Investment Evaluation for Small Scale Information Systems

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av

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Abstract
This paper presents a set of factors to consider when conducting investment evaluations for small scale IT systems. These factors have been derived by combining information from an extensive literature review, a single case study and an external expert. The literature review uses prior research on evaluation of large scale investments to inform and constrain the single case study. The single case study adds depth to the analysis by combining technical and operational perspectives from senior management, middle management and the general workforce. Ultimately an expert was consulted to evaluate the generalizability of the findings from the single case study, before the final list of factors was compiled. These factors should not be applied formulaically, as one of the main findings of this study is the diversity and complexity of small scale IT projects, preventing the application of general models. Instead, decision makers are encouraged to use these factors as a complement to their own experience, and to maintain close communication with potential stakeholders throughout the decision process.

Key-words: IT, Information Technology, IS, Information System, Evaluation, Small Scale
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1 INTRODUCTION

Today, computers are a vital part of almost every company in the developed world. Information technology has evolved from huge machines that execute basic algorithms to small devices that can support humanity with a multitude of complex operations. Computers have reshaped all of society in the last 50 years and today it is hard to imagine a world without them. Because computers have become a key part of corporate success, the size of IT investments have increased. In the year 2000, total IT spending worldwide was estimated to almost 2 trillion USD (Pisello, 2003).

On the other hand, the development of new information systems tend to be more expensive than expected. A report released in 2012 by McKinney and University of Oxford suggests that “half of all large IT projects —defined as those with initial price tags exceeding $15 million— massively blow their budgets.” In addition the report concluded that on average 45% of the investigated projects went over budget (Bloch et al., 2012). Previous findings provide convergent evidence for the budget problem in IT projects (Flyvbjerg and Budzier, 2011). The authors specifically warned for so called black swans, which are projects that ends up with a cost overrun of 200%.

Because of the costs documented above, management tend to be reluctant to invest in new IT systems. This unwillingness to accept small but important improvements to IT infrastructure, stifle innovation and may damage a company’s competitiveness. On the other hand, starting any project without some kind of prior evaluation would be foolhardy. Therefore this thesis aims to develop methods that are applicable to the evaluation of such small-scale projects.

1.1 PROBLEM FORMULATION

As more and more operations rely on computers, and software and hardware evolves in an ever increasing pace, it is not uncommon that older software systems need to be updated or replaced. When evaluating whether to adopt a new computer system, a wealth of methods are available. There are methods that cover both monetary perspectives and takes intangible values into account. The definition of an intangible value according to IAS 38 follows:

“An identifiable non-monetary asset without physical substance” - International Accounting Standards Board standard 38
A few examples of intangible assets are databases, internet domains and knowledge. However evaluation, of intangible values tend to either be unreliable or take too long. On the other hand, monetary evaluation does not always reveal the full picture, and in addition, projects often ends up being a lot more expensive than expected (See section 1). Due to the costly worst case scenarios, improvements of small IT systems can easily be rejected. A graph illustrating a simplified example is provided in Figure 1. However, for small scale system investments the monetary factor might not be sufficient to guide good decisions. Other factors such as customer satisfaction, risk management and employee stress levels etc. could be worth taken into account. If a small project did end up as a black swan, it would still only have a minor impact on the total net profit of the company.

![Investment Calculation Small Scale Computer System](image)

*Figure 1: An example of an investment calculation*

### 1.2 objective and research questions

The objective of this study is to investigate how investment evaluation of small scale computer systems should be performed, which will be done by answering the following research questions:

1. *How can existing methods developed for large scale IT investment evaluation be applied to a small scale IT context?*
2. *What factors should be taken into consideration when evaluating whether to invest in a small scale computer system?*
1.3 OUTLINE

1. A brief background is presented, along with the problem formulation and the research questions.
2. The methodology of this study is presented. A single case study approach is chosen and it is supported by a comprehensive literature review as well as an external expert.
3. The extensive literature review examines evaluation methods of large scale IT projects, the applicability of these methods to smaller projects are discussed.
4. The key findings from the interviews, the literature review and the expert are presented individually and put in relation to one another.
5. I conclude that large scale methodologies is not transferable to small scale studies. Instead I identify 35 factors that can act as a support for decision makers.
2 METHODOLOGY

In order to answer the questions set out in the first chapter, an explorative approach is adopted. The topic of evaluating small scale IT investments have not previously been studied. Therefore, an explorative approach is suitable (Hallin and Blomkvist, 2014). This is combined with an inductive workflow where the findings are results of observations. To be able to make observations a case study is conducted. This study aims to understand the complex social phenomena of evaluating small scale IT investments, and for that type of research a case study is appropriate (Yin, 2009). Additionally, Collis and Hussey (2009) argue that a case study can provide the researcher with a full understanding of a problem. Arnaboldi (2012) argues that a single case format can be used as a representative or a typical case. However, a case study with a specific target group tends to end up with a subjective view. On top of this, it is still unclear if the findings from the case company are representative. To compensate for the subjective view and company specific findings an external expert is consulted to complement, criticize and validate the findings.

In total three lines of inquiry are pursued: First, an extensive literature review is conducted to assess what can be learned from models on how to evaluate large scale IT projects. With this background serving as a basic framework, interviews are conducted with various people in the case company. The combination of these two create the results of the case study. Finally, an experienced external expert is interviewed to present his view of the matter as well as commenting the case findings. This process is graphically represented in Figure 2 below.
2.1 **The Case Company**

This case study has been conducted with Söderberg & Partners in Stockholm, Sweden. They are active in the finance sector and sells supporting systems related to finance, including insurances, payroll and benefits. For this case study a quotation system for group insurance is analyzed. The team involved with group insurance consists of twelve members. However, due to the complexity of the current quotation procedure, only two persons in the group handle these tasks.

2.2 **Interviews**

Interviews are one of the most common methods used in social science research and are a good way to gain deeper understanding of a phenomenon and to discover new dimensions of what is being studied (Hallin and Blomkvist, 2014). The interviews are the main source of novel data in this study. In order to get insights from the various stakeholders in the company, interviews are held with a number of people with different roles. In total, five interviews are conducted. This is considered sufficient for the study and Collis and Hussey (2009) argue that the size of the sample is not crucial for master thesis studies.

The interviewees and their titles are presented below in Figure 3. The lighter boxes show employees and are denoted by role, the darker boxes represents the business areas in which the employee is active.
The interviewees are selected, as they understand the project in different ways based on their roles in the company. The interview with the head of the department is necessary since that person, in this case, makes the final prioritization among investment decision for small scale systems. Additionally, the head of the department has to consider the strategic questions related to prioritizing different projects. The technical group manager needs to assess the feasibility of the system and do also hold the responsibility to deliver the system solution. In this specific case, it is the product specialist as well as the group manager in customer service that primarily use the current solution. Hence, their thoughts regarding the need for a new investment are an interesting input which helps to identify additional factors that senior management might have missed. The last interview is conducted with a potential user of the system that is currently working with related tasks. This interview could potentially be left out. However, since the potential user is a stakeholder that is effected by an investment, the decision is made to include them.

The interviews are conducted in a semi-structured way and are held individually for an hour or less. Collis and Hussey (2009) argue that semi-structured interviews, with open-ended questions, makes it possible to get more detailed knowledge but also makes it possible to identify relevant topics that
otherwise might not have come up during the interviews. An interview template is developed for the semi-structured interviews, this can be found in Appendix A. Interview templates are generally based on a number of predefined themes or questions that are written down (Hallin and Blomkvist, 2014). For the purpose of comparability, all of the interviews are based on the same template but different interpretations of the questions are expected. In all of the interviews notes are taken and relevant follow up questions are added to the template. To be able to extract exact phrasing, the interviews are recorded. All of the interviewees provided their informed consent to these recordings. All of the interviews are conducted in Swedish, as it is the native language of the interviewees and the author. The risk of misunderstandings during the interviews where considered a greater threat to data validity than information loss during translation.

2.3 Expert Opinion

After the initial results are produced, an external expert is consulted. The expert is currently lead architect at Visma IT, but have also been active at IBM for several years. He has almost 20 years of experience in IT development. Throughout his career, the expert has been active in investment evaluations for IT projects, both at Visma and IBM. He has been involved in both large and small scale projects, internally as well as externally as a consultant and the expert has been active in both development and maintenance. The opinion of the expert is used to identify aspects that are unique to this case so that these aspects can be highlighted in the results, and when future applications of this work are discussed.

The expert is consulted to enhance the reliability of this report and to adjust the findings according to the observed state of the industry. By including an expert, the results of the case study can be complemented as well as criticized which is included in the discussion in the fourth and fifth chapter.

2.4 Data Analysis

Due to the limited time scale of a master thesis, only a relatively small qualitative dataset is analyzed. The data is collected, compiled and grouped for each interview so that parallels between the interviews become clear. When the data is compiled, it is categorized into subgroups which are matched with factors that are primarily identified in the literature review. However, within the literature reviews a lot of different terms corresponded to similar topics, hence the categories are given names that aligned with the interviews. The factors that are considered most vital for this study are: business alignment,
long term potential, risk and time. An additional set of factors were identified during the interviews but are left out, these are: competence, cost, data availability, decision documentation, feasibility, goals, impact, legality, problem, scenarios, simplicity versus flexibility, stakeholders and usability. Several considerations were taken into account when deciding which factors to include in the main analysis such as amount of data, amount of research already conducted and complexity of the problem. A lot of research is already conducted in the areas of cost, feasibility, legality and usability; this is also the case for risk and time, but new interesting perspectives on these topics were mentioned during the interviews. Due to lack of data: competence, data availability, decision documentation and impact are not primarily considered. Finally, goals and problems, scenarios, simplicity versus flexibility and stakeholders are left out since this study would not be able to sufficiently capture the complexity of these problems. On top of the identified factors, an interesting discovery regarding idea management are found during the interviews and is included into the study. The selected factors are examined and compared with previous findings in the literature. This comparison forms initial conclusions that are discussed with the expert who provides feedback on the generalizability of the findings. This results in a revised picture of the findings and the final conclusions.

2.5 Delimitations

This study is limited to investment evaluation of small scale IT-systems (systems intended for 2-10 users). The limitation is set because there is already a lot of research conducted on large IT investments due to the extent of their impact on the host company. The development process is very important for the final performance of an IT system. This study does not aim to account for this, instead the focus lies on how to evaluate what system to develop, rather than how different implementation methods affect the outcome. Neither will this study deal with the evaluation of developed IT systems, even though there is obviously some overlap with evaluation relating to the investment process. Since the case company is active in a Swedish context, the findings will reflect this. However, the literature study is based on studies conducted across the world and the expert interviewed has experience of other countries within the Nordic region. Finally, care should be taken to adjust these factors to the context they are applied, for example by accounting for cultural differences and adapting the factors according to company structure.
2.6 Quality of Research

To evaluate the quality of research Collis and Hussey (2009) argue that three perspectives need to be considered. These are reliability, validity and generalizability. How each of these concepts relates to this study is discussed below.

Since this study is primarily based on new data from one company, due to the single case format, and a relatively small sample of interviews, the reliability could be questioned. To compensate for this, the interview template is intentionally created as a combination of themes and open-ended questions, rather than only question topics that are suggested by Hallin and Blomkvist (2014). The reliability of the study is also strengthened by including an expert opinion, to evaluate the reliability of the case. The benefit of the single case study is that it offers real life experiences. Different parts of the organization has been included, and multiple points of views are taken into account. This contributes to the validity of this research. Finally, the author of this report has attempted to provide an objective overview by comparing and contrasting well-known theories, and highlighting the points of contention.

All of the interview material has been anonymised in order to create a safe environment, where the interviewees feel that they can voice their true opinions, which strengthens the validity of the findings. It could be argued that the loss of transparency would hurt the reliability of the report; this is considered a minor issue and an acceptable cost of the improved validity.
3 Literature Review

Investment evaluation of IT systems have been on the agenda for a long time. The first conference focusing on issues related to IT investment evaluation, the International Federation of Information Processing, took place in 1961. Since 1961, many evaluation strategies have been introduced. (Berghout and Renkema, 1994) In 1993 Farbey et al. argued that there is no single best method with regards to IT evaluation, because the differences between projects are too big. Others agreed that no single method is accurate in foreseeing the business value gained from IT investments. (Hirschheim and Klein, 2003) However, this scepticism resulted in a scarcity of methods by the early to mid-90s. In the Netherlands structured reviews of previous studies were conducted and 65 different methods were identified (Berghout and Renkema, 1994; Swinkels and van Irsel, 1992), the entire list of methods can be found in Appendix B. (Renkema and Berghout, 1997)

The 65 methods listed by Renkema and Berghout (1997) are not based on a unitary set of principles and assumptions. Rather, they can be grouped into four categories: the financial approach, the multi-criteria approach, the ratio approach and the portfolio approach. (Renkema and Berghout, 1997) The financial and multi-criteria approach are discussed in individual sections below. The ratio approach is left out from the study because it is optimised for bigger projects and is not applicable in this context. The main idea of the portfolio approach is to spread risk within different segments. Since small scale projects seldom need to be risk managed to this extent the portfolio approach is left out from this report as well.

One problem that has been identified with investment evaluation of IT systems is that top management tend to avoid using structured methods when deciding upon IT investments. Only 16% of the companies use rigorous methods to evaluate IT investments according to Hochstrasser and Griffiths (1992). This is aligned with observation that CEOs feel uneasy and sometimes dissatisfied with the use of investment evaluation (Parker and Benson, 1989; Uwizeyemungu and Raymond, 2009). As a result, management are now relying more on instinct (Bannister and Remenyi, 2000), which indicates that the current methods are too complex in relation to the utility of the delivered forecast.

Many sources of complexity of IT projects have been identified in the literature. First off, the actual development process is problematic. The outcome of an IT development project is affected by many different factors, making predictions difficult. Additionally, most of these factors are hard to measure, adding further complexity to the evaluation process. In 2007 Hartono et al. conducted an analysis of
field studies that had been carried out within IT development and listed the following features as the main antecedents of success; (Hartono et al., 2007)

- Degree of management support
- Nature of organizational attitudes and commitment
- Perceived user friendliness of the system
- Degree of developer skills
- Task characteristics such as degree of problem difficulty supported by the system
- Level of user experience
- Level of user participation
- Degree of perceived value
- Level of user training

In addition to these antecedents other factors have been identified which makes an investment evaluation problematic. First, many of the benefits tend to be intangible (Remenyi et al., 2007). Second, the systems tend to affect more than one particular unit within an organization and in a more general way enhance different aspects of the organization. Third, it can be hard to foresee where benefits will arise and in some cases it can be in an external context that is hard to measure accurately (Mahr, 2010). Examples can be found in benefits related to agility, flexibility and first-to-the-market (Kohli and Grover, 2008). Lastly it is hard to measure the performance of IT, since the results can be seen both as a short term improvement as well as a long term investment with multiple factors. (Martinsons et al., 1999).

Even though the results can be seen as short term improvements, studies have shown that companies should focus on the long term investment. Therefore, companies should try to account for long term effects when evaluating potential projects (Brynjolfsson and Hitt, 2003; Irani and Love, 2002; Santhanam and Hartono, 2003).

Due to the complexity of developing IT systems, it is very important to do a risk assessment as a part of the appraisal (Strassman, 1990). A project risk assessment is an “Evaluation of the risk factors associated with the delivery or implementation of a project, considering stakeholders, dependencies, timelines, cost, and other key considerations. This is typically performed by project management teams.” (Atkinson and Jourdan, 2008). In addition to the risk assessment, an IT investment evaluation (described next) should be primary the decision support.

3.1 **Financial Approach**

The financial approach is to evaluate projects based on tangible financial measures. It is traditionally used for all types of investment evaluation (Renkema and Berghout, 1997). However, the
The appropriateness of the financial methods has been widely debated (Gammelgard et al., 2007). The financial approach, whilst being useful in traditional project evaluation, may be unsuitable for the IT industry. (Farbey et al., 1993) One of the main reasons why it is problematic is that the choice of method can affect the outcome of the evaluation, even though the same data is provided. In addition to this discordance, management should be aware of the problems related to limiting themselves to a single financial dimension in IT investment evaluation. A financial approach excludes intangible values, which have proven to be a key factor in many IT projects. One reason for this is that they tend to be hard to measure (Love and Irani, 2001; Remenyi et al., 2007).

In this report two methods from the financial approach category are discussed. First, the payback method, a method based on the simple question; which investment should be implemented in order to get back the invested money as fast as possible? The second approach is Net Present Value (NPV), which belongs to discounted cash flow methods. Since discounted cash flow methods are more reliable, but also more time consuming, NPV will be used as reference method in relation to the first approach (Berk and DeMarzo, 2013). NPV was chosen over other discounted cash flow methods since it is a well-known method in the industry.

3.1.1 Payback Method
The payback method is widespread; 56% of the firms use it as a part of the decision process (Graham and Harvey, 2001). The payback method has been criticised for not considering what is happening after the payback is completed. Furthermore it does not account for the time value of money and it is unclear how to determine the maximum acceptable time for a project to break even. Because of this shortcoming, it is primarily used as support rather than as the sole evaluation method (Lefley, 1996).

A payback calculation require only two primary inputs from the project: the expected cost and the expected earnings per year. With a simple division the expected payback time is calculated (shown in Equation 1). The lower payback time the better (Berk and DeMarzo, 2013). The only challenge in the payback method is to calculate the expected cost and earnings per year, this can be especially difficult if these vary over time. A cost calculation is conducted within every investment evaluation, but the accuracy of these are far from perfect, as discussed in chapter one. Calculations of the expected earnings per year can be done in some cases, but for IT projects this can be hard due to the wide range of interacting socio-technical factors (Love and Irani, 2000; Serafeimidis and Smithson, 2000).
Equation 1: Payback Method Formula

\[
Payback \ Period = \frac{Expected \ Cost \ of \ Project}{Expected \ Earnings \ of \ Project}
\]

One of the main reasons that the payback method does not cope very well with IT investment evaluation lies in the very nature of IT investment. An IT investment typically has a long term focus, with aims of flexibility and the possibility to integrate components to the system. The payback method on the other hand focuses on a short term perspective, which can result in misallocation of resources. (Irani and Love, 2002) In addition, it has been estimated that projects with a long term focus (three to seven years after development) perform two to five times better than projects with a short term focus (one year after the development) (Brynjolfsson and Hitt, 2003).

The unclear earnings per year together with the short term perspective tends to make the payback method unusable since it is neither well adapted nor accurate. This indicates that even if the payback calculation is included in the decision making material one might be wise to not even give it a glance.

3.1.2 Net Present Value

NPV is also commonly used in the industry but it is a more sophisticated method which takes into account the discount rate, time and net cash flow. For each period of time the net cash flows are calculated. These cash flows are then adjusted to the present day value by applying the discount rate. In the end, the NPV calculation provides a value representing the profit or loss of the investment. (Berk and DeMarzo, 2013) The net present value formula is printed in Equation 2, where \( i \) represent the discount rate, \( R_t \) is the net cash flow at a certain time \( t \) and \( N \) is the number of timespans calculated. NPV has two main advantages compared to the payback method: it takes inflation or deflation into account, and it makes it possible to compare the return on investments after a set time span. (Greenfield et al., 1983)

Equation 2: Net Present Value Formula

\[
NPV(i, N) = \sum_{t=0}^{N} \frac{R_t}{(1 + i)^t}
\]
As long as you have totally captured all of the costs and benefits that is related to the investment it gives a good indication whether to invest or not. This is described in the NPV Decision Rule (Berk and DeMarzo, 2013):

*When making an investment decision, take the alternative with the highest NPV. Choosing this alternative is equivalent to receiving its NPV in cash today.*

Even if net present value calculations are considered straight forward, studies show that they are not commonly used within IT investment evaluation. Violino (1997) claims that less than 25 percent use formal return on investment when evaluating IT investments. Formal return on investment (ROI), is a way to calculate the relation between the investment and the expected outcome (Beattie, 2010). Net present value is one of the methods that can be applied to the ROI framework.

The payback method, as well as net present value are in general commonly used within the industry. However, shortcomings in capturing the entire value of IT evaluation have been noticed while applying strictly financial measures. As a result, other ways to evaluate potential investments have been suggested, among them the multi-criteria approach which is described in the following section.

### 3.2 Multi-criteria Approach

Scientists have previously shown that the positive effects of IT systems are sometimes difficult to translate to financial measures of performance (Brynjolfsson and Hitt, 1996). According to Melville et al. (2004), a strictly financial model cannot capture the complete benefits from an IT project. Literature states that when developing new systems, intangible values are a great part of the results and financial methods fail to capture this (Remenyi et al., 2007; Viglas et al., 2011). In an attempt to include the intangible values, the multi-criteria approach was developed.

One of the first methods that emphasized the multi-criteria approach that is still used, is the balanced score card developed in 1992 (Kaplan and Norton, 1992). The balanced score card is a tool developed primarily for top management and provides four key aspects that should be considered and measured to obtain a competitive advantage:

- Are we satisfying customer needs? (customer perspective)
- Are we working effectively and efficiently? (internal perspective)
- What are the emerging opportunities and challenges? (innovation and learning perspective)
- How do we look to shareholders? (financial perspective)
How these four aspects interact can be seen in Figure 4 below.

Figure 4: Relationships between the four perspectives in the balanced scorecard

In a follow up article in 1996 Kaplan and Norton stressed the importance of having a balanced scorecard that is aligned with the business strategy (Kaplan and Norton, 1996). However, at the time, balanced scorecards tended to fail due to the difficulties to design them correctly. This problem could be a result of a lack of well-defined characteristics of an effective balanced scorecard (Lawrie and Cobbold, 2004). The difficulty to incorporate a balanced scorecard was exemplified by Braam and Nijssen (2004) who included a case company that failed to implement a successful balanced scorecard two times before they were successful at their third attempt. One of their respondents commented “You need some experience to get it right.” (Braam and Nijssen, 2004).

Even though the balanced score card is a well-developed tool it is not intended for an IT context. Many different methods have been developed over the years to adapt the balance scorecard. At an early stage, a special balanced IS (Information System) scorecard was developed, illustrated in Figure 5. However, as with the original version, people seemed to struggle to use it effectively, due to the complexity of the measure (Martinsons et al., 1999). Another approach that have been presented is to use the balanced score card in combination with a MCDM method (Multiple-Criteria Decision-Making).
like ANP (Analytic Network Process) or AHP (Analytic Hierarchy Process). (Viglas et al., 2011) However, these are poorly adapted for small scale.

![Diagram](image)

**Figure 5: Relationships between the four perspectives in the balanced IS scorecard**

### 3.3 Intangible Assets

It has been found that intangible assets are important parts of the value created from IT investments, examples are provided such as design of processes, organizational structures and ways of communicating (Brynjolfsson and Hitt, 1996; Hartono et al., 2007; Kohli and Grover, 2008). Due to the non-physical nature of intangible assets typical measurement instruments are too blunt to capture them (Kohli and Grover, 2008). According to Kaplan and Norton (1992) “you can’t manage what you can’t measure”. Kohli and Grover (2008), whilst agreeing with this sentiment, claim that some intangible assets can be measured, and therefore managed. Specifically, they argue that external characteristics such as flexibility, agility and customer service should be included in the values created from IT development. However, internal factors such as quality of employee life and user satisfaction are harder to measure and should therefore be left out (Kohli and Grover, 2008).

Researchers have identified multiple areas that should be taken into consideration, but have not come to a conclusion of what aspects are the most important. On the other hand, it is important to avoid
information overload and losing relevant data in the sheer mass of information (Kaplan and Norton, 1992). Multiple attempts have been conducted in order to categorize the intangible assets. DeLone and McLean (1992) developed their framework named IS success model which is one of the earliest models to include intangible assets. This model was slightly revised in their evaluating article that was published ten years after the initial publication. The method addresses six primary categories, namely: system quality, information quality, use, user satisfaction, individual impact, and organizational impact. In Table 1 these categories are exemplified with aspects that should be considered. (DeLone and McLean, 2003, 1992)
<table>
<thead>
<tr>
<th>Systems Quality</th>
<th>Information Quality</th>
<th>Use</th>
<th>Service Quality</th>
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<tr>
<td>Adaptability</td>
<td>Completeness</td>
<td>Nature of use</td>
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<td>Availability</td>
<td>Ease of understanding</td>
<td>Navigation patterns</td>
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<td>Reliability</td>
<td>Personalization</td>
<td>Number of site visits</td>
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<td>Response time</td>
<td>Relevance</td>
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<td>Usability</td>
<td>Security</td>
<td>Security</td>
<td>Reduced search costs</td>
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</tbody>
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Cost savings | Expanded markets | Incremental additional sales | Repeat purchases | Repeat visits | User surveys |

Table 1: Examples of DeLone and McLean's IS success model
It has been confirmed that intangible values of IT projects create synergies with other parts of the organization (Brynjolfsson et al., 2002). This could be interpreted as an indication that values created by IT development are spread in many different locations within the organization. In the following section the theoretical framework for this study is presented.

### 3.4 Theoretical Framework

When evaluating IT systems it is important to not only look at aspects such as functionality, security and data quality. The first question that should be asked is; how does this system create business value? Does it help to increase process efficiency? Will the organization be more flexible after the implementation? Will future decision making be easier if the system is developed? When it has been established in what area business value will be created, other qualities can be considered, such as functionality, security and data quality (Gammelgard et al., 2007).

Mahr (2010) described related findings and emphasized the importance of having IT development that were aligned with the overall business. Shoemaker et al. (2011) are also thinking along the same lines. In their guidelines, which are described below, they focus on first establishing the goals and then measuring them when the implementation is done:

1. Set goals for what is to be improved
2. Establish a basic understanding of an organization's current process and product
3. Invest in change
4. Measure the effects of the change to determine if any improvement have been achieved
5. Measure the ROI by (a) determining what resources have been expended, (b) establishing what improvements, both qualitative and quantitative, have been achieved, and (c) determining the difference between the investment made and the benefits obtained

The research conducted within the field has shown that IT generally enhances firm performance through supporting several internal and external processes (Martinsons et al., 1999). However, it is yet to be proven which specific IT project types that correlates with certain benefits (Mahr, 2010). Additionally, research is still not clear on how certain types of IT projects relates to different managerial perspectives, such as individual focus, group focus or organization focus. (Kohli and Grover, 2008) Finally, there is a lag effect that typically occurs in IT projects. This means that the benefits of the project do not show until a time after the implementation is completed. The lag effect has not really been investigated, as a consequence, it is hard to know if expected results are completely absent or if they are yet to come. (Kohli and Grover, 2008; Santhanam and Hartono, 2003)
4 IDENTIFIED EVALUATION FACTORS

In this chapter, findings from the case study are presented as well as how the findings relate to the theory presented in the previous chapter. Firstly general observations from the interviews are discussed and similarities and differences are displayed to the reader. This is followed by a section were the expert presents his view on IT investment evaluation. The expert opinion is presented to provide the reader with a picture of the current process in the industry. After the initial two general sections, the four main themes identified in this study are presented. The four themes are discussed by comparing findings from interviews with findings in theory along with comments from the expert. The themes are:

- Business Alignment – A description of how projects can be categorised to evaluate if the projects are aligned with the current business plan
- Risk – Describes different perspectives of risk associated with IT projects
- Time – Presents aspects of time related to IT projects
- Long Term – An overview of different aspects that could be considered to achieve long term profit

After the themes, another important discovery that was found during the interviews are presented on the topic how to manage ideas from the employees. The chapter is concluded with a discussion of the factors that were identified in the study.

4.1 INTERVIEWS
One can notice that the interviewees generally highlighted factors that were related to their job, as expected. The group manager in customer services brought up the necessity of usability, an intuitive system that guides the user as well as clear and understandable error messages. The potential user agreed on the usability and requested simplicity so it would be easier to learn. Another request from the potential user was that information would only need to be entered into the system once. The technical group manager on the other hand considered completely different factors: Do we have all the data needed to create such system? Do we possess the competence within the development team? Is this a feasible solution? The head of the division had another idea, and believed that system age, costs and the impact on the organization were factors that should be considered. Additionally, he brought up the issue of how flexible the system should be to handle different scenarios, as a high degree of flexibility tend to correlate with a high complexity. The product specialist had three strong factors that should be a part of every evaluation; legality, cost and time.
The technical group manager also pointed out the importance of not rushing the projects. There is no need to start development before all of the necessary conditions are in place. Premature starts tend to lose more time than they save as resources are often misspent. The group manager in customer service identified the need of ensuring that the system feels useful to the users. Perceived usefulness is also discussed in the literature and it relates strongly with time spent using the system (Petter et al., 2008), and can thus be seen as a key marker of the success of the project. The technical group manager pointed out the same problem with IT investments as Farbey et al. (1993) highlighted in their study.

“The best method to use when evaluating IT investments is not always the same, it is dependent on the circumstances” – Technical Group Manager

All of the interviewees pointed out a number of stakeholders, which indicates that a big part of the organization is affected even when small scale systems are developed. The potential user emphasised the importance of employee participation in the decision process, and that she was pleased with how users were included in development decisions within the case organization. The technical group manager believed that one success factor was that the development team only had a person in charge of prioritizing the projects, in this case the head of department. When a development project has several managers from different parts of the organisation, the job of prioritising tasks might unintentionally be put on the developers.

4.2 The Expert
The expert begun by pointing out that investment evaluation is difficult, and that it is conducted in many different ways throughout the industry. He then gave an overview of how a general investment evaluation should be performed. It all starts with a need, a problem that needs to be solved. After that, goals that fulfil this need should be established. Depending on the size of the project and the company the goals can be translated into quantifiable requirements before potential solutions are identified. Each of the solutions should contain an expected price as well as business cases for market impact, as well as effect on intangible goals. On top of this, each of the solutions should have a financial expectancy based on NPV, this calculation should be done on a three to five years basis because IT systems tend to become obsolete rapidly. This is in line with the recommendations by Brynjolfsson and Hitt (2003), which argued for a three to seven year span. Both incomes and expenditures should be included in the NPV calculation. However, it is difficult to provide an accurate financial expectancy, because of difficulties quantifying some of the benefits (see financial approach section). When the calculations are
completed the expert argues that the decision should be made and the reasoning well documented. However, in the real world the process seldom looks like this example due to various reasons such as limited time and lack of knowledge according to the expert.

4.3 BUSINESS ALIGNMENT

The head of the department discussed the importance of having IT projects that were aligned with the overall business. The projects should not only work for themselves but should also create a unity and generate synergies within the organization. This is in line with the finding of Mahr (2010), who discussed the importance of having projects aligned with the overall business. The expert agreed with this and added the fact that in an external context it can be challenging to point this out. The head of the department does not do a formal evaluation of small scale projects, but has a mental template that he uses to evaluate the projects. This is not unusual according to Bannister and Remenyi (2000), who has shown that managers tend to rely on instinct. The expert agrees with this and states that little time and effort is spent on investment evaluations.

“The decisions are made in an unstructured way. Relatively little time is spent on understanding gains and consequences from investment evaluations today.” – Expert

The initial step in the head of departments’ internal process was to categorize the project into one of three categories; cash generating, performance increasing and strategic. Each of them are described below.

4.3.1 Cash Generating

The cash generating category is defined as follows; completion of the development results in a guaranteed new customer or another guaranteed additional cash flow. To illustrate: if the development is required to win a quote, it is a part of the cash generating development. However, if the development is required to participate in a quote it is not a guaranteed income and therefore not a cash generating development. The head of the department described the cash generating category as following:

“If we decide on this investment, we gain this deal which will generate incomes. These are the easy decisions” – Head of the Department

According to the head of the department none of the project categories are always the best choice. However, in general one should opt to develop a cash generating project. This is especially true for newly started companies or business units since a stream of income is always required to survive. The
customer group manager also mentioned that it is important to consider whether the projects are cash generating when evaluating new IT systems. The head of the organization stressed that there are both positives and negatives with cash generating projects. The downside with these projects is that additional customers might overload the systems, and that only looking at cash generation might lead to short termism. Short termism was identified as a common problem in literature since it contributes to misallocation of resources. (Irani and Love, 2002)

4.3.2 Performance Increasing

The second category is performance increasing. This category includes not only system related performance increases – such as speeding up algorithms that creates bottleneck effects – but also removing manual work by automatization. The head of the department described that if cash generating projects continuously are prioritized will a point eventually come where you:

“Either have to employ new personnel or increase the efficiency of your processes” –
Head of the Department

The product specialist discussed the need to facilitate everyday life with new system development. The group manager in customer service as well as the head of the department talked about the need to create efficiency in work, to automate repetitive work which in the long run can shorten the response time towards customers.

4.3.3 Strategic Investment

Strategic investment is the widest category and many different issues fall into this grouping. Examples of strategic investments would be to implement a feature that a competitor is offering or to improve the traceability of the system. The technical manager suggested the possibility that cross selling could be encouraged by offering an integrated solution across products, to implement such solution would also be a strategic investment. The product specialist discussed how workload could be shifted from the users to the system maintenance group by automating work. The group manager in customer service called for a greater system flexibility by continually developing the existing systems. Both the head of the department, the product specialist and the technical group manager emphasized that the projects both could improve customer relations and create possibilities for customers to operate the system on their own in an adapted customer view.
4.4 Risk

Managing risks is a constant endeavour within all organizations and is required in order to succeed. A lot of risks are associated with IT, and new developments can both help and harm. Systems that have been active for a few years tend to be more stable and also safer because problems already have been identified and fixed. New systems on the other hand can use recently developed technologies that are more secure than their predecessors. The group manager within customer service mentioned the importance of system up time and that the data was well protected against unlawful access. This point was also acknowledged by the technical group manager who talked about user levels to control permissions and to create systems that could withstand attacks. The product specialist emphasised traceability as an aspect that was important, both in order to track potential intruders, but also to identify errors made by employees at an early stage.

On the other hand, non-technical risks related to IT systems exist. Both of the group managers and the product specialist all discussed the importance of reducing the number of errors that are related to the everyday work of the users. These risks could be managed by implementing simple changes, such as predefining data that is commonly recurring and adding data validation features to forms. Another way to minimise risk of typos in very repetitive work by automating the process. In the long run, a small number of errors, builds a good reputation on the market which helps managing the risk of losing customers.

The expert stated that risk is typically categorised into risks under the developing phase and risks at production phase. He argues that risk analysis should be conducted for both these stages. This belief is aligned with Strassman (1990) who wrote "Risk analysis is the correct analytical technique with which one can examine the uncertainty of Information Technology investments prior to implementation.". The expert agrees that one should both consider the external risks such as hackers and internal risk such as user errors which could lead to corrupt data.

A third perspective exist on top of the technical, and the customer perspective. The third perspective could be described as the employee perspective. A new IT system can help to reduce dependency on employees with specific competency, as well as allowing employees with less competence to complete tasks that were previously beyond them, thus freeing up the experts for other work. This is described by the potential user as well as the head of the organization. Another thing that the head of the
department and the technical group manager both highlighted was that boredom among users also can be managed.

“Employees might consider quitting their job if they feel change is never made in certain areas” – Technical Group Manager

When possible it is good to remove boring tasks from the employees according to the head of the department. The product specialist hopes that the new system will make the process more effective with:

“Reduced working hours and increased quality” – Product Specialist

The head of the department states that happy employees in some cases perform better, but above all happy employees tend to stay longer in their positions. The expert agrees with the reasoning regarding boring tasks but states that this generally isn’t included in risk evaluations, which is aligned with the findings in literature by Kohli and Grover (2008).

4.5 TIME

A timeframe needs to be included in an investment evaluation. But how should time be assessed? The head of the department tries to classify projects as short, medium or long. These categories roughly correspond to matters that take days, weeks or months. Naturally a project with long development time is expected to have higher impact after implementation than a project that could be completed in a few days. However, according to Martinson et al. (1999) results of IT can be observed with a short term or a long term perspective, resulting in different outcomes. An example of the short term view was described by the technical group manager who suggested that a payback-like method should be used to evaluate time. But instead of cash flows, time flows should be considered. In that calculation expected time to develop the system is divided by the time gain. The result is a payback value, how long will it take until we have started to gain time by implementing the system. The formula is described in Equation 3. Note that the units needs to match to generate a correct response.

\[ \text{Payback Time} = \frac{\text{Expected Implementation Time}}{\text{Expected Time Earning of Project}} \]

The expert propose a different technique. The first stage in this technique is to calculate an expected development time; this should be done by an experienced developer. When the estimate is completed,
add some extra time since IT projects tend to go wrong. Finally add an extra 10% on testing of the system from the sum of the previous two. It is a well-known fact that IT projects tend to go over budget and time (Bloch et al., 2012), therefore all of the buffer time is reasonable. According to the expert, a comparison should be made with similar projects, if such exists, in order to see if the time calculations differ a lot. If they do, one should try to understand why this is and potentially gain valuable information. The last step, which is easily forgotten, is to look at the calendar and the resources and adjust for holidays and potentially unavailable resources.

A long term take of time analysis is hard since it is difficult to identify directly correlating measures to an individual IT system, especially if it is small scale. Hence very case specific measures needs to be identified in order to trace the effects over a longer time span. The expert argues that evaluation directly related to the system should be conducted six to twelve months after the completion of the system. The system should be evaluated on measures that were decided upon already before the development starts. Long term goals be set to complement this, but these should be set at a company or a department level and not only related to specific system. The head of the department agrees and he believes that he cannot spend resources on evaluating every system that he decides to invest in. Instead, he believes his performance can be evaluated by the performance of his department.

"Ultimately, I am evaluated based on the results delivered by my business" – Head of the Department

4.6 LONG TERM POTENTIAL

“The most important task for me as a business leader is to create long term recurring profit” – Head of the Department

This quote is generally applicable to project management, and holds true in the context of IT projects as well. The head of the department argues that you could have other goals as well, but even if you wanted to achieve the most satisfied customers (or employees) in the industry this would mean nothing if you failed at generating profit. The decisions taken today will affect the future of the company. Therefore the long term potential of IT development projects should be considered in an evaluation. This is aligned with current theory, such as Irani and Love (2002) as well as Santhanam and Hartono (2003), who both argue for the need of long term perspectives with regards to IT investments. The expert shares this opinion and states that IT development is part of securing future incomes. The head of the department emphasizes inclusion of a long term perspective when taking investment decision.
“You have to live with the legacy of your former decisions” – Head of the Department

Is this new system the only thing that can be developed in this area? Will another system be replacing this one in six months? Is this system a prerequisite to develop a future system of importance to the company? All of these questions were brought to light by the product specialist, the technical manager and the head of the department. Yet, even though long term perspectives should be considered when IT system are developed, it is important not to plan too far ahead with regards to the actual tasks according to the technical manager. He states that one should never be assigned more than one task at a time. The reason for this is that another task with higher priority may appear because the development cycle of the current project is completed. To not plan too far ahead is a central aspect of being a flexible organization.

4.7 MANAGING IDEAS

All of the interviewees felt that they could influence the investment decision, which seemed contradictory because they also unanimously agreed that the head of the department single handedly took investment decisions. However, the belief that everyone had some influence seemed to contribute to a very good working environment. This study identified three causes of such beliefs. First off, all ideas are encouraged and are stored in a backlog if it is not possible to take action at once. When a resource is available ideas can be taken from the backlog and the users can see their ideas realized. The expert concur that a backlog is good to make sure that ideas are not lost. Additionally, he states that resources are rarely devoted to working with the backlog, so sometimes issues can wait for a very long time until action is taken. Secondly, the users have a close relation to the developers, so that they can give feedback and make sure that things are developed as intended. This is also one of the success antecedents identified by Hartono et al. (2007). Finally, the head of the department works actively with communicating his way of thinking to the workforce. As a kick-off assignment the participants were given a presentation about project prioritization, followed by an exercise where they had to engage in a project prioritization problem. This experience made the employees appreciate the complexity of the problem, according to the head of the department.

4.8 DISCUSSION OF FACTORS

An IT investment evaluation presently consists of many parts according to the expert. However it still tends to be a non-strategic, short term model measuring financially tangible benefits without putting much consideration into the larger strategic picture (Irani et al., 2002). Gammelgard et al. (2007)
Mattias Folke suggests that “an investment evaluation also needs to include a technical assessment of the investment and to relate this assessment to the impact on business value”. Similar findings have been identified in this study and the head of the department argues that business alignment is one of the most important aspects to consider. According to the expert a proof of concept is a good way of working with technical assessment of projects. However, the effort devoted to the proof of concept must be proportional to project size. A risk analysis is also included but tends to be linked to the project primarily. Nevertheless, a larger strategic picture should be considered as well. Likewise the time perspective is often included in the investment evaluation but focuses strictly on the development time, when time gains should be considered as well. Finally the long term perspective should be included.

The common denominator of the discussed factors are that they all focus on a strategic goal. An IT system investment is a part of the strategy of a company, and if this is not accounted for in the decision process the company endangers their future success. It has been proven that IT systems tend to have effects beyond the single unit that the development was intended for (Mahr, 2010). The interviews provide some additional support for this, as the interviewees identified a plethora of potential stakeholders. The number of stakeholders is yet another indication that the strategic value of an investment evaluation should be considered before a decision is taken.
5 CONCLUSION

The aim of this report was to investigate how investment evaluation of small scale computer system should be performed. In this report I have reviewed data from three sources: the scientific literature on evaluation methods for large scale IT projects, a case study, and expert opinion. The one sentiment all sources shared was the fact that investment evaluation of IT systems is difficult. A number of methods for IT evaluation has been developed for large scale projects and through the literature review I investigated the possibility of applying these to a small scale setting, this was also discussed with the expert. The first research question of this report was:

1. How can existing methods developed for large scale investment evaluation be applied to a small scale context?

Large scale investment evaluations should not be applied to small scale projects. The models that are used today tend to be very extensive and still they do not predict future outcomes very well due to the number of aspects that affect the process. The infrequent use of the large scale methods among senior management is a clear indicator that these are not considered very valuable, even in their intended setting.

Instead inspiration should be taken from the large scale investment evaluations when managing a small scale task. A financial evaluation with net present value should be included, under the precondition that this is only a vague indication of what could be the end result. In addition to the monetary factor, other aspects should also be considered. The other factors are presented under the second research question below.

2. What factors should be taken into consideration when evaluating whether to invest in a small scale computer system?

The study indicates that the most important factor to be considered when evaluating a small scale system is business alignment. One method that is described in this report categorize projects as cash generating, performance increasing and strategic, which are non-exclusive factors. Projects that conform the overall business strategy should be prioritized. It could be argued that the cost should be the most important factor to consider, but in the contexts of small scale projects the cost aspect is not as central, as it is not as severe for the organization. With this being said, of course it should be considered when conducting an investment evaluation for a small scale computer system. A number of
other factors should also be considered, such as time, risk and long term potential. A complete list of factors can be found in the next section on managerial impact.

Due to the significant differences from one IT project to another it is hard to use a single model to perform an investment evaluation. Based on the same reasoning it is hard to use exactly the same factors for evaluating investments in new IT systems. In addition, many of the factors can be reflected in many different ways: time can be considered as time to develop a system or time gain by the project. An even clearer example is risk which branches out into subcategories. The first two sublevels are illustrated in Figure 6.

![Diagram: Illustration of risk related to IT projects]

The first branch in Figure 6, **During Development**, is typically included as a risk analysis in an investment evaluation of IT systems. The risk analysis handles issues such as what happens if the project would run over budget or time and how it continuously can be monitored so that adjustments can be done in time.
But also other risks such as loss of personnel or handling a computer crash or a fire. The second branch, **In Production**, is usually managed by either goals or requirements of a project. In this case system security is a typical test and can be assessed by a controlled attack. To make sure that the system does not crash on invalid user input or that it does not go down are typical requirements that can be put on a system in the investment evaluation phase. User satisfaction is harder to measure but is still a risk that has to be managed. If the users do not like the new system they are less likely to use it in the end, and the development might have been a waste. Finally, the last branch, **Not Developed**, could be considered as identifying a problem but is otherwise not formally included in a typical investment evaluation. However, what would happen if the system is not developed should also be evaluated. This evaluation should then be compared with the project risk assessment in order to minimise potential loss of income, loss of personnel or exposure of security flaws.

### 5.1 Managerial Impact

My findings clearly suggest that considering the current environment regarding IT evaluation, companies should not use formal investment evaluations for small scale computer systems. Methods are poorly adapted to the small scale, are too complex and do not provide accurate results. Instead I encourage senior managers to keep on making rational decisions for small scale IT systems. Nevertheless, systems tend to differ from one another and it is difficult to identify general factors that are applicable in every situation. Instead, the list of 35 factors that are compiled in Table 2 can be used as a checklist to decrease the risk that crucial factors are not accounted for. The factors are extracted from the literature review, the case interviews and expert opinion. A longer compiled list of factors in prior research can be found in appendix C.

#### Table 2: Factors that should be considered in a small scale investment evaluation

<table>
<thead>
<tr>
<th>Factor</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability</td>
<td>What availability requirements do we need from the system? Is it acceptable to not be able to access it during specific times such as nights or weekends?</td>
</tr>
<tr>
<td>Business Alignment</td>
<td>Is the project aligned with the overall strategy of the company? Is it cash generating, performance increasing or a strategic initiative to invest in this system?</td>
</tr>
<tr>
<td>Competence</td>
<td>Does the introduction of this system alter the competence we need from employees?</td>
</tr>
<tr>
<td>Cost</td>
<td>How much do we expect this system to cost?</td>
</tr>
<tr>
<td>Question</td>
<td>Description</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Data Availability</td>
<td>Do we have access to all the data in the appropriate format to the system or will the data have to be collected or reformatted?</td>
</tr>
<tr>
<td>Decision Documentation</td>
<td>Have we documented why we made the decision that we did?</td>
</tr>
<tr>
<td>Employee training</td>
<td>Do we need to train the employees in order for them to use the system appropriately?</td>
</tr>
<tr>
<td>Expected system load</td>
<td>How much traffic do we expect on the system? Do we need to work with optimizing components?</td>
</tr>
<tr>
<td>Feasibility</td>
<td>Is it feasible to develop the system under these preconditions?</td>
</tr>
<tr>
<td>Goals</td>
<td>What are the goals of the system? When should we measure and evaluate the success of these?</td>
</tr>
<tr>
<td>Impact</td>
<td>What impact is expected from the project? Is this revolutionary, developing or improving?</td>
</tr>
<tr>
<td>Improve relations</td>
<td>Will our customers or partners benefit from this development?</td>
</tr>
<tr>
<td>Improve service</td>
<td>Can better service be offered if this system is developed?</td>
</tr>
<tr>
<td>Improved information flow</td>
<td>Can this project help with enhancing further information flows?</td>
</tr>
<tr>
<td>Job satisfaction</td>
<td>Will employees be more satisfied with the working situation if this system is developed?</td>
</tr>
<tr>
<td>Legality</td>
<td>Do the intended system violate any laws? E.g. The Personal Data Act in Sweden.</td>
</tr>
<tr>
<td>Long Term Potential</td>
<td>Does this system contribute to generating long term benefits?</td>
</tr>
<tr>
<td>Problem</td>
<td>Is it clear what problem the system is intended to fix? Can this be formulated concisely?</td>
</tr>
<tr>
<td>Product quality</td>
<td>Can the system help improving product quality?</td>
</tr>
<tr>
<td>Reduced delivery lead-times</td>
<td>Can the system help reducing delivery lead-times?</td>
</tr>
<tr>
<td>Reduced Inventory</td>
<td>Can the system help reduce inventory needed in stock?</td>
</tr>
<tr>
<td>Reduced manufacturing lead-times</td>
<td>Can the system help reduce manufacturing lead-times?</td>
</tr>
<tr>
<td>Reliability</td>
<td>Is it acceptable to experience a system crash or loss of data in the system? Is this accounted for in the system solution?</td>
</tr>
<tr>
<td>Require changes to existing systems</td>
<td>Will the implementation of this system demand changes in already existing systems?</td>
</tr>
<tr>
<td>Require new hardware/software</td>
<td>Must additional hardware or software be added in order for the new system to work?</td>
</tr>
<tr>
<td>Response time</td>
<td>What response time can be tolerated from the system?</td>
</tr>
<tr>
<td>Risk during development</td>
<td>Have an evaluation on how to manage risk during the project, a risk analysis, been conducted?</td>
</tr>
<tr>
<td>Risk if not developed</td>
<td>What will be the consequences if the system is not developed?</td>
</tr>
<tr>
<td>Risk in production</td>
<td>What demand is set on security when the system is completed? Digital threats (e.g. hackers) and physical threats (e.g. fire).</td>
</tr>
<tr>
<td>-------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Scenarios</td>
<td>Have scenario planning been used to predict how the development phase may evolve?</td>
</tr>
<tr>
<td>Simplicity versus flexibility</td>
<td>How many features should be added? How complex cases should the system be able to handle? Is the system intended for automatization, users or system experts?</td>
</tr>
<tr>
<td>Stakeholders</td>
<td>Have the stakeholders been identified? Have they been invited to participate in the evaluation process?</td>
</tr>
<tr>
<td>Time Consumption</td>
<td>How much time is required in order to develop the system? Is a time schedule created?</td>
</tr>
<tr>
<td>Time Gain</td>
<td>Are any time gain expected from the system? If yes, how much?</td>
</tr>
<tr>
<td>Usability</td>
<td>What degree of usability requirement is set on the system? Are policies or standard created regarding self-instructing system, error messages etc.</td>
</tr>
</tbody>
</table>

Even though these factors have been identified, they should not be considered as a complete list for every circumstance. In IT evaluation, the current project must be considered and factors that are not mentioned in Table 2 should be added when relevant.

5.2 Quality of Research
The reliability of these findings can be questioned, due to the nature of the single case study approach. But by confirming the result with the expert as well as crosschecking them with previous literature, the reliability of these findings have been increased. The validity of the report is supported by the multiple perspectives that were taken from the interviews. However, due to the limited amount of interviews conducted the reliability could be criticized. To compensate for this the expert was consulted and case specific aspects were identified such as including risk of losing personnel in the risk analysis.

The findings in this study are likely to be helpful within investment evaluations for IT systems, in particular for small scale solutions. But the results should not be applied outside the IT context due to the specific circumstances related to IT, namely that IT affects multiple parts of an organization as well as IT development being a complex process where several factors affect the final product. The results produced are merely recommendations of factors to consider when conducting an investment evaluation and should not be considered a model. As a result some factors might be more generalizable than others, but overall the factors cannot be considered generalizable.
5.3 Future Studies

This study has given an initial perspective on small scale investment evaluations, but there are still a need for more research in this area. First of all, a quantitative study analyzing the factors would be a notable contribution to the field. However, due to the previously discussed problems that success in IT development is dependent on several variables, the study must be performed with a very large sample to produce an accurate and reliable result.

Additionally, apart from verifying these factors, additional factors that were not the focus of this report might warrant further investigation. Two factors are of particular interest. First scenario planning as a tool for IT investment evaluation. Scenario planning has been replacing financial measures in other areas of evaluation and the applicability of this tool to the IT context would be very interesting to investigate further. Second the matter of simplicity versus flexibility; how to best decide what to include and what to leave out? This is interesting because there are no well-known method to answer this question today. Instead decision makers and in some cases developers have to rely on intuition.

A final matter that require further investigation is how to work effectively with a backlog of feature requests and desired future system developments. This work is important to avoid losing valuable ideas and to keep developing a more effective organization. Toyota has through lean created an employee mentality where everyone helps to identify potential efficiency gain throughout the organization. If a similar collaborative and proactive culture could be fostered in the IT sector, it could create a notable competitive advantages.
6 REFERENCES


APPENDIX A – INTERVIEW TEMPLATE

Since the interviews was conducted in Swedish is the interview template also provided in the very same language.

**Presentation**
Presentera mig och arbetet. (Generellt om investering, använd gärna systemet som jag utvecklat, men inte nödvändigt)
Godkännande av inspelning
Godkännande av citering (samtliga citat får granskas för godkännande innan publicering)

**Introduktion**
Vad har du för roll på Söderberg & partners?
Vilket inflytande upplever du att du har för att påverka nya system?

**Case Specific**
Ville du ha systemet? Varför, varför inte?
Vilka fördelar hoppas du på att det nya systemet ska ge?
Ser du några nackdelar med att utveckla det nya systemet?
Vilka problem låg till grund för beslutet att utveckla ett nytt system?
Vilka tror du indirekt kommer påverkas av att systemet utvecklats?
Tror du att systemet på något sätt kan påverka risken assosierad med processen på något sätt?

**Generellt**
Finns det enligt dig några enskilda faktorer som är helt avgörande som borde stoppa utveckling av nya system?
Finns det några andra faktorer du tycker att man bör ta hänsyn till?
Tycker du att det finns något bra sätt att mäta dessa? Under arbetet? I efterhand?
Vet du om något utvärderings verktyg/metod används för att besluta om utvecklingen av system?

**Avslutning**
Har du något mer du vill ta upp angående ämnet? Är det något du vill tillägga?
Tack för ditt deltagande.
APPENDIX B — METHODS FOR THE EVALUATION OF IS INVESTMENT PROPOSALS

This appendix is directly taken from the article Methodologies for information systems investment evaluation at the proposal stage: a comparative review (Renkema and Berghout, 1997). The author does not claim that this is his work.

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Seven milestone approach: Lincoln [63]; Lincoln and Shorrock [64]
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Socio-technical project selection: Wiseman [66]
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System dynamics analysis: Kleijnen [48]; in: Farbey et al [6]; in: Powell [17]
Systems measurement: Udo and Guimaraes [67]
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Value chain analysis: in: Powell [171]
Ward’s portfolio analysis: in: Sassone [52]
Wissem’a method: in: Powell [171]
Zero based budgeting: in: Keen [70]

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APPENDIX C – EVALUATION FACTORS FOR IS INVESTMENTS

This appendix is directly taken from the article “Evaluating IT/IS investments: A fuzzy multi-criteria decision model approach” (Chou et al., 2006). The author does not claim that this is his work.

Bacon (1992), Escobar-Perez (1998)
Net present value
Internal rate of return
Profitability index method
Average/accounting rate of return
Pay-back method
Budgetary constraints
Support explicit business objectives
Support implicit business objectives
Response to competitive systems
Support management decision making
Probability of achieving benefits
Legal/government requirements
Technical/system requirements
Introduce/learn new technology
Probability of project completion

Jones and Beatty (1998)
Reduced transaction costs
Improved cash flow
Reduced inventory
Improved information flow
Improved internal operations
Improved service
Improved trading partner relations
Improved competitive advantage
Disrupted work at first
Changed operating procedures
Decreased productivity at first
Long learning time
Required new hardware/software
Increased computer support needs
Substantial site preparation
Required changes to existing systems

Irani (2002)
Improved growth and success
Leader in new technology
Improved market share
Market leadership
Enhanced competitive advantage
Improved flexibility
Improved response to changes
Improved product quality
Improved organizational teamwork
Promotes concept of open culture.
Improved integration with other business functions
Increased productivity
Increased plant efficiency
Reduced delivery lead-times
Reduced manufacturing lead-times
Improved capacity planning
Improved stability of MPS
Improved data management
Improved manufacturing control
Improved accuracy of decisions
Reduced raw material inventory
Reduced levels of WIP
Reduced labor costs
Reduced manufacturing costs
Increased throughput
Improved data availability and reporting structure
Improved communication through on-line order progressing
Improved product tractability
Formalized procedures with accountability and responsibility
Improved schedule adherence
Cost of ownership: system support
Management/staff resources
Management time
Management effort and dedication
Employee time
Employee training
Employee motivation
Changes in salaries
Staff turnover
Productivity losses and organizational impact
Strain on resources
Business process re-engineering
Security software protection
Security breaches
Organizational re-structuring

Productivity
Training
Labor savings
Work quality
Change of management
Learning curve
Job satisfaction
Better decisions
Improvement in communications
Morale
Loss of control

**Mirani and Lederer (1998)**
Enhances competitiveness or create strategic advantage
Enables the organization to catch up with competitors
Aligns with stated organizational goals
Helps establish useful linkages with other organizations
Enables the organization to respond more quickly to change
Improves customer relations
Provides new products or services to customers
Provides better products or services to customers
Enables faster retrieval or delivery of information or reports
Enables easier access to information
Improves management information for strategic planning
Improves the accuracy or reliability of information
Improves information for operational control
Presents information in a more concise manner or better format
Increases the flexibility of information requests
Saves money by reducing travel costs
Saves money by reducing communication costs
Saves money by reducing system modification or enhancement costs
Allows other applications to be developed faster
Allows previously infeasible applications to be implemented
Provides the ability to perform maintenance faster
Saves money by avoiding the need to increase the work force
Speeds up transactions or shorten product cycles
Increase return on financial assets
Enhances employee productivity or business efficiency

**Mcaulay et al. (2002)**
Enhances competitive/strategic advantage
Increases access to expertise
Increases flexibility
Reduces uncertainty
Eliminates unnecessary functions
Improves management information for strategic business planning
Improves information for management decision making
Enables faster retrieval or delivery of information for reports
Improves reliability or accuracy of information
Enables focus on core in-house operations
Improves the quality of IT systems
Improves service quality/service delivery to customers
Provides new and/or broader ranges of products/services
Improves disaster recovery
Increases process efficiency
Reduces technology costs through reduced system enhancements and modifications
Reduces operations costs
Reduces workforce costs
Increases access to new technologies
Allows previously unfeasible applications to be implemented
Allows faster development of applications
Reduces the risk of technological obsolescence
Vendor opportunism
Lack of flexibility (becoming locked into the vendor)
Potential loss of secrets and intellectual property
Change in commitment or financial stability of a supplier
Client engaged in new line of business—requires changes to contract or even termination of contract
Lack of active management of the vendor by the client
Over-dependence on the vendor
Vendor’s lack of client’s enterprise knowledge
Treating IT as an undifferentiated commodity to be outsourced
Lack of employee morale leading to poor performance and high staff turnover
Loss of expertise within the company
Vendor fails to provide contracted service to the required level
Costs of controlling the vendor very high

References