating:** *Estimated fraction of the public that will have a negative opinion of the service.* Ordinal scale compared to other SEMC services | | X | | |
| | Tech. maturity | **Technological maturity:** *Estimated level of functionality as a fraction of the use cases (geographically, indoor – outdoor, during transport etc.) where the service works properly.* Ordinal scale compared to competing services | X | | | |
| | | **Quality performance:** *Estimated level of performance of the service on given hardware (old or estimated new).* Ordinal scale compared to competing services | X | | | |
| | | **Strategic dimension total** | 3 | 1 | | |
| Market | Value added | **Ease of use:** *Estimated or required need for learning to be able to operate the service.* Ordinal scale compared to competing services | | X | | |
| | | **Usefulness:** *Estimated ability to satisfy the relevant customer need.* Ordinal scale compared to competing services | X | | | |
| | Installed base | **Preinstalled base:** *Estimated fraction of handsets that are shipped with the application preinstalled.* Ordinal scale compared to other SEMC services | X | | | |
| | | **Compatible base:** *Estimated fraction of the handsets on the market that can run the application with full or almost full functionality.* Ordinal scale compared to other SEMC services | | X | | |
| | Cost of usage | **Operator related usage cost:** *Estimated cost generated from usage of the cellular network on average* Ordinal scale compared to other SEMC services | X | | | |
| | | **Intellectual Property cost:** *Estimated cost of buying media and licenses under one or more business models.* Ordinal scale compared to competing services | | X | | |
| | | **Market dimension total** | 3 | 3 | | |
| Development | Complexity | **Business complexity:** *Estimated or decided number of businesses besides the developing company involved in enabling the service.* Green=0-2, Yellow=3, Red=3+ | | X | | |
| | | **Technical complexity:** *Lowest level of abstraction required in the application development .* Green=Application, Yellow=OS/own platform, Red=Third party platform | X | | | |
| | Cost & Time | **Market timing***: Estimated timing of the market opportunity.* Ordinal scale, Green=Good - acceptable timing, Yellow=Early or Late, Red=Too Early or too Late | | X | | |
| | | **Unit cost***: Estimated cost of development effort / estimated number of users + estimated marginal cost of each copy* Ordinal scale compared to other SEMC services | | X | | |
| | | **Development dimension total** | 1 | 3 | | |

Green=acceptable or better, Yellow=questionable, Red=unacceptable

Table 10.1 The outcome of the evaluation of the subscription music streaming service.

# 11 Conclusion

The contribution to the knowledge base in the fields of decision making and estimation primarily lies in the general approach which has showed a method of building decision models from a holistic view point. The aim of making a normative model is fulfilled by the synthesis of current practise and theoretical input. The RaMHAE implementation at Sony Ericsson can be seen in figure 9.1, while the usage process is presented in figure 9.2 and the evaluation sheet is shown in table 9.1. The generic base for the model (before adaption to Sony Ericsson) can be seen in figure 7.1.

The approach used in this thesis, a three dimensional approach to the business, makes the need to consider all factors important to the company, obvious to decision makers. The RaMHAE for Sony Ericsson is perceived as fair and balanced when evaluated by professionals and employs a rather simple green/yellow/red evaluation mechanism that makes it rather easy to use. Changes in the cases were found to quite often increase one driver's rating while decreasing another which tells us that the model is rather rigid.

The largest benefits with using the checklist were found to be that it helped the decision maker move the subjective *gut feeling* from an overall level to a number of more tangible drivers. This lets others survey the decision making and thus help both the decision makers and colleagues to have a dialog over the assumptions made. The list of prerequisites also helps to clarify under which conditions the service will be most successful.

The largest drawback of using RaMHAE is that it is constructed like a kind of self evaluation, if the user wants a certain answer he or she can change the use case and make arguments that justify that answer. This limits the rationality in the model´s decision making, although it can probably make the subjectivity a bit more obvious at a review. Another drawback lies in the three graded scale where the user often finds situations where an answer is in between two grades this opens up for a far more dangerous type of subjectivity that is harder to identify. Constantly giving a service the benefit of the doubt could generate a vastly over rated response.

Overall we believe that the suggested approach could be a support in making more rational, less subjective decisions. Lowering the level of subjectivity and forcing the decision maker to think about all dimensions of the business. The general approach of the model is not constrained to any specific industry as the basic three-dimensional structure describes a generic business. Although our implementation focuses on an actual implementation at Sony Ericsson the RaMHAE should be able to be adopted in other similar businesses and industries with rather small modifications. The process of screening relevant criteria for the three dimensions from actual projects and

academic research and building a model with the properties of this implementation should be possible in any industry. However this is not tested and is a matter for future research.

## 11.1 The Practical Problem at Sony Ericsson

Geographical proliferation of cell phones raises a serious question regarding the scope of a service, it should not only be considered for a single market. The multiple evaluation cases method introduced in the RaMHAE implementation enables the company to assess the implication under multiple sets of prerequisites. This will probably be helpful in lowering the risks of having a too narrow scope during the evaluation.

To answer what makes a service successful a number of case studies pointed out a number of criteria which were carefully chosen to both have scientific and industry relevance. Since the criteria and drivers selected had two goals: being holistic and practically useful in this particular industry and were tested accordingly our perception is that they include most aspects of making a service successful.

The goal of the model from Sony Ericsson's point of view was to enable a screening of application ideas in order to balance risk and utilise resources in an efficient manner. The sorting mechanisms built in to the RaMHAE helps allocating resources to the overall most promising services and implementing them with the most suitable business model. Risk of missing out on opportunities are lowered since the projects are benchmarked with competing solutions, finding out where and when Sony Ericsson must invest to fill gaps in their offerings and introduce applications on the market with acceptable timing.

The RaMHAE was also required to be easy to use, this way it was more likely to be adopted by the organization. Therefore a simplistic grading scheme was incorporated and the number of evaluation questions minimized and summarized in a one page table for convenient use.

The last point in the practical problem, to tackle the subjectivity of the *gut feeling* and show the underlying deliberations were only successful in part. The overall evaluation is broken down into a number of driver evaluations which in turn are evaluated somewhat subjectively. However strictly making an objective decision would be tedious and still be required to be based on estimates which in many cases are impossible to make objectively.

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# Appendix I – Abbreviations List

| Abbreviation | Term | Explaination |
|---|---|---|
| (E) GPRS | (Enhanced) General Packet Radio Service | A packet oriented mobile data service for GSM |
| 3G | Third Generation mobilephone standard and technology | A group of cell phone terminal and network standards including UMTS and CDMA2000 |
| AHP | Analytical Hierarchy Process | A decision making method based on comparison of unique requirement pairs |
| API | Application Programming Interface | A source code interface that an operating system, library or service provides to support requests made by computer programs |
| CD | Compact Disc | A regular music or data disc |
| CMM | Capability Maturity Model | A model developed to support assessment of companies' software development capabilities |
| COCOMO | Costructive Cost Model | A model using SLOC to determine programming effort |
| CPU | Central Processing Unit | A class of logic machines the can execute computer programmes |
| CTO | Chief Technology Office | An organisational unit within Sony Ericsson |
| DRM | Digital Rights Management | Technologies which provide access control for digital media |
| FP | Function Points | A measure of programme size using the number of functions in the programme |
| GPS | Global Positioning System | A satellite based system to determine geographical coordinates |
| GSM | Global System for Mobile communication | The most popular standard for mobile phones in the world |
| IM | Instant Messaging | A network dependent real time chat service |
| IMS | IP Multimedia Subsystem | An architectural framework for delivering internet protocol (IP) multimedia to mobile users. |
| IP | Internet Protocol | A way of transferring data over the internet |
| IP | Intellectual Property | Creations of the mind such as musical, literary, and artistic works; inventions; and symbols, names, images, and designs used in commerce, including copyrights, trademarks, patents, and related rights. |
| ISP | Internet Service Provider | A company selling internet connectivity (data) wired or wireless (e.g. Bredbandsbolaget) |
| KPI | Key Performance Indicator | Metrics used to help an organization define and measure progress toward organizational goals |
| MB | Mega Byte or Mebi Byte | One million or 2^20 Bytes (one byte represents one character) |
| MMS | Multimedia Messaging Service | Multimedia message (photos, sounds etc.) for handsets |
| MNO | Mobile Network Operator | A business providing mobile connectivity via mobile radio technologies to users (e.g. Telia, Vodafone) |
| MP3 | MPEG-1 Audio Layer 3 | A digital audio encoding format using a form of lossy data compression |
| PCA | Processing Complexity Adjustment | A way to adjust function points to function counts |
| PEST | Policital, Economic, Sociocultural, Technological - analysis | An analysis tool for the market environment |
| SAG | Sony Application Group | A business unit in the Sony corp. |
| SEI | Software Engineering Institute | The institute that developed CMM |
| SEMC | Sony Ericsson Mobile Communications AB | Sony Ericsson's intl. legal entity |
| SERC | Sony Ericsson Research Center | The organizational unit in charge of testing and development of conceptual technologies |
| SLIM | Software Lifecycle Management | A model using SLOC to determine programming effort |
| SLOC | Source Lines of Code | The size of the noncompiled programme code |
| SMS | Short Message Service | Text messages for handsets |
| TAM | Technology Acceptance Model | See section 3.2.1 |

| Abbreviation | Term | Explaination |
|---|---|---|
| TPB | Theory of Planned Behaviour | See section 3.2.2 |
| TRA | Theory of Reasoned Action | See section 3.2.1 |
| UCP | Use Case Points | A way of determining programming effort from the number of use cases |
| UMA | Universal Mobile Access | A telecommunication system which extends mobile services voice, data and IP Multimedia Subsystem/Session Initiation Protocol (IMS/SIP) applications over IP access networks. |
| UMTS | Universal Mobile Telecommunication System | One of the 3G technologies used predominantly in Europe |
| WLAN | Wireless Local Area Network | A wireless local computer network |
| VMNO | Virtual Mobile Network Operator | A business providing mobile connectivity via an MNO's network (e.g. Glocalnet, Virgin Mobile) |
| VoIP | Voice over Internet Protocol | A way of making voice calls over the internet |
| | JAVA | A programming language originally developed by Sun Microsystems |
| | Heartbeat | The platform generation cycle time within Sony Ericsson consitutes a heartbeat |