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ERP – More than just Ones and Zeros

**- Investigating the Costs and Benefits of Enterprise
Resource Planning Systems -**

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Abstract

To evaluate investments in IT-system investments in general and Enterprise Resource Planning (ERP) systems in particular has in numerous studies proven to be problematic. This thesis is based on the fact that this problem is primarily due to the ERP-system infrastructural and multidimensional nature. In order to address this complexity the thesis presents a holistic approach to ERP-system investment evaluation based on the fact that the investment is evaluated on three different levels, i.e. on a macro, meso and micro level. The main idea of using this approach is that it will capture the multidimensionality of the investment and hence make it possible for the investing company to evaluate it on a more rational basis. Based on this theoretical framework the thesis investigated, by conducting an empirical study, what investing companies perceive as the costs and benefits characteristics of ERP-systems. Moreover, our empirical study showed that although the investing companies have identified numerous cost and benefit areas related to their ERP-system investment, there appeared to be a lack of metrics that could be used for measuring these. Having identified this, we propose a method for evaluating an ERP-system investment. This method is based on a combination of our empirical findings and a cross-section of what is currently considered, in the literature, to be the most useful metrics for measuring the different aspects of costs and benefits related to an ERP-system investment. By adopting this approach we feel that the investing company will be able to capture the multidimensional nature of the ERP-system investment.

Key Words; ERP-systems, Investments, Strategic IT-Investments, IT-systems, Evaluation, Costs & Benefits and Multidimensionality.

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Table of Content

1 BACKGROUND	1
1.1 RESEARCH ISSUE	3
1.2 OBJECTIVE OF THE STUDY	5
1.3 SCOPE AND LIMITATIONS.....	5
1.4 THE DISPOSITION OF THE THESIS.....	6
2 RESEARCH METHOD	7
2.1 INTRODUCTION	7
2.2 CONCEPTUAL FRAMEWORK	7
2.3 METHODOLOGICAL CONSIDERATIONS	8
2.4 RESEARCH APPROACH.....	9
2.5 CHOICE OF DATA COLLECTION METHOD.....	10
2.5.1 <i>Type of Data</i>	10
2.6 SAMPLE OF STUDIED COMPANIES	14
2.7 RESEARCH EVALUATION	18
2.7.1 <i>Validity</i>	18
2.7.2 <i>Reliability</i>	19
2.8 SUMMARY	20
3 THEORETICAL FRAMEWORK	21
3.1 INTRODUCTION	21
3.2 WHAT IS AN INVESTMENT?	22
3.2.1 <i>Investing in IT</i>	25
3.2.2 <i>ERP-system Investments</i>	27
3.3 THE IT ARCHITECTURE	28
3.3.1 <i>The Enterprise Resource Planning System</i>	30
3.4 BUSINESS PROCESS RE-ENGINEERING.....	33
3.4.1 <i>Principles of Business Process Re-engineering</i>	34
3.4.2 <i>What Makes the BPR Successful?</i>	35
3.5 EVALUATION	37
3.5.1 <i>Ex-ante and Ex-post Evaluation</i>	39
3.5.2 <i>Formative and Summative Evaluation</i>	40
3.6 RISK ASSESSMENT.....	41
3.6.1 <i>Macro Risks and Uncertainties</i>	41
3.6.2 <i>Meso and Micro Risks and Uncertainties</i>	43
3.7 LEVELS OF EVALUATION	46
3.8 EVALUATION MODELS.....	50
3.9 SUMMARY	64

4 RESULTS FROM THE EMPIRICAL STUDY	66
4.1 MACRO LEVEL QUESTIONS	69
4.2 MESO LEVEL QUESTIONS	78
4.3 MICRO LEVEL QUESTIONS	90
5 ANALYSIS	95
5.1 MACRO LEVEL ANALYSIS	95
5.2 MESO LEVEL ANALYSIS	103
5.3 MICRO LEVEL ANALYSIS	113
5.4 A COMPARISON BETWEEN THE EMPIRICAL FINDINGS AND THE THEORETICAL FRAMEWORK	116
5.5 SUMMARY	118
6 AN ERP-SYSTEM INVESTMENT EVALUATION METHOD	120
6.1 ELEMENTS INCLUDED WHEN DEVELOPING THE METHOD	120
6.2 MACRO ANALYSIS	121
6.3 MESO ANALYSIS	123
6.3.1 <i>Intangible Costs</i>	124
6.3.2 <i>Tangible Costs</i>	124
6.3.3 <i>Intangible Benefits</i>	126
6.3.4 <i>Tangible Benefits</i>	128
6.4 MICRO ANALYSIS	130
6.5 SUMMARY OF THE METHODS MAIN FEATURES	131
6.6 THE METHOD'S STRENGTHS AND WEAKNESSES	132
6.7 SUMMARY	135
7 CONCLUSIONS AND REFLECTIONS	136
7.1 SUGGESTIONS FOR FUTURE RESEARCH	139

REFERENCE LIST

APPENDIX

1 Background

The role of information technology (IT) in the business arena has continuously shifted over the last decades, and it has become a more important part of how companies manage and control their operations and resources. When computing became a commercial reality, more than forty years ago, it was predominately in the form of local data administrative systems focused on automating clerical and operational functions. However, during the last forty years business computing has changed from these basic local data administrative systems into international computer networks, and as the sophistication of the computer systems increased, so did the investment cost.

One type of computer system that assists international companies in managing their information flows is the Enterprise Resource Planning (ERP) system, and the main function of the system is to optimise the company's internal and external processes. As companies face a more challenging external business environment, and to prepare for the European monetary union, many companies have implemented ERP-systems to integrate their data flows and improve their operations (Banks, et al., 1999). This has proven to be a huge market and according to Byttner (2000), the global market for these kinds of systems is worth over SEK 80 billion annually, based primarily on the software licences and the suppliers consultancy and education revenues. The investment and implementation costs for an ERP-system is usually between SEK 40 – 70 million and include not only the costs related to licences, hard- and software, but also numerous operational costs, e.g. staff training and education, consultancy fees, redesigns of existing systems and existing business processes (Byttner, 2000). While many companies have invested in ERP-systems, there appears to be few companies that feel that the system delivers the expected results.

Traditionally, companies tend to perceive their IT-systems as costs, often due to IT being looked at as a support function for the company's main business activities. Generally, it can be said that companies have

had a tendency to disregard common business principles concerning IT related investments (Falk & Olve, 1996). Moreover, IT related investment decisions have often been taken without any consideration for other investments in the company, this is usually because the company lacks any clearly defined IT strategy leading to most IT investments being reactive in nature. A result of this lack of coordination is that the company develops a large number of more or less well integrated systems making it hard to get a holistic picture of the company's IT architecture. (Falk & Olve, 1996) When it comes to evaluating IT investments in general and ERP-system investments in particular, companies tend to evaluate predominately on hard- and software costs, i.e. disregarding future operational costs as well as implementation, training and consultancy costs, this leads to the company basing its investment decision on cost calculations that do not include all the cost elements of the investment. However, when evaluating the ERP-system investment, it is also imperative to examine the benefits that the system will generate. These benefits can be related to issues of productivity, cost reductions, and intangible benefits. Due to this, many companies are becoming more concerned with their levels of IT-spending in general, and their ERP-system investments in particular, as well as the problems related to clearly identifying the financial and non-financial benefits generated by the investment. Although, there are currently numerous models available for measuring costs or benefits for IT investments in general, few of the traditional models are geared to do both. (Whiting, R., et al., 1996)

Since most ERP-systems are based on different modules and applications, these are commonly used to evaluate the system, therefore it is important for the company to identify the purpose for investing in these modules and applications in order to be able to determine if the purpose have been achieved (Magnusson, Å., 1998). This goal attainment can be both subjective and objective, e.g. the system helps the company to provide better service (subjective) as well as reducing costs (objective).

Hence, it would be beneficial for the investing company to focus more on the modules and applications that they deem as important to their business rather than focus on the system as a whole. (Wagle, D., 1998)

1.1 Research Issue

Many companies are today managed as process organisations, and it is common that these companies have chosen to introduce new ERP-systems in tandem with a Business Process Reengineering (BPR) project. This often leads to the introduction of an ERP-system, which is usually a very complex task in itself and one that basically influences and effects all the company's functions, being done at a time of organisational uncertainty (Wah, 2000). However, there is a reason why companies decide to introduce the ERP-system at this time, namely that most modern ERP-systems are based on the fact that the company is organised according to the process principle. Therefore, both the computer system and the organisational structure are changed simultaneously. One problem related to this is that the investing company seldom states what will happen to its old computer system, i.e. is it integrated with the new one or just replaced. Moreover, over the last couple of years the companies that are investing in ERP-system have identified that the ERP-system investment is not just an investment in an IT-system, but rather an investment that will affect the whole organisation of the company, this aspect makes the evaluation of the investment very complex and multidimensional (Falk & Olve, 1996).

Just because a company invests in an ERP-system, the effects that it gives rise to do not have to lead to the company becoming more efficient, i.e. lowering their costs or realising any other types of savings or benefits (Carlsson, J., 1998). The company might experience this investment as value creating or value neutral depending on which criteria the company has chosen to evaluate the usefulness of the ERP-system. Moreover, when companies engage in continuous investments or re-investments leading to new modules and applications being introduced, the old evaluation criteria might not be as relevant as before.

The underlying reason for doing a thesis on how to measure costs and benefits of ERP-systems stems primarily from our interest in both management accounting and the importance of using both subjective and objective measures for evaluating these types of multidimensional investments. We also have an interest in discovering what constitutes relevant variables to be used in these evaluations and that these measures are relevant when doing both pre- and post-investment evaluations. Finally, we feel that due to the infrastructural and multidimensional nature of the ERP-system investment it can be difficult for companies to determine which aspects of the company are affected by the investments as well as which effects can be attributed to the ERP-system.

Our main problem is to identify the characteristics included in an ERP-system investment evaluation model, in terms of structure and terminology. Linked to this is the problem of how relevant variables can be identified and measured by company management.

The study aims to provide two things. Firstly, the study will present what nine different companies, with experience from ERP-system investments, identify as costs and benefits derived from these systems and how they try to measure these effects. Secondly, we will suggest a method for identifying and measuring the costs and benefits related to an ERP-system investment. The study will also outline a description of currently available methods and theories related to the evaluation of ERP-system investments. Furthermore, the study will also contribute to the knowledge area of ERP-system investment evaluation in two different ways. Firstly, the study will make an empirical contribution in so far as the study will identify how investing companies approach the evaluation of ERP-system investments. Secondly, the study will also make a practical contribution since it proposes a method for evaluating the costs and benefits of an ERP-system investment, and this method is based on a combination of empirical and theoretical findings.

1.2 Objective of the Study

The primary objective of this study is to identify the costs and benefits characteristics of an ERP-system investment based on an empirical study. The secondary objective is to, based on the empirical findings and the theoretical framework, suggest what could be included in an evaluation method for ERP-system investments in terms of structure and terminology, including how relevant variables should be identified and measured.

1.3 Scope and Limitations

In the methodology chapter we will explain the methods used to answer the research questions, and it will provide an insight into the scope and limitations of our research project, as well as describing the choices we made during the research process.

The theoretical part of the thesis will focus on methods that can be used for evaluating ERP-system investments and associated topics. Related areas like project management and issues of responsibility have basically been excluded from this part of the thesis, as these areas are not included in the research problem.

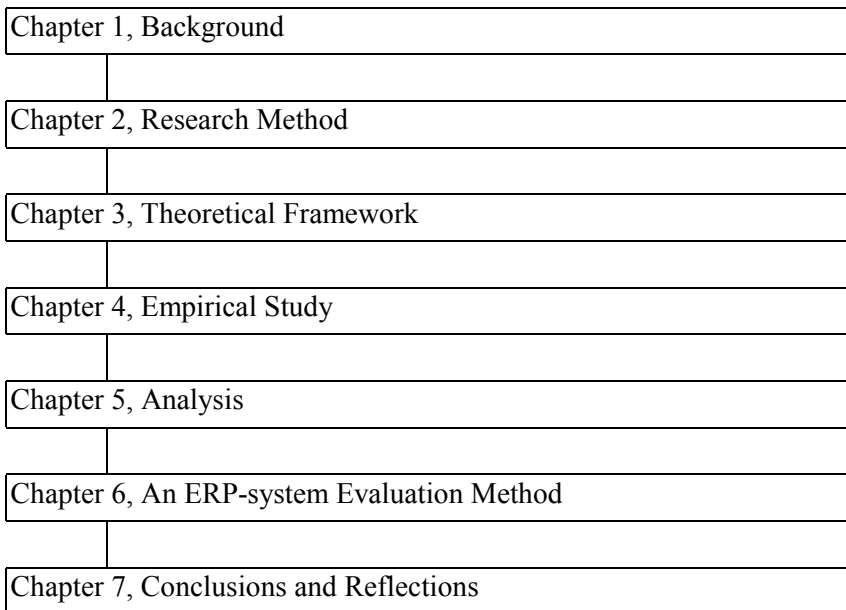
Our empirical study will be limited to nine companies that can be further divided into three types of companies, namely companies that have engaged in the ERP-system investment evaluation process (the buyer), companies that develop and sell ERP-systems (the supplier) and consultants that help investing companies evaluate investments in and implement ERP-systems. Furthermore, all companies operate on an international level. Due to the time constraint, we have been restricted in the scope of our empirical study. This has also led to the majority of the companies being found in the Gothenburg area.

Finally, this thesis is written primarily for anyone who wants to further their knowledge in the area of IT investment evaluation in general and the costs and benefits of ERP-system investments in particular. Due to this, the thesis is mainly designated for business administration

students and researchers. However, the thesis is also aimed at companies investing in or designing ERP-systems. It is therefore assumed that the reader has some basic insights in the area of IT, ERP-systems and investment evaluation.

1.4 The Disposition of the Thesis

In order to fulfil the purpose of this thesis we have followed the investigation process presented above and in chapter 2. This process can be further described according to the following figure.



(Figure 1.1, Our Working Process)

2 Research Method

2.1 Introduction

The main goal of research is to develop knowledge. Research methodology refers to the procedural framework within which the research is conducted. It describes an approach to a problem that can be put into practice in a research process, which could be formally defined as an operational framework within which the facts are placed so that their meaning may be seen more clearly (Ryan et al, 1992). In other words, the method is the tool used by the researcher during the process of developing new knowledge.

This chapter will deal with issues regarding the method chosen for this thesis. It will include a brief discussion of methodological issues, our research approach, choice of collection method, sample selection and a research evaluation discussion.

2.2 Conceptual Framework

There are currently two main conceptual frameworks in which to approach a scientific problem, namely the positivistic and the hermeneutic approach.

The positivistic framework focuses on drawing conclusions based on empirically determined knowledge. When working in a positivistic framework, the researcher aims to measure the research issue in an objective way. Furthermore, the researcher adopts an external position to the subject that should be examined and it is important that fact is separated from opinion. (Ericsson & Wiedersheim-Paul, 1999)

Under the hermeneutic framework, the aim is to reach a more holistic understanding of the research issue. It interprets text, human interaction, values and norms in a process that yields a better understanding of a subject, i.e. there is a focus on subjective consciousness. (Ericsson & Wiedersheim-Paul, 1999)

We approach our research within the positivistic framework, and the main argument for this is that we aim to identify, based on empirical findings, companies' views related to the costs and benefits with ERP-system investments. Moreover, since we adopt an external position to the organisations that are included in the research, as well as focusing on the companies' *de facto* views relating to costs and benefits with ERP-systems, rather than trying to interpret why they view certain factors as costs and benefits, we conclude that the positivistic framework will be the most appropriate for this study.

2.3 Methodological Considerations

In order to fulfil the purpose of this thesis, some basic methodological issues can be identified:

1. We start by building up an initial theoretical frame of reference where we describe a number of methods currently available for evaluating investments in ERP-systems.
2. The empirical part of the study is aimed at generating data related to the initial theoretical frame of reference. Especially concerning what companies identifies as costs and benefits with an ERP-system investment, and how these are evaluated.
3. Based on the empirical findings and the theoretical frame of reference we will establish a method for identifying and evaluating the characteristics of costs and benefits in ERP-system investments.

It becomes clear that this study is neither deductive^{*} nor inductive[†] in nature. We have chosen this approach since we aim to use the theoretical framework to interpret and analyse the results generated from the empirical study. Furthermore, since we will use both the

^{*} A deductive approach is based on a logical process built on available theory, and this theory is used as a base for the empirical study (Ericsson & Wiedersheim-Paul, 1999).

[†] An inductive approach bases its conclusions on empirical evidence, leading to that rather general conclusions, theories and models can be established (Ericsson & Wiedersheim-Paul, 1999).

empirical findings and the theoretical frame of reference for establishing the method, as well as letting our work be influenced by both theoretical and empirical findings we conclude that the study will be abductive* in nature. (Kalling, 1999)

2.4 Research Approach

Investigations can often be based on how much the researcher knows about the problem area before the actual research begins. There are five main types of research approaches that are normally used, namely descriptive[†], explanatory[‡], explorative[§], predictive** and prescriptive^{††} (Lekvall & Wahlbin, 1993 and Ryan, et al., 1992).

In this thesis, most of the research conducted in the first part is based on a descriptive approach since we aim to establish outline existing models used for evaluating ERP-system investments. This is presented in the theoretical chapter. Additionally, we are also going to document and describe what companies consider costs and benefits with ERP-systems, and this is based on the findings of the empirical study. This thesis also includes some explorative elements, mainly during its early

* Abduction is based on a combination of the inductive and the deductive approach and the analysis of the empirical findings can be combined with, or based on, previous theories (Alvesson & Sköldbberg, 1994).

† The descriptive approach is primarily used when the researcher is interested in showing the characteristics of a specific and often well-defined problem area (Lekvall & Wahlbin, 1993).

‡ The explanatory approach implies that the researcher wants to establish causal relationships between a usually fairly large number of variables (Lekvall & Wahlbin, 1993).

§ The explorative approach is often adopted when the researcher has a limited knowledge about the subject area and there is a need to identify what research issues to address. This approach is also commonly used during the initial phase of larger research projects, i.e. the researcher aims to specify the research problem. (Lekvall & Wahlbin, 1993)

** The predictive approach is used when the researcher aims to do a prognosis for the future development of a phenomenon. However, this does not imply that the researcher has established any casual relationships underlying the development (Lekvall & Wahlbin, 1993).

†† The prescriptive approach is based on the researcher identifying what ought to happen or be done, this approach often includes elements of value judgements and theoretical speculations (Ryan, et al., 1992).

stages, when we examined the secondary sources available in order to develop our understanding of the subject area. During this phase we were also able to more clearly define our purpose as well as the limitations adopted for the descriptive part of the research. The second part of this thesis is prescriptive in nature, since this part focuses on constructing a method for identifying and measuring the cost and benefit characteristics of ERP-system investments.

2.5 Choice of Data Collection Method

When deciding on which collection method to adopt for a study there are a number of factors that should be considered. Since all methods have their strengths and weaknesses, it is important to evaluate each method's appropriateness in regard to the research project at hand. Because a research project is usually made up of different types of data, a number of methods might be used in order to be able to address the research problem as fully as possible. It is common to make a distinction between two different types of data, namely primary and secondary data. Primary data is information collected and used for the first time, and usually through direct examination, whereas secondary data consists of information already available, i.e. it has been collected or produced by a third party and perhaps for a different purpose (Ericsson & Wiedersheim-Paul, 1999). Because of the inherent difference between these two types of data, different collection methods have to be adopted when collecting it. This thesis will use both primary and secondary data to address and analyse the research problem, and hence a number of collection methods will be used.

2.5.1 Type of Data

Collecting and processing information can be done in three separate ways, either by adopting a qualitative, quantitative or triangulation (a combination of the two) based method. According to Lekvall & Wahlbin (1993), quantitative data is primarily used when the aim of the research project is to answer questions like: How often? How much?, How many? or How usual?, i.e. there is an aspiration to quantify the result. The collected data is then expressed as numbers

Research Method

and analysed in a quantified way. This sort of data is often used when analysing data from a large population. On the other hand, qualitative data is better suited for research projects that use data that cannot easily be quantified, and qualitative data is often suited for research projects that aim to understand or find a specific pattern within the investigated area.

This thesis will use a combination of qualitative and quantitative data to address the research question. We have chosen this approach since it will generate data that will help us identify and understand what companies views as costs and benefits in ERP-system investments. Furthermore, due to the multidimensional nature of ERP-systems a company will experience both qualitative and quantitative effects from the investment, and thus be able to capture as many as possible of the effects, we have chosen to use this combination.

Secondary Data

In order to further our understanding of the research problem area we started by collecting secondary data. The main advantage of starting the data collection process with secondary data was that it gave us the possibility to establish a thorough understanding of the problems related to the evaluation of ERP-system investments. Furthermore, using secondary data is relatively uncomplicated and it gave us the advantage of exploring the problem area on a step-by-step basis. However, it is always important to be critical of the information presented in secondary sources, especially since the material might have been gathered to address a different problem area. Moreover, many secondary sources do not clearly describe issues such as the purpose of a study, how the data has been gathered, analysed and interpreted making it difficult for the researcher to assess their usefulness (Lekvall & Wahlbin, 1993). In order to address this problem we have tried to triangulate the secondary data by using numerous independent sources.

The information about relevant literature is collected from the library computer systems GUNDA & LIBRIS, CD-ROM databases and the Internet. The literature on evaluating ERP-systems *per se* is very limited, but it was fairly straightforward to find material in the related field of IT evaluation. Due to the rapid development of the IT sector, in regard to new products and applications, we have focused on as recent material as possible. In order to get access to the latest developments in this area we have used a number of articles published in academic journals and trade magazines. We have also used secondary information from Internet based discussion forums, ERP-system product information from suppliers and some company specific material.

Primary Data

For the collection of primary data a number of collection methods was evaluated, e.g. experiments, surveys (questionnaires and interviews) and case studies (Lekvall & Wahlbin, 1993, Eriksson & Wiedersheim-Paul, 1999 and Ryan et al., 1992). Based on the purpose of our research project, and our understanding of the subject area developed during the collection of secondary data, we decided to conduct a survey, using personal interviews as well as asking the respondents additional questions via e-mail. Surveys are commonly used for research projects that are based on a descriptive and an explorative research approach and would hence fit our purpose very well (Lekvall & Wahlbin, 1993). There are some generally accepted strengths and weaknesses with personal interviews that have been taken into account when deciding on which collection method to adopt. Furthermore, the collection method was also evaluated in regard to its usefulness for this particular research project, i.e. for its purpose, problem, time frame, data availability and the characteristics of the respondents.

The main advantage of conducting a personal interview is that it provides us with the opportunity to discuss complex and unstructured issues with the respondent that would have been hard to cover using alternative methods. Moreover, since we are aiming to gather

Research Method

information that can be analysed by evaluating a fairly large amount of information with a rather small number of variables, usually by describing and comparing the respondents' answers, as well as exemplifying the issues using isolated information, we conclude that the personal interview will be our best choice. When using personal interviews as our primary data collection method we considered the following aspects;

- Interview structure; our control over how the respondent will perceive the questions, including the design and relative order of the questions asked.
- Interview standardisation; the importance of paying attention to how the respondent might interpret the questions and how we could create boundaries that would restrict their answers.

The interviews conducted during the research project were characterised by us having a discussion with the respondent. Although we controlled the topic discussed, the respondent had the opportunity to influence the direction of the interviews. In order to make sure that we managed to cover all the related topics during the interviews we used an interview guide, which is included in this thesis as an appendix. The interview guide consists of broad open-ended questions and a number of prepared attendant questions. The attendant questions were only used if the respondent did not answer it in conjunction with the broad open-ended ones. However, certain issues were raised during the interviews that were hard to foresee and hence not included in the interview guide.

Before conducting the interviews, we sent out material regarding the research project to our respondents in order to help them prepare themselves for the interview. This material included information regarding the aim and purpose of the research project as well as which main subject areas that we wanted to discuss during the interviews, i.e. the broad open-ended questions. One of the main weaknesses of using interviews, as a data collection method is that the respondent might provide the researcher with answers that he or she thinks the researcher

wants, this is known as the interviewer effect (Lekvall & Wahlbin, 1993). In order to minimise this possibility we only gave the respondent general information about the topics we were going to discuss, leaving the more detailed questions for the actual interview.

During the interviews, we tried to avoid asking indistinct and leading questions. Based on our interview guide we asked both general and specific questions in order to be able to catch the multidimensionality of the problem area. The main reason for this was that we wanted to address our research problem from different perspectives and hence be able to better answer our research question. The interviews lasted for approximately one and a half-hours and were all taped. Both of us also took additional notes during the interviews in order to reduce any uncertainties when typing up the interviews. The interviews were typed up to facilitate analysis and interpretation. The typed version was also sent to the respondents so that they would have the possibility to rephrase or clarify any issues raised during the interview, thus avoiding misunderstandings. At this point, we also took the opportunity to ask additional and clarifying questions that we felt had not been fully addressed during the actual interview. After we had completed our analysis of the interviews, using our theoretical framework, we sent our results to the respondents asking them to comment on our analysis and findings. The strengths and weaknesses of the analysis and findings were discussed as well as potential changes. By co-operating with our respondents, we feel that we are able to present a better understanding of what they really tried to say during the interview.

2.6 Sample of Studied Companies

In order to increase the credibility of this thesis, it is important that the sample used is as representative of the investigated population as possible, especially since a well defined and representative sample will lead to more correct conclusions being drawn. It is common to divide the sample selection methods into two main categories, namely the probability sample and the non-probability sample. The main difference between the two categories is that the probability sample

Research Method

makes it possible to calculate inferential* discrepancies, whereas the non-probability sample method is based on more qualitative and intuitive estimations of the level of inference (Lekvall & Wahlbin, 1993). For our research project, we felt that it was more important for us to have a sample that would allow us to fully address our research problem, rather than establishing a statistically acceptable level of inference. Due to this, we established our sample based on certain specific criteria that we had determined as important for our research problem.

With the intention of being able to establish a holistic picture of the characteristics of ERP-system investment evaluations we have interviewed three different types of companies involved in this process, i.e. the buyers, the suppliers and the consultants. Since we have divided our interviewed companies into these different categories, we also have slightly different criteria for including them in the sample. The first criteria for the buying companies is that they have been involved in the investment evaluation process of an ERP-system, thus the company would have experienced the problems related to identifying the costs and benefits of an ERP-system. Secondly, the company should operate in a mature industry sector. Finally, the company should operate on an international level, since this would help us to get an insight into the widespread effects that an ERP-system can have on an international company. The main criteria for the suppliers and the consultants included in the sample were that they have international companies as their customers. This also served as a way to triangulate the data generated from the buyers, plus it would indicate if the suppliers and the consultants had a different view on costs and benefits of ERP-system investments.

To determine which companies to use in our sample we searched the literature and the Internet for companies that could meet our criteria. It became clear that there were several companies that would suit our purpose and we started by contacting 17 companies with operations in

* Inferential are the estimates about populations on the basis of limited information acquired from samples of those populations (Terry, J.V., 1995).

different industries. The contacted companies were; AstraZeneca Plc., Borealis A/S, ESAB AB, EKA Chemicals AB, Ernst & Young Management Consulting, Frontec AB, IFS AB, KPMG Consulting, Oracle Svenska AB, PreEra, SCA Hygiene Products AB, Scania, Siemens Elema AB, AB SKF, Tamro Distribution AB, Volvo Parts and Öhrlings PriceWaterhouseCoopers Management Consulting. Out of these 17 companies, 10 showed a genuine interest to participate in the research project. However, due to SCA Hygiene Products AB moving parts of their ERP implementation operations to Munich we ended up interviewing the nine companies listed below. In view of the fact that this thesis' primary focus is to identify what the buying companies perceive as costs and benefits with ERP-system investments, we have interviewed more buying companies than suppliers and consultants.

Buyers	Suppliers	Consultants
Borealis A/S	IFS AB	KPMG Consulting
ESAB AB	Oracle Sverige AB	PreEra
EKA Chemicals AB		
Tamro Distribution AB		
Volvo Parts		

(Figure 2.1, Interviewed companies)

Since the readers might not know some of these companies, a short presentation of each of them will now follow.

Borealis was founded in 1994 when Neste and Statoil merged their petrochemical and polyolefins businesses. The company operates in the polyethylene and polypopylane (plastic raw material) business, and it is one of the leading European producers in this area. The company is active in Europe, the US, the Middle East and the Far East.

Research Method

ESAB is the worlds leading producer of welding equipment and material and was founded in 1904. Since 1994 ESAB is owned by the British company Charter PLC. The company has a strong European presence and is also represented in the US, Mexico and the Far East.

EKA Chemicals was founded in 1895 and is, since 1994, owned by the Dutch company Akzo Nobel. EKA Chemicals is a supplier of chemicals and systems for environmentally compatible pulp bleaching processes as well as other market chemicals for certain industrial and speciality applications.

Tamro Distribution is part of the Tamro group and was originally founded in Finland in 1895. The group has gone through numerous mergers, including one with the Swedish pharmaceutical distribution company ADA AB. Today Tamro is the leading pharmaceutical wholesaler, distributor and service provider in the Nordic and Baltic regions, including north-west Russia.

Volvo Parts is a fully owned subsidiary of Volvo. Volvo was incorporated in 1915 as a subsidiary to AB SKF. Today Volvo is among the largest producers of trucks, buses and construction equipment. The company is also active in marine, industrial power systems and aircraft engine components. Volvo has a strong global presence.

Oracle is one of the worlds leading suppliers of information management systems, and the worlds second largest independent software company. Oracle was founded in 1977 and is currently offering its products (databases, tools and applications along with consulting, education and support) in over 145 countries.

IFS develop and supplies business applications that span the entire demand and supply chain. Since the company was founded in 1983 it has expanded rapidly and is now a major player in the business applications market and is currently represented in 42 countries.

KPMG Consulting is part of an international network with a strong focus on helping companies with IT-based projects.

PreEra was founded in 1997 and has a strong local presence and expertise in regard to organisational development, marketing communication and process- and computer system development for both international and national organisations.

Apart from selecting which companies to include in the sample, it is also important to select the right persons to interview in these companies. We wanted to interview people that had first hand experience in the investment evaluation process and the implementation of an ERP-system. This criteria was basically the same for the buyers, suppliers and consultants. The people that we interviewed were selected in co-operation with the company. This was accomplished by explaining the purpose of the research project to the contact person at the company, leading to that we were put in touch with a suitable interviewee.

2.7 Research Evaluation

To be able to achieve a high level of credibility for the conclusions presented in this thesis, it is important to demonstrate that the research was designed and conducted in such a way that it accurately identifies and describes the phenomenon that was investigated (Ryan et al, 1992). In order to do this, it is important to describe issues concerning the research projects validity and reliability. By openly showing how we have conducted our research, describing the steps taken to reach our conclusions and providing a discussion concerning the research projects validity and reliability we feel that we will increase the projects credibility.

2.7.1 Validity

In general terms it can be said that validity is an expression of how well the adopted measurement tool measures the things it aims to

measure, and that nothing irrelevant affects the results. However, it should be noted that there is no objective way to determine to what extent an adopted measurement tool is valid or not, thus the level of validity is based on a subjective basis (Lekvall & Wahlbin, 1993 and Ericsson & Wiedersheim-Paul, 1999). In order to achieve a high level of validity we were very thorough when defining our interview questions, and paying attention to how the definitions address the areas explored. This included explaining the purpose of the interviews to the respondents in order to avoid misinterpretations and misunderstandings. Furthermore, by starting with the development of a theoretical frame of reference, which was used both for designing the interview guide and analysing the results, we have been able to establish a logical relationship between existing theory and the empirical evidence. To increase the research project's face validity*, we discussed the questions in the interview guide together with our tutor. We have also disclosed all information regarding the research process so that the reader can form his or her own opinion about the data collected and the interpretations and analysis made.

2.7.2 Reliability

Reliability is basically an expression for a measurement tool's capability to withstand random effects, i.e. if the measurement tool will generate the same or similar results on multiple occasions (Lekvall & Wahlbin, 1993). Since our research project is executed using nine different companies and interpretations and the analysis is based on personal interviews in conjunction with a theoretical frame of reference, it will be quite hard to replicate. Even if the study was repeated, using the same theoretical frame of reference, the situation would probably have changed, e.g. technological developments, new research regarding ERP-systems investment evaluation being published or the person interviewed might have resigned.

* Face validity is in this case defined as how well-informed people will perceive a question in the interview guide in regard to its purpose (Lekvall & Wahlbin, 1993).

However, by using clear and well-structured questions in conjunction with establishing an audit trail we feel that we have taken the necessary steps to improve the research project's reliability.

2.8 Summary

In order to address our research question we perform an abductive study within a positivistic framework. The research is a combination of an explorative, a descriptive and a prescriptive research approach. The data gathered and analysed is of both primary and secondary nature, and the primary data was predominantly collected by using open personal interviews. We have used both qualitative and quantitative data, and we have tried to openly display all our actions during the research project so that the reader can judge the validity and reliability of the research.

3 Theoretical Framework

3.1 Introduction

To evaluate ERP-system investment alternatives is a difficult task, but the problems that occur during this process are not new, they have been known for the last 30 years. When companies started to invest in different IT-projects, the main goal of these investments was to carry out routine services in a more efficient manner, and thus the main goal of these investments was to lower the costs of the company. The pattern of these investments have changed and now the main goal is not just to lower costs, but also to create advantages in relation to the company's competitors, and these advantages are often related to strategic issues (Falk & Olve, 1996). Related to the new goals of the investments, the size of the investments is also growing. Today, most investments deal with not only hard- and software, but additionally these investments must be supported by what is referred to as 'ordinary' investments, especially if the total capacity of the original investment is to be realised. However, it is becoming more common to start by examining the available IT based solutions and then evaluate which of the company's processes can be improved by adopting these. Especially, since IT can break old rules that limit the manner in which work is performed. (Turban et al., 1999)

The main problem with an ERP-system investment is to identify its intangible benefits and then quantify and evaluate these, but the problem is not only the difficulty to consider these non-quantifiable results of the investment, but also identifying the results of these and decide which evaluation model is the appropriate tool to use for the evaluation. The purpose of the investment should be used when evaluating the investment alternatives, i.e. does this investment fulfil its purpose, but at the same time the evaluation should also be influenced by other factors as well, e.g. the external business environment of the company. (Falk & Olve, 1996)

This chapter will present and explain major aspects related to IT-system investments, starting with a brief presentation of what an

investment is, as well as what constitutes an IT- and ERP-system investment. After this a description of the development of the IT-architecture and an outline of the main characteristics and functions of an ERP-system will be provided. This is then followed by a presentation of the concepts of Business Process Re-engineering (BPR), which is closely related to this type of investment. We will then move on to discuss what evaluation implies as well as the related area of risk assessment. After this there will be a presentation of the levels of evaluation that should be considered during an IT-system investment in general and an ERP-system in particular, including a discussion of the costs and benefits and how these could be perceived. The final part of this chapter contains a presentation of a number of models used for evaluating most types of investments and the chapter ends with a short summary.

3.2 What is an investment?

According to Nilsson & Persson (1991) an investment involves the acquisition of something that is to be used for a long period of time and it is not to be used for immediate consumption. Ljung (1996) states that an investment is a capital effort which will affect the company's cash-flow over a long period of time, i.e. the investment claims capital which should not only be repaid but also provide a profit in the future, however, neither of the mentioned authors discusses the preferable time horizon for an investment. Amling (1989) defines an investment as the purchase by an individual or institution of a financial or real asset that produces a return proportional to the risk assumed over a long period of time, i.e. a minimum of three years although a ten-year time horizon is preferred.

Investments will tend to affect the investing company's cash-flow for an extensive period of time, and it is very important to consider this when comparing different investment alternatives and making the decision. According to Ljung (1996) an easy way to present this is to put the cash flow on a time chart. This cash flow analysis should include the investment base, i.e. all direct payments that occur at the

Theoretical Framework

initial phase of the investment, e.g. purchase of buildings, machines, tools and spare parts. It should also include the annual net cash flow of the investment and at the final year on the chart, the investment should, where appropriate, be assigned a residual value. When deciding on the time limit used as a base for the chart, it is important to separate the economic lifetime of the investment from the technical. The economic lifetime includes the number of years until the investment provides the highest level of profitability, while the technical is the number of years that the investment can be used considering the wear and tear of the investment.

Investments can have different perspectives, e.g. private, business or social (Amling, 1989, Ljung 1996, and Nilsson & Persson, 1991). Since this thesis is focused on companies and their experiences of ERP-system investments, there will be a focus on the business area. The purpose of a company's business is not to consume scarce resources, but rather to produce products and services and according to the definitions of what an investment is, examples of company investments are purchase of machines and equipment, research and development, marketing and staff training.

Ljung (1996) states that the long-term nature of the investments is the foundation, on which the company runs and develops its business. Thus, when considering an investment, the company should not only look at the investment itself but rather how the company wants the investment to aid its future development. Investments are often related to changes of the business and therefore they often demand much capital.

Kämmerer (1995) states that a characteristic of investments is the belief in the future, and by conducting an investment, the company sacrifices parts of the present resources in order to achieve future benefit when the investment is realised, i.e. a form of postponed consumption. Investments play a central part in the community, from the individual person to the multinational company. In business administration, the investment process is a central part of a company's

business due to its connection to the survival of a company. There must be a flow of new ideas, products, processes and capital as well as disclosure of the changes and the expectations both within the company and to the external business environment of the company is to be competitive.

According to Bergknut, et al. (1981) it is not a necessity that the investment has production and profitability goals, but the purpose of the investment could also be to strengthen the ability of the company to react in an uncertain future, e.g. through education, new planning systems or a flexible production system. Even if the aim of the investment is to enable the company to fulfil future goals and objectives, it must be considered that the investment also has an organisational meaning, i.e. it changes and strengthens parts of the company's organisation. The fact that the investment is connected to the company's organisation, long-term planning and usage of resources has led to there being different views on what the purpose of an investment is, but each view on investments includes all three aspects but there is a difference on where the focus is.

Investments based on the organisation can for example be production, market, administration or research and development investments. These types of investments aim at changing the company's organisation in order to improve a certain part of the company. Investments with a focus on the physical resources of the company can be equipment, buildings, financial, land, personnel or storage facilities investments with the aim to increase the resources of the company. The company could also focus on capacity, profitability, product or market goals with the investment. In this case, the investment can be an expansion investment, de-investment, replacement investment or a rationalisation investment. The purpose of an expansion investment could for example be to increase the capacity of the company, the number of products or entering new markets, while a de-investment is the opposite.

Theoretical Framework

A replacement investment aims at removing old equipment in order to secure the present level of capacity and the purpose of a rationalisation investment is to automate certain parts of the company in order to lower the costs.

An investment often requires substantial amounts of resources, and there are also risks related to the investments and thus, management should make the decisions concerning investments. The initiative to make an investment often comes from the company's management, however, if the initiative comes from lower levels in the organisation, the initiative taker must convince the management that the company will benefit from the proposed investment, and this is often done through investment evaluation calculations. To predict the future cash flow, both in terms of when the payments, occur and the size of the payments is a very difficult task. It is also difficult to consider all the important organisational aspects related to the investment as well as changes in both the internal and the external business environment, hence there is always a level of risk related to all investments. (Bergknut, et al., 1981)

Investment decisions are often based on guesses on the company's future conditions. In a changing and turbulent environment the investment can often be considered as gambling, even if the company does everything in its power to face the unpredictable.

3.2.1 Investing in IT

Having identified some major characteristics of what constitutes an investment, it is time to present an outline of what an IT-system investment comprises. Investing in IT-systems are somewhat different from investing in other types of assets, and the main difference is due to the multidimensional nature of the IT-system (Kämmerer, 1995). Historically, IT related investments were mainly carried out in order to reduce costs and to rationalise business processes. Although this is still a common reason for making the IT investment, companies are now more interested in both the cost reducing as well as the revenue improving effect that IT-systems can generate. Moreover, Noghabai

(1993) points out that due to the fact that the companies business functions now use IT as a means to gain competitive advantage, the strategical aspect of investing in new IT-systems plays a more central part in the company. Furthermore, due to new technological developments in business computing, e.g. the creation of company networks and new personal computing technologies, the nature of the IT-system has changed from individual systems into a more infrastructural investment and the IT-system has now become a more integral part of the company's operations. (Falk & Olve, 1996)

Because of the infrastructural nature of the IT-system investment it has become difficult to evaluate it, especially compared to non-infrastructural investments. However, it is still important that the company try to determine the tangible and intangible effects that the investment might have on the company. In order to make the effects of an IT-system investment easier to identify, Falk & Olve (1996) propose that the investing company should try to identify what type of IT-system investment the company is undertaking. The authors' method focuses on identifying the main reason for making the investment as an important variable, and suggests that by dividing IT investments into four different categories the investing company will find it easier to identify, manage and evaluate the effects of the investment. These four categories are; (Falk & Olve, 1996)

- *Necessary systems.* This type of investment is usually necessary to make in order to be able to keep the company's operations running, this category also include investments that have to be undertaken in order to comply with new legal requirements. The company does not usually have any viable 'do nothing' alternative and hence the company tends to focus on identifying the most inexpensive and acceptable solution as possible.
- *Rationalising systems.* The underlying reason for this type of investment is usually to rationalise the company's routines, and by doing this reduce operating costs, i.e. there is a cost reducing focus. Since the investment will affect the cost structure of the

company, it is possible to identify cash flow effects related to the investment, and traditional investment evaluation models (focusing on discounted cash flows) can be adopted.

- *Decision support systems.* This type of IT-system investment is often undertaken to enable the company to do business in a new way, i.e. there is a strategic element in the investment, and these types of investments are often done in tandem with a Business Process Reengineering (BPR) project. The benefit stemming from this type of investment can be difficult to identify, evaluate and manage since there will be both tangible and intangible effects. However, different forms of cost/benefit analysis can be used to evaluate the investment and it is possible to identify some causal relationships between these.
- *Competitive enhancing systems.* This type of IT-system investment is usually aimed at changing the company's competitive situation, i.e. it is an IT-system investment of strategic importance. Option thinking is sometimes used for evaluating this type of investment.

It should, however, be kept in mind that although a system might have been procured for addressing a specific reason, it may well have effects on other levels, e.g. a decision support system can have rationalising benefits.

3.2.2 ERP-system Investments

Although the ERP-system is an IT-system investment it still has some unique features. Firstly, the ERP-system investment span all the four groups identified by Falk & Olive (1996), and thus often constitutes the information backbone of the company and is in the fullest sense of the word an infrastructural IT investment. Secondly, an ERP-system investment is not just a technical solution, but it will also have a very direct impact on the company's organisation, structure, culture and strategy. Thirdly, due to the fact that the ERP-system investment impacts on so many different levels of the company, it is difficult to find an investment evaluation model that successfully will capture the multidimensionality of the system. Finally, unlike most other types of investments, the ERP-system investment's cost structure is different.

Although there are some considerable costs related to licences and hard- and software costs, the main cost element is implementation costs. The implementation process is also quite lengthy, and although the ERP-system vendors state that implementations are possible to do in approximately six months, this only includes the installation of the system, rather than any delivery of business benefits, which might take years to materialise. (Banks, et al., 1999)

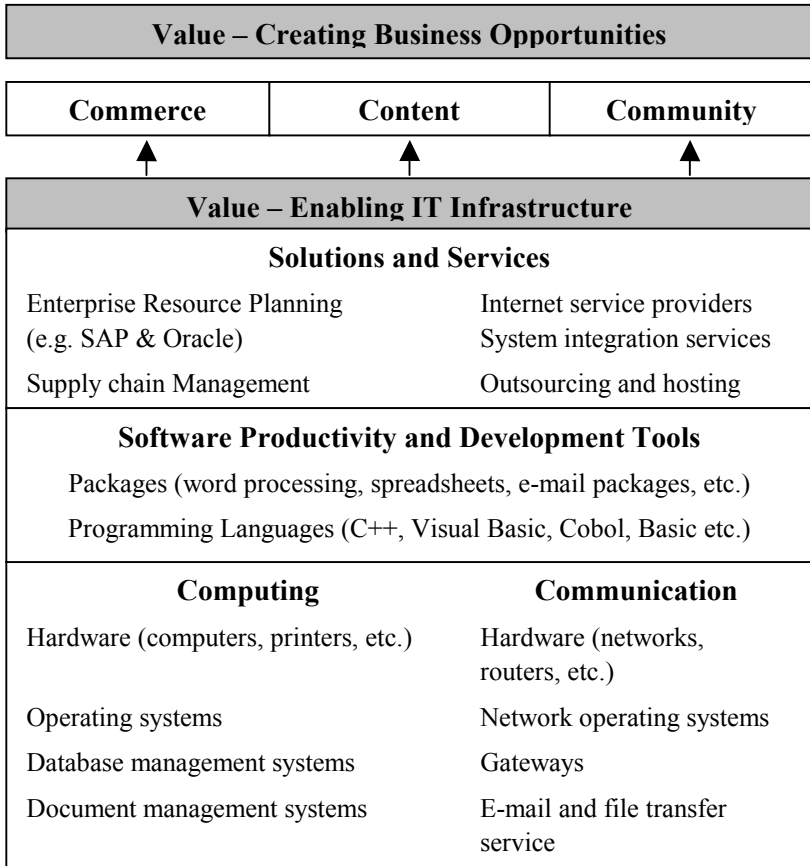
Before moving on to focus on what evaluation is, we would like to present a short historic background regarding a company's IT-architecture, as well as outlining the main characteristics and functions of an ERP-system.

3.3 The IT Architecture

The evaluation process of ERP-systems is, as identified in the previous chapter, multidimensional in nature due to the fact that the ERP-system encompasses many aspects of the organisation and how it is managed. Before moving on to identify the impact that this multidimensionality has on the evaluation process, we will present the hard- and software issues surrounding that process. Companies that have decided to invest in an ERP-system usually have both old and new technologies that they wish to integrate in order to make information flow in a seamless way throughout the company. In order to determine the technical and business options available to the company, the IT architecture should be examined. The IT architecture defines the technical computing, information management and communication platform of the company, and the components of the IT architecture are shown in figure 3.1. Decisions regarding the building of the technical IT architecture should be closely linked to decisions made in designing the IT organisation that will manage the architecture, which in turn, should be linked to the strategy and organisational design of the company itself. Conversely, the company's strategy, structure, incentives and processes strongly influence how the technology will be designed, deployed and used within the company.

Theoretical Framework

Moreover, since most companies did not replace the old IT system with the new, but added the new technologies to what was already in place most companies today have a complex combination of old and new systems that they need to integrate. (Applegate et al., 1999)



(Figure 3.1, The IT Architecture, Applegate, et al., 1999,)

Due to this, most companies have a certain level of residual systems, in order to better understand the role that these systems might play during the evaluation process of ERP-systems, a short description of each of the areas will be provided.

3.3.1 The Enterprise Resource Planning System

During the early parts of the 1990s most companies had embraced the Client/Server technology* and created international computer networks but they began to experience problems with fragmented information. Since all large companies collect, generate and store vast quantities of data, that is usually spread across dozen or more separate and different computer systems, housed at diverse geographical locations, information fragmentation was becoming a real problem. Moreover, all of these residual systems, lead to enormous costs in regard to storing and rationalising redundant data, for re-keying and reformatting data from one system for use in another, for updating and debugging obsolete software code and for programming communication links between various systems. Although these direct costs are important, the indirect costs may be even higher. An example of indirect costs related to information fragmentation could be communication problems between ordering and manufacturing systems leading to that customer responsiveness might suffer. One solution to the problem of information fragmentation is for the company to implement an Enterprise Resource Planning (ERP) system. These standardised commercial software packages are designed to integrate the organisations' different information systems and make the information flow unhindered through the organisation. (Davenport, 1999)

* In a Client/Server (C/S) set-up, the client requests services from the server, the sever processes the request and returns the result to the client. The communications mechanism is a message passing interprocess communication (IPC) that enables distribution placement of the client and server process, hence it is important to remember that the C/S computing model is a software model and not a hardware definition making C/S computing fundamentally platform-independent (Prakash, 1999).

Theoretical Framework

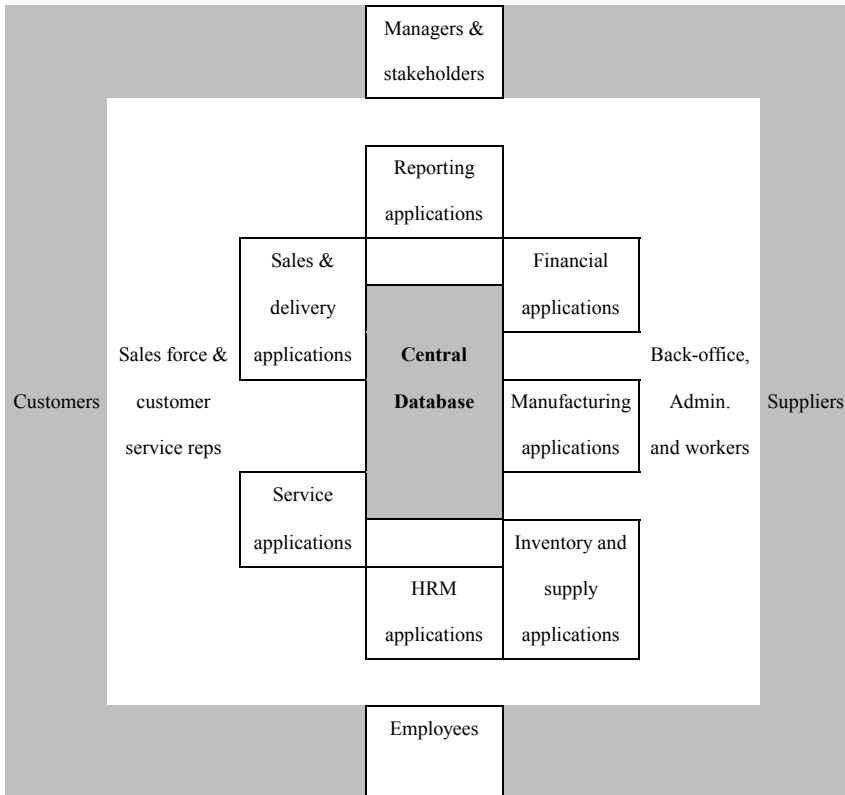
The ERP-systems are the first large-scale global IT infrastructure created for many different types of industries, and they represent an entirely new type of commercial application because it is designed to aid multinational organisations in integrating all of its operations world-wide (Roche, 2000).

Although each of the ERP-systems suppliers has its own system architecture, the core of the system is based around one comprehensive central database. This database draws and feeds data into a series of applications supporting numerous company functions. Due to this design the ERP-system's single database streamlines the flow of information throughout the company (see figure 3.2). When new information is entered in one place, all related information is automatically updated, hence creating a continuous flow of real-time operating information. Because of this real-time operating information, companies are able to realise gains in productivity, responsiveness and customer service. (Davenport, 1999)

Based on the above description of the ERP-system, it would appear that this solution could be the answer to every multinational company's prayer, however, this is not the case. Despite the considerable benefits of ERP-systems, most packages only provide between a 50 to 70 percent functional fit to companies' needs (Banks, et al., 1999). Furthermore, the direct costs of investing in an ERP-system are significant, and if the implementation costs are included, e.g. training, consultants and re-organisations, the costs might quickly spin out of control. Additionally, due to the very nature of the ERP-system, it will impose its own logic on an organisation's strategy, structure and culture, and the system might push a company towards full integration, forcing it adopt generic processes, causing a great deal of disruption and in the worst cases weaken important sources of competitive advantage (Davenport, 1999). Since the introduction of ERP-systems will affect the whole company in direct and indirect ways, both in regard to costs and benefits, a multidimensional approach for evaluating it is required.

ERP – More than just Ones and Zeros

Due to the strong interrelationship between the ERP-system and the company's organisation, structure, culture and processes, it is common that the implementation of an ERP-system is done in tandem with a business process re-engineering (BPR) project. So before we move on to discuss evaluation, it is important to outline what a BPR project implies.



(Figure 3.2, The ERP-system Architecture, Davenport, 1999)

3.4 Business process re-engineering

Business process re-engineering (BPR) is a fairly complex area with many definitions. However, Holtham (1994) provides one useful definition;

“BPR is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service and speed.” (p. 61)

Since BPR projects focus on one or several processes of the company, ERP-systems are often considered as a possible IT solution, or it might even be the reason for the BPR, since the ERP-system encompasses most of the company’s processes. Therefore, BPR projects and ERP-system investments are often carried out in tandem.

Cule (1995) proposes that all organisations are based on three corner stones, or what he call the *architectural triad*, i.e. process architecture, organisation architecture and information architecture.

Process architecture represents the way things are done or a series of actions or operations conduced to an end, and it includes all processes and procedures within a company as well as the process measurement scheme. The governance of the company, its values and beliefs is a part of the organisation architecture, which also includes the management of the processes. This is a human-centred part of the company, which deals with how the company should be organised in order for the business processes to work and who is doing what. It includes both the internal relationships between people and between functions, as well as the external relationships of the company. The central part of the information architecture is information, and it is often defined in the information systems context, e.g. information engineering, database design and management or data repositories.

However, Cule (1995) states that information architecture covers all information, whatever sources or forms that are required to effectively execute the business of the company. It is therefore a requirement that this architecture also has a human-centred approach to information, in which a category of data has different meanings to different people. It includes the coded data, most often stored in databases, as well as all other information used to support the other parts of the triad. This information can be derived from purposeful reading and conversation connected to the processes of a company.

To explain how these different architectures are connected, Cule (1995) compares the triad to a tripod. If one leg of the tripod is altered, naturally there will be a state of imbalance, and in order to maintain balance the legs must be altered synchronously.

3.4.1 Principles of Business Process Re-engineering

Mayer et al. (1995) have made a summary of the important principles of BPR, identifying the most important one as effective leadership. The characteristics of a good leader include competence, commitment, involvement and genuine interest in people and their activities. Moreover, the leader should not only be able to guide the followers, but also to encourage creativity, initiative and trust. It is also important that BPR is goal oriented, i.e. the process of a company must be organised around goals, or outcomes, rather than tasks. This encourages the company to structure its activities in such a way that it emphasises the accomplishment of the stated business goals.

The main purpose of BPR is to increase customer and user satisfaction and it is important that the company is focused on this. This forces the company to work with customer needs and priorities, i.e. it is a necessity to be dedicated to satisfying needs that are explicitly stated as well as those that are merely expected. It is also important that the company is process-oriented, i.e. the users of process output must perform the process.

Theoretical Framework

Another way to look at this is to create and empower process owners, and make them responsible for the outputs of the process. With a focus on process-orientation, the company will get a greater accountability for process performance.

The BPR should also have a value-focus, and non-value added activities must be identified and targeted for elimination. This ensures that business activities are focused on keeping the customers satisfied due to the fact that value, in this case, is connected to the perceived benefits of the customer. To treat geographically distributed resources and agents as if they were centralised ensures the best utilisation of the company's assets, it promotes sharing knowledge and at the same time, minimise the chances of local performance optimisation. This is also known as the virtual-resource principle.

The concurrency principle states that activities must be performed concurrently to the greatest extent possible within the budget constraints of a company. The principle of non-redundancy (referring to information capture) states that information must be captured only once, and at the source. This in order to enhance the cost-effectiveness of the IT that support the business processes. When it comes to decision making, this should be done to the greatest practical extent where the work is performed according to the modularity principle, i.e. control should be engineered into the business process. By performing a BPR, it is important that the persons involved are able to change their way of thinking. This paradigm-shift principle leads to radical and fundamental changes, which is what a re-engineering initiative strives for.

3.4.2 What Makes the BPR Successful?

According to Coulson-Thomas (1994), the real value of BPR lies in the discussion and discovery process that those in leadership positions go through to determine the readiness of re-engineering.

To be able to conduct a successful BPR, each company must look at its specific situation and decide what needs to be focused upon, but Coulson-Thomas presents his own non-exhaustive checklist on areas to consider.

Firstly there is leadership. It is very important that top management supports the BPR project, if it is to be successful. It is also essential that the leaders of the projects are able to launch the initiative to make a BPR, but also to make both bold and, sometimes unpopular, decisions as well as sustaining the commitment of the BPR throughout the project. The leaders must also be patient with the people involved and let them make mistakes, but also be able to take criticism and be actively involved and show passion for the BPR project.

Unless the BPR project is only to improve an existing process, it is vital that the project is driven by a clear and strategic focus and an evocative long-term vision, and that the goals of the BPR project should be ambitious. Connected to the goals is follow-up, and performance indicators should show both the change process itself as well as the resulting achievements.

When embarking on a BPR project, the company must be aware that this provides an opportunity to look at the organisation from a new perspective. By challenging the prevailing mindset, the company may be able to understand the need for change and unleash the skills, learning, creativity and innovation required to bring about new process designs. To be able to do this re-thinking, communication is essential, both internal and external. The company must involve the employees in order to make them motivated to participate in this process, and due to the nature of the BPR, it is important that the whole strategic nature is addressed, which is preferably done with cross-functional teams including all levels of the company.

IT should, in a BPR project, be viewed as an enabler and not the driver of change or a guardian of past practice. The challenge is primarily to decide what the company wants from the application of IT in the business, and then determine how to manage IT as a business in order to achieve those objectives. (Coulson-Thomas, 1994) The traditional approach to re-engineering is to first look at what problems exist and how these can be solved with the use of IT.

However, altering processes and establishing new IT solutions can prove to be a very traumatic experience for the company and it is therefore important that a multidimensional view of ERP-system evaluation is adopted. By doing this, the company will be able to better address the architectural triad identified by Cule (1995).

3.5 Evaluation

According to the Oxford Dictionary and Thesaurus (American ed., 1996) evaluation means assess, appraise, value, estimate, gauge, calculate, figure, reckon, compute, judge, rate, rank or quantify. It can also be defined as a weighing up process to assess the value of an object or the merit of a situation. It is an interaction between understanding and measurement and to be able to perform an evaluation, the evaluator should first understand what is to be evaluated, the context of the evaluation and the method used.

Evaluation is a process that is intuitively known, or at least instinctively undertaken by anyone, in either a conscious or instinctive reviewing process, e.g. ice-hockey teams, summer holidays and investments are all evaluated. To explain the concepts of evaluation further, Remenyi et al. (1997) points out that:

“We can evaluate anything including evaluation itself” (p.48).

When evaluating an IT-system investment it is necessary to understand what the organisation is trying to achieve through the use of IT, including an assessment of the organisational context and then measure the value of the results from the use of the IT-system. This can be

further described using the decision making process in the evaluation model presented and explained below (Figure, 3.3). (Remenyi et al., 1997)

The horizontal axis represents the *level of understanding* in relation to the issue being evaluated and the clarity of what the evaluator believes to be the cause and effect if taking the proposed actions. If the *level of understanding* is complete, it implies that the evaluator has confidence about the impact of the decision to be made. The vertical axis represents the level of certainty that the evaluator has concerning the issue being evaluated, which in this model is referred to as the *standard of desirability*. When connecting these two, four situations (quadrants) are created where an evaluator might find himself.

Certain <i>Standard of Desirability</i>	I Definite opinion	II No clear opinion (understanding)
	III No clear opinion (desirability)	IV No definite opinion
Uncertain	Complete	Incomplete
	<i>Level of Understanding</i>	

(Figure 3.3, The decision making process in evaluation, Remenyi et al., 1997)

In quadrant I, the evaluator’s level of understanding is complete and the evaluator is certain about the level of acceptability, meaning that the outcome of the investment is either acceptable or not, although the evaluator is certain about the opinion that he or she has. In quadrants

II, III and IV, either the level of understanding, the standard of desirability or both are incomplete, and thus the goal of the evaluation is to move everyone involved in the decision making process into quadrant I, where they have a definite opinion. (Remenyi et al., 1997)

One problem when evaluating an IT-system investment is that there most likely are many aspects that need to be evaluated, i.e. there are many decision making levels, and as a result of this, there are multiple stakeholders and hence evaluators. The first problem is to bring everyone involved in the process into quadrant I. Unfortunately this is not always accomplished but through discussions, negotiations, further analysis and education, the process of evaluation should at least move the evaluators closer to quadrant I. The second problem is to aggregate the decisions over all levels to a single point of view. During this process it is likely that the evaluators will express their views on the IT-system in terms of satisfying or falling short in relation to certain criteria. This leads to the evaluation process becoming a discussion, clarification, assessment and negotiation process and the goal should be that all evaluators should move towards using the same decision making foundation. (Remenyi et al., 1997)

3.5.1 *Ex-ante and Ex-post Evaluation*

There are a number of ways to categorise evaluation, where *ex-ante* and *ex-post* are the first primary category. Predictive evaluation performed to make forecasts and evaluation of the impact of future situations can be referred to as *ex-ante* evaluation. This type of evaluation is normally performed using financial or other types of estimates, which may be either single point estimates of cost and benefits or range estimates of such figures. In either case, this type of analysis attempts to forecast the outcome of the investment in terms of an indicator or set of indicators, e.g. payback-time, net present value or internal rate of return. The purpose of this type of evaluation is to support systems justification, which is sometimes mixed up with evaluation, but justification implies first an evaluation followed by a justification process showing that the investment is the right option to choose. A problem with *ex-ante* evaluation is that these evaluations are complex, the evaluator must understand the present situation in order

to predict and understand the future, as well as be able to predict the potential impact of the future. On the other hand, it requires only estimates of likely costs and benefits that will occur if the investment is carried out. (Remenyi et al., 1997)

Post-implementation evaluation aims to assess the value of an existing situation and can be referred to as *ex-post* evaluation. The purpose of this type of evaluation is to assess and confirm, or refute, the value of a realised design or a completed action. The *ex-post* evaluation investigates and analyses the current system and compares its performance to some previously defined situations. This is done in order to confirm the value of the system and support operational decisions about improvements. These evaluations may be conducted using the same financial measures as the *ex-ante* evaluation, or with other non-financial measures, e.g. user satisfaction or customer satisfaction. However, compared to the *ex-ante* evaluation, *ex-post* evaluation require actual costs and benefits which sometimes are very difficult to determine. (Remenyi et al., 1997)

3.5.2 Formative and Summative Evaluation

A second primary category of evaluation is that of formative and summative evaluation. Formative evaluation is sometimes referred to as learning evaluation, as the name is taken from the word form, which can be explained as to mould by discipline and education. This approach is an iterative evaluation and decision making process, which continually influences the investment and the participants in order to achieve a more acceptable and beneficial outcome from the investment, which is the overall objective of this approach. On the contrary, the purpose of the summative evaluation is to assess the final value, or sum, of the investment. Which approach is to be chosen depends on the needs and preferences of the evaluators involved in the investment process. (Remenyi et al., 1997)

All investments carries a certain inherent level of risk, and IT- and ERP-system investments are no different. We will therefore now move on into a general discussion regarding risk assessment.

3.6 Risk Assessment

It is important to consider risks and uncertainties when making a decision concerning potential investments in general, and ERP-system investments in particular, since this investment is a commitment for a time period that is more or less certain. In this context, risk is related to situations where the probability for different outcomes are known or can be calculated, while uncertainty is related to situations where the investor is able to consider different events and outcomes, but does not know the probability for these. Based on this definition three alternatives can be identified when it comes to risk and uncertainties related to decisional situations (Bergendahl et al., 1986).

Firstly, there are decisions under certainty where the conditions used as a basis for decision making are considered to be fully certain. Calculations that are within this category are called risk-neutral. The second alternative is decisions under uncertainty, which is the case when the investor has an idea of the possible events and results that may be derived from the investment, but is not able to determine which is the best alternative. A result of this is that the decision is often made reflecting the attitude to the different outcomes. The level of uncertainty usually declines during the investment lifetime, making it very hard to calculate the risk so that it reflects this time related dimension. To make decisions under risk means that the investor is in a situation where events and outcomes can be represented with probabilities that are included in the calculations and then the results of these calculations are judged as if they were risk-neutral. (Bergendahl et al., 1986)

3.6.1 Macro Risks and Uncertainties

Based on a combination of the work of Remenyi et al. (1997) and Kämmerer (1995), risk can be divided into a macro, meso and micro level, this division is also related to the different levels of IT-system investment evaluation (see 3.7). Kämmerer (1995) divides the macro

level into two dimensions, i.e. the economic and the institutional dimensions, based on which he discusses risks and uncertainties. The economic dimension includes three areas of risk and uncertainty, i.e. exploitative contributions, exploratory contributions and financial contributions.

Exploitative contributions are related to the marketing strategies, and there is a risk or uncertainty that these contributions are not supportive to the marketing strategies, but might even be ineffective or even have the opposite effect. The risk connected to the exploratory contribution is that the future opportunities prove to be non-feasible, which leads to the actual contribution being negative when the investment only is seen as a sunk cost in a worst-case scenario. Even if a proposed investment proves to have a positive present value, the risk related to the financial contribution is that the investment may actually weaken the financial status of the company, which may lead to problems with acquiring new capital for future needs. Dealing with this type of risk is often related to mapping and analysing the financial part of projects and situations.

Institutional risks are derived from new or altered valuations both internally and externally, e.g. resistance to change or legal restrictions, which the company must consider and adjust to. This might become crucial for the success of an investment. In order to deal with this type of risk, the investor must interpret, shape and influence the social world, e.g. through lobbying. These risks require that every individual not only must be open to new currents and values in a social context, but also that everyone is trying to influence these currents and values. It is seldom possible to objectify this risk in a plan and analysis until a later stage of the investment process when these rules and values have been approved.

The idea of dealing with strategic risks and uncertainties is to be prepared for the future beyond the calculations and the manipulation of the risks and uncertainties in these calculations. One way to deal with these problems is to work with an alternative analysis, an approach

Theoretical Framework

based on the idea that the environment of a commercial company is continuously changing and hence, the prognoses made for the investment are often proven to be wrong. Therefore it is important to analyse and evaluate how, if possible, an investment can be used for a different purpose than it was originally intended for, and by doing this create more flexible investments. This is a process that should be used repeatedly during the investment process to make it more successful. (Kämmerer, 1995)

An alternative method for dealing with these problems is the liquidation analysis, which examines what options the investor has if a worst-case scenario becomes reality, i.e. the investment must be terminated. When using this method, the investor looks at the possibilities of disposing of the assets that have been acquired and analysing how these consequences will affect the company. Based on this the investor will get an idea of the risks connected to a given investment. A third option is to use the portfolio analysis, which aims at spreading the risks over a number of projects within the same area during the planning and the initial stages of the investment. This analysis helps the investor to choose which investment to go through with, at a later stage of the investment process. This choice should be made as late as possible, due to the fact that the further into the investment process the company is, the smaller the risks are. However, the investor must consider the costs of working with several alternatives, but even if the costs are higher when using the portfolio analysis, the risks will be lower. (Kämmerer, 1995)

3.6.2 Meso and Micro Risks and Uncertainties

Risks and uncertainties connected to IT investments can be derived from a number of sources, e.g. financial, technical, functional and IT-infrastructure, where financial is at the micro level whilst the other three sources are connected to the meso level.

Technical risks and uncertainties mean that the investment might demand equipment and competence that the investor does not have access to at present and this might lead to unexpected costs and time-delays. Functional risks and uncertainties are connected to the fact that

the investment might not be successful, i.e. the situation that the investment is supposed to support has changed and thus, the expected effect of the investment will not be realised. The IT-infrastructure of the investor might not be appropriate for the investment and this might lead to problems when it comes to technical standards that can not be altered, limiting the number of investment alternatives. It could also lead to difficulties related to the compatibility of the existing systems. These risks and uncertainties are often referred to as IT-infrastructure risks and uncertainties. The financial aspect of this is that there is a risk that the potential in- and output of an investment fluctuate from the original estimates. (Remenyi et al., 1997)

The most common ways to identify and evaluate these risks and uncertainties are connected to the net cash flow calculations. However, it should be mentioned that risks and uncertainties are derived from different sources and some of them can be very difficult to connect to the investments cash flows.

One approach that can be used in assessing these risks and uncertainties is the sensitivity analysis. When using this method, the investor alters separate parameters in the calculation, which is followed by a study of the results, thus the investor is able to determine the influences of these alterations. Ordinarily, the investor determines the critical values, i.e. maximum and minimum values, for each parameter in line with the profitability of the project. However, in order to determine the financial effect on the investment, the investor must also be aware of, and estimate the probability of the investment. The advantage with the sensitivity analysis is that by using this method, the investor is able to study a limited number of uncertain parameters and what the effect will be if there are alterations to these parameters. However, the weakness of this method is that if the number of parameters is increased, or if the investor alters several at the same time, the information derived from the sensitivity analysis quickly becomes useless. (Kämmerer, 1995)

Theoretical Framework

An alternative technique to the sensitivity analysis, often used when including more variables, is simulation. This method is based on experiments with models to create different scenarios. This is a method that enables the evaluation to include qualitative information, which makes it possible to work with risk assessment in a more complete order, but it also leads to the process becoming very complicated. (Kämmerer, 1995)

One method that is often recommended as a risk and uncertainty evaluation instrument is the cost of capital approach. A problem is that the cost of capital is to some extent a subjective measure concerning the time-limit dependent on which method is used to calculate the cost of capital and it is also influenced by the investor's view on the external business environment and the future. The user must be aware of the risks connected with the manipulation of the cost of capital, i.e. a risk premium is added to the risk free cost of capital, and it is very important that the investor has experience of using this method. A problem when comparing investment alternatives that have different time perspectives is to avoid favouring the short-term alternatives, and this can be achieved by the investor choosing a lower cost of capital for the long-term investment. However, in this case it is not considered that the level of risk often decreases over time during a long-term investment, thus the result might be the opposite, and the long-term investment alternatives might be favoured instead. (Kämmerer, 1995)

The idea of using a safety margin, which is an alternative to the cost of capital method, is to first divide the investment alternatives into groups based on the risks and then assign the uncertain variables a value, creating a safety margin. It is an advantage, if not a must, to create a uniform pattern for adding values representing these risks. (Kämmerer, 1995)

Another financial risk evaluation method is the payback technique, where the estimated payback time of an investment is compared to the period that the investor feels is possible to review with an acceptable level of security.

If the payback time proves to be longer than the stated time limit, there is a risk that the investment will not repay itself. (Kämmerer, 1995)

Due to the fact that the IT- and ERP-system investments affect the company on many various levels, it is important to identify the costs and benefits related to these levels. Subsequently, before examining a number of available evaluation models we will discuss the different levels of IT- and ERP-system evaluation.

3.7 Levels of Evaluation

Outcomes and benefit evaluation is of critical importance for IT-systems investment planning in general and ERP-system in particular. According to Remenyi, et al. (1997) in order for management to have a comprehensive understanding of what impact the evaluated IT-systems will have on the company, it is of utmost importance that the evaluator is able to see the complete picture. There are three distinct levels of evaluation of IT-system investments, which correspond to differences in detail and the related quantification, and these are the macro, meso and micro levels. By evaluating the IT-systems on these three levels, the evaluator will see how the IT-systems may be used to drive improvements and create a positive benefit stream.

The macro, or strategic, level expresses the represented situation in general terms. The important issues within the macro level are to accomplish a high level of conceptual clarity in order for all stakeholders involved to understand exactly what is being proposed, how it is envisaged that it will work and what the expected outcomes and benefits will be. A macro level evaluation does not have to be very time-consuming to develop or use, as it may be used as a filter to prevent unsuitable ideas, or ideas which have not been developed with sufficient conceptual clarity to be understandable, from being pursued and thus consuming the company's scarce resources. Without a macro level evaluation it is unlikely that a suitable or useful meso or micro level evaluation will be conducted. (Remenyi, et al., 1997)

Theoretical Framework

A meso, or intermediate, level of evaluation expands the strategic level concepts by adding considerably more detail, especially in the area of the results of the proposed idea. The situation presented in the macro level, and the ideas on how to improve this situation will, in the meso level, be expanded by specifying the particular issues that the IT-system investment must address if the desired outcomes and benefits are to be achieved. These variables will be stated in terms of the effectiveness of the IT-system, and at this level elements of cost may also be included. If business outcomes and the corresponding benefits are to be achieved, they must be measurable, i.e. the stakeholders should be able to assess whether they have been delivered or not. However, this does not mean that these outcomes and benefits must be translated into financial measure, e.g. opinion surveys are suitable, and thus it is necessary to establish metrics, which may be specified as stemming from the IT-system investment. The establishment of a metric will allow a more objective assessment to be made of the extent to which the IT-system has delivered the business outcome or benefits. If a suitable metric cannot be identified, the suggested outcome or benefit should not be included in the evaluation. It is usual that no financial calculations are carried out within this level of evaluation. (Remenyi, et al., 1997)

The micro, or detailed, level of evaluation involves the attempts to quantify the outcomes, costs and benefits described in the meso level evaluation. This quantification may be conducted in terms of financial estimates, or it may be performed quite differently by using estimates related to the proposed IT-system investment. The quantification of the outcomes and benefits can be quite difficult to perform. The primary benefits of some IT-systems will essentially be simple functional requirements, which will either be fulfilled or not. Such benefits will be evaluated on a binary scale* and no further quantification is really possible without stretching the assumptions beyond an acceptable level. Other outcomes and benefits will be more relative in nature and

* Usually this means that a simple yes/no scale is used.

these can be evaluated using a qualitative* or numeric† scale. Other outcomes and benefits, e.g. average invoice value, can be measured on a SEK per invoice scale (a financial approach) and the company will identify what will constitute a satisfactory result for the proposed IT-system investment. When performing an evaluation on the micro level, it is common to also include the costs of the investment in order to be able to calculate performance indicators such as ROI. (Remenyi, et al., 1997)

When evaluating an IT-system investment, it is important to incorporate both tangible and intangible benefits, especially on the macro and meso level, but if it is possible to identify intangible benefits at the micro level these should naturally be included in the evaluation. A tangible IT benefit affects the profitability in a direct manner, while an intangible IT-system benefit can be seen to have a positive effect on the business of the company, even if it does not affect the profitability. The cause and effect relationship of an intangible benefit may not always be clearly visible and thus hard to understand.

Remenyi, et al. (1995) argues that it is also possible to divide the benefits into quantifiable and unquantifiable. A quantifiable tangible benefit affects the profitability directly and it is possible to measure this benefit in an objective manner. An unquantifiable tangible benefit also affect the profitability of the company, but it is difficult to measure to what exact extent the effect will be. A quantifiable intangible benefit can be measured, but the impact of the benefit should not affect the profitability of the company. Unquantifiable intangible benefits are probably the most difficult benefit to measure, it is difficult to measure the benefits themselves and at the same time the

* The qualitative scale measures aspects of an IT-system on for example a scale running from very good to very poor, and this may be converted to a measurable numeric scale.

† The numeric scale measures aspects of the IT-system on a scale based on non-financial numbers or percentages.

Theoretical Framework

benefit does not necessarily affect the company's profitability in a direct manner.

High <i>Tangibility</i>	Staff reduction Lower assets More sales	Better information
	Faster information Positive staff reaction	Market reaction Access to new staff
Low	High	Low
	Measurability	

(Figure 3.4, IT output/benefit matrix, Remenyi et al., 1997)

Just as the benefits, costs related to the IT-system investment can be divided in tangible and intangible and at the same time quantifiable and unquantifiable. A tangible cost will directly effect the profitability of the company in a negative way, while an intangible cost will cause problems that will indirectly lead to an increased cost profile of the IT-system.

High <i>Tangibility</i>	Invoiced purchases	Computerphobia
	Staff turnover	Morale Increased politics Rumours etc.
Low	High	Low
	Measurability	

(Figure 3.5, IT cost matrix, Remenyi et al., 1997)

If the evaluation is not properly conducted there is a risk that management will not be able to achieve a complete level of understanding and thus, not be able to make a correct decision concerning the value of the IT-system investment.

Having identified all these factors that influence the IT- and ERP-system investment, it is finally time to move on to examining a number of models that can be used to evaluate the investment.

3.8 Evaluation Models

When it comes to the methods used for evaluating the proposed investment, there are a number of available alternatives including both the traditional financial calculation models, such as the return on investment (ROI) and cost benefit analysis (C/B), but also models that try to evaluate the proposed investment using alternative approaches.

Return on Investment

The most commonly used approach for evaluating investments today is the return on investment (ROI). The ROI approach includes a number of techniques that try to estimate what financial return an investment will generate, i.e. the cash flow of the company, including the initial investment cost. This approach tends to be used by companies with tight financial disciplines. (Farbey et al., 1999)

ROI is based on the idea that all costs and benefits can be transformed into measures, i.e. the costs and benefits are quantified in monetary terms, which makes it easier to comprehend for the people involved in the decision making process. However, this approach will encounter problems if the value of the ROI is zero or negative, if the costs and benefits are not easily translated into monetary terms, or if there is no casual connection between the ERP-system investment and the accomplishment of the decided business goals. The main benefit from using one of the ROI models is that by using this technique it will be easy to rank the different investment alternatives, but at the same time

Theoretical Framework

it is difficult to identify the qualitative benefits (which might be a part of an ERP-system investment) and hence the evaluation of the investment alternatives might not be correct. (Projekt Janus, 1999b)

ROI evaluation models are preferably used when making rationalisation investments where the costs and benefits derived from the investment are direct and quantifiable, i.e. when the investment is expected to produce direct savings or benefits. At the same time these estimates can be supported by accurate calculations and there is a low level of uncertainty concerning the result of the investment. It can also be favourable to use one of the ROI models if there are a number of investment alternatives, and there is a need to compare these in a standardised financial order. On the other hand, the weaknesses of the ROI models are revealed when the benefits can not easily be transformed into financial measures, if there is a high level of uncertainty concerning the calculations, or if the intangible benefits are not taken into account due to the fact that they are difficult to translate into monetary terms. (Projekt Janus, 1999a)

Considering these strengths and weaknesses of the ROI methods, this approach to evaluating investment alternatives is preferably used when the investment can be identified as cost reducing. There should also be a high level of certainty concerning the result of the investment, all effects of the investment can be translated into financial measures, that the same time-scale is used for comparing all the alternatives, and that the investment should be on a tactical or operational level. It is also of importance that the company's environment, both internal and external, is relatively stable and that the management has a strong focus on the financial measures provided by the ROI and at the same time has confidence in standardised methods of evaluation. (Projekt Janus, 1999a)

Because ROI methods have problems with quantifying intangible costs and benefits, which may be very substantial when investing in IT, the usage of a sensitivity analysis can increase the correctness of the result of a ROI evaluation. Based on the issues identified above, it can be

said that by only using a ROI method, more strategic investments are likely not to be approved unless the ROI is complemented with some other method. (Farbey et al., 1999)

Boundary Values

Boundary values (BV) is the name of a group of ratios focusing on IT, which can be used to compare companies and industries. By calculating the BV, the company can use this as a base to initiate further investigations in to the chosen investment alternatives. By using BV, a company evaluating investment alternatives will decide on a number of marginal values, often stated as ratios, which display the level of expenditure related to IT. These ratios can then be used in at least two ways, firstly the ratios can be used as general guidance making it possible to determine the acceptable cost level of the investment. Secondly, these ratios can be used to investigate if a certain department of the company, or the company as a whole, is investing at the same level as the competitors and this can then be used to control the efficiency of the IT-department. However, it should be pointed out that comparisons concerning investment levels may be dangerous since an expensive investment does not have to generate more benefits. (Farbey et al., 1999)

There are a great number of ratios that companies can use to measure the costs and benefits connected to IT, and these can be divided into three categories, i.e. resources, key factors concerning development of applications, and service and tangible applications. These ratios are focused on IT costs in relation to other known measures, e.g. cost of employment or total assets. By using these ratios, the company can easily notice if the company is in line with the industry or if there is a deviation, which can then be further investigated. (Projekt Janus, 1999b)

Theoretical Framework

An advantage with BV is that it is cheap and it is a useful way of getting management involved in the process. One of the limitations with BV is that it is based on aggregated statistics, which might make it hard to use as measures on specific applications. Disadvantages with BV are that the numbers produced do not include any explanations, and it is not possible to convert these values into monetary terms. However, it is a useful technique that can be used when the company has a need to compare IT investments with other types of investments, when the investment to be made is strategic, the expected benefits of the investment are more indirect and the company's environment is changing. (Projekt Janus, 1999a)

Return on Management

Return on management (ROM) focuses on measuring the productivity of a company's management. The calculation of the ROM uses the additional financial value that can be directly linked to the management of the company after an investment has been carried out as a base on judging the investment. The financial value of the management is the value after all costs of the investment have been paid, and this is then divided by the cost of management. By estimating these costs and benefits of an investment, it is possible to use this as an *ex-ante* evaluation method, but due to the difficulties in making these estimations, this method is preferably an approach to be used for *ex-post* evaluation. However, given a large database of such *ex-post* computations, it is possible to classify projects in order to associate type of application with ROM and thus help in defining, on an *ex-ante* basis, which type of application appears to have the best chance of achieving a high ROM. (Farbey et al., 1999)

The purpose of ROM is to supplement the ROI method as a technique to evaluate IT-investments. One of the advantages with this method is that it focuses on the management of the company, and at the same time it is relatively inexpensive to perform. On the other hand, a disadvantage is that the value, that is seen as a financial benefit produced by the management, can not always be related to this part of the company, and hence there might be changes in the ROM that are

not a result of good management (Projekt Janus, 1999a). ROM is a method to be used for establishing working relations between the IT-department and the company's management. At the strategy formulation phase, changes in ROM must be based on an estimate of revenue after the change is implemented and estimates of changes to resource costs and contributions. (Farbey et al., 1999)

Cost Benefit Analysis

The main goal of the Cost Benefit (C/B) analysis is to put a financial value on every effect derived from an investment, e.g. if the goal with an ERP-system investment is to improve the working environment for the employees of the company, then the goal can be put in terms of lowered recruitment and education costs, which are derived from what is presumed to be a lowered staff turn-over. This means that all costs and benefits will get a certain value, which can be used in one of the ROI models. The costs and benefits, which have no obvious market value or price, will be assigned a monetary value based on some notion of valuation (Farbey et al., 1999). Due to the connection to the ROI methods, C/B analysis also requires a stable business environment. The C/B analysis is especially useful when a number of effects of the investment are intangible, but all the people involved in the investment process agree on the actions taken to measure and evaluate these costs and benefits.

The main advantage of this approach is that the costs and benefits will be quantified and this makes it possible to use this information in combination with other quantitative evaluation models. One weakness with this approach is that some of the values given to certain costs and benefits will be seen as 'constructed' and thus the reliability of the evaluation might decrease. A second problem with the C/B analysis is that it might take a long time to get the results and it requires good analysts.

Theoretical Framework

This technique might also overlook the problems related to risks with the investment, and it does not consider costs and benefits that are too difficult to quantify and due to this the C/B analysis might encourage companies to make low risk investments. (Projekt Janus, 1999b)

Based on this, it can be said that the C/B analysis is best suited as an investment evaluation tool when the company is able to quantify the results of the investment and has plenty of time to conduct the evaluation. Due to the lack of consideration of risks and the necessity of good analysts, the C/B analysis is best suited for the process of determining what the company generally needs rather than at the time of specification, which means that this method is well suited for strategic investment evaluation. (Projekt Janus, 1999a)

Multiple-Objective-Multiple-Criteria

This method takes into consideration the different goals of the company, as well as the criteria to achieve these goals when evaluating the investment alternatives. The basic idea of multiple-objective-multiple-criteria (MOMC) is that there are measures of utility other than monetary value, and these will be used to rank the realistic alternatives in relation to the level of achieving benefits related to the goals set up by the different parties involved in the investment process. (Farbey et al., 1999)

The MOMC approach is based on the presumption that the value of an investment can be measured in other terms than financial, i.e. one can measure and rate different alternatives with preferential values, and the result of this will be a measure of the benefits instead of the value in monetary terms. What might be considered a benefit for one person or department might be seen as a cost for other departments or even the company as a whole and hence it is important that there is a thorough discussion on what is to be seen as benefits for the company and what the desired result of the investment is. In this context, the benefits are to be seen as tools to measure the level of satisfaction. (Projekt Janus, 1999a)

The ranking of the investment alternatives is done through dividing the goals into sub-goals until it is possible to quantify these. These sub-goals will then be connected to how important the different involved parties consider achievement of the different goals, and then the investment that will yield the highest level of satisfaction is calculated, using a special software program. The investment alternative that provides the highest level of satisfaction for all parties is the most preferable one. (Projekt Janus, 1999b)

A benefit with MOMC is that it enables different perspectives of the investment and it stimulates communication between the parties involved, which leads to a better understanding of the choice of investment. It also makes it possible to rank different alternatives without quantifying all benefits connected to the investment. A negative aspect of this approach, when used for evaluating ERP-system investment, is that there is no calculation of what the actual profit of the investment will be. This can lead to difficulties when trying to compare the alternatives with alternatives evaluated based on for example a ROI model. Another issue that can be seen as negative is that this approach includes much discussion about what is to be seen as benefits or not and this will most likely be both time- and money consuming. Based on this, it can be recommended that MOMC is best suited for evaluating investments that are tactical and relatively complex. (Projekt Janus, 1999a)

Value Analysis

The value analysis (VA) approach focuses more on the surplus that will be a result of the investment, rather than cost savings. When using VA the evaluator puts the different positive effects of the investment into homogenous groups. According to the VA there are two different categories of soft benefits, the first one is that the ability of the managers will increase due to the new ERP-system, while the other group includes the company's benefits that are a result of the fact that the managers are able to make better decisions. (Projekt Janus, 1999b)

Theoretical Framework

VA uses a number of techniques to determine the value of an investment, and one of these is to construct a prototype to be able to acquire an understanding of how the system will work when it has been implemented. If the investment is assumed to give a number of different benefits, then these benefits can be divided into sub-groups and then evaluated. VA is similar to MOMC as the evaluator has the possibility to use preferential weights to assist the ranking of the different alternatives. One benefit with VA is that a value is given to costs and benefits, which normally are classified as intangibles, and this makes it possible to express these costs and benefits in both monetary terms and as qualitative benefits. This makes it possible to use a method such as ROI when evaluating the financial information, and by building prototypes the company is able to lower the level of uncertainty related to the investment. (Projekt Janus, 1999a)

VA permits the decision-maker to test the sensitivity of the solution to different interpretations and valuations. The biggest problem with VA is that the process of evaluation might become both time-consuming and expensive due to the high level of sophistication (Willcocks & Lester, 1999). VA is preferably used in situations where the company uses *ad-hoc* evaluation techniques rather than standardised methods, when the environment is unstable and the investment is of a strategic nature (Projekt Janus, 1999a).

Critical Success Factors

Using critical success factors (CSF) is a well-known strategic approach to evaluating investments, based on the idea that top management discuss which are the CSF of the company or an investment. By focusing on these factors, the management will be involved with and devoted to the investment and hence they will support an investment that will help the company strengthen these factors. (Farbey et al., 1999)

An advantage with this approach is that by using CSF, the company focuses on the questions that are seen as most important. During a further evaluation of the investment alternatives, it is possible to see

how an investment in an ERP-system can support management in dealing with these factors. A negative aspect of this method is that it is not possible to use CSF to deal with future strategic opportunities, nor can it be used to identify information that supports or creates advantages compared to the competitors. (Projekt Janus, 1999a)

CSF is a method that can be used when it is important to have top management involvement in the investment process, since it can be used as supporting evidence for further investigation. It is a strategic model, but due to the fact that it is based on the present external business environment of the company, it demands that the company operates in a relatively stable environment. (Projekt Janus, 1999b)

Priority Value

According to the priority value (PV) method, if an investment in IT is to be approved, it is necessary to estimate the business value of the investment, control the consequences of the investment, and ensure that the investment is in line with the company's business. This method is preferably used in four steps, where the first one is setting up a number of CSF questions that can be answered by yes or no. The second step focuses on becoming aware of the total cost of the IT-investment, so that the management will be able to have better control over the costs. This should be followed by the specification of the measurable variables that are connected to the companies' business, and finally a PV is calculated, which includes the relative benefits that the investment might yield. (Projekt Janus, 1999b)

The method can be used for evaluating infrastructural strategic investments, and it can be adapted to changing environments. Another important issue to consider is that PV does not consider numbers to be of great importance in the evaluation process, and hence lacks a need to be connected to financial evaluation methods. (Projekt Janus, 1999a)

Theoretical Framework

By using PV it is possible to start with a wide definition of what basis the investment alternatives should be evaluated upon and then through the different steps become more aware of the details. A problem with PV is that the approach might be considered complicated, and that it does not supplement the more traditional and strict financial evaluation methods. (Projekt Janus, 1999a)

Information Economics

The main purpose of information economics (IE) is to help the investor attain a comprehensive tool, which does not have to be used in tandem with any other method, to be able to prioritise among the investment alternatives. IE is based on C/B analysis but is customised to deal with the uncertainties related to IT-investments and thus focus on values and risks rather than costs and benefits or cash flow. IE extends normal C/B analysis by three processes, the first process is value linking, which examines the consequential impact of a primary change spreading through different functions. The second process is value acceleration, which attempts to define the value of future systems, which are dependent on the introduction of the system in question. Therefore, the value of a primary system is seen to be enhanced if it is also viewed as the platform on which later systems can be constructed. The third process is job enrichment, which provides an evaluation of the additional value to the organisation of the enhanced skills and understanding, which its staff may gain from the use of IT. (Farbey et al., 1999)

When using IE, value is seen as the total positive effect that the investment might have on the company and IE helps the company to compare different alternatives by considering all affected parties through discussion. IE divides the company in two groups, i.e. the business and the technology, and both groups have their approach to reasoning when it comes to investments and the values and risks connected to these. The values and risks are considered within each group and then against each other so that they can be ranked according to the company's specific needs. (Projekt Janus, 1999a)

Additionally, IE tries to complement the obvious financial benefits with benefits that are related to the accounting system, which is done with the so-called 'extended ROI'. This can be explained by the company trying to identify benefits within their whole process that will exist if the investment is made, and then seek to assign monetary values to these benefits. Together with the two groups, this information provided will help the company to make a decision concerning the investment. However, it is rather the balance between the values and risks than the total IE-value that is of importance, since two investments with totally different strategic goals might have the same IE-value. (Projekt Janus, 1999b)

The fundamental advantage of IE is that it encourages communication between the IT-department and management, as well as helping to increase the level of communication, trust and coherence between the different functions of the company. The wide approach used in IE can also be seen as a general advantage. The problems with this method are that it can be too mechanistic when used for evaluating all projects and at the same time be very time-consuming. Due to the fact that it is based on subjective calculations, an IE evaluation might not have the management's full support, which can lead to problems implementing the investment. (Projekt Janus, 1999a)

The Balanced Scorecard

The basic idea of the balanced scorecard (BSC) is that it will provide a complete picture of the company's business to the management, but it is possible to adjust it to specific departments and situations. This approach looks on the effects on the company as a whole from four perspectives, i.e. financial, internal, customer, and learning and growth. According to BSC, no area is more important than any other and only the most critical factors within each perspective should be measured to avoid unnecessary information. (Kaplan & Norton, 1996)

Theoretical Framework

By using BSC, the management gets a more holistic picture of what factors actually affect the company, both internally and externally. The focus of this approach is not on control, but rather on strategy and vision, and by this, the management aims to eliminate some of the problems that exist with the more traditional methods. (Projekt Janus, 1999a)

One of the advantages with BSC is that it helps, not only management, but everyone involved to understand the internal networks that are a result of the environment of the company. Without a deeper understanding of these relations, there is little chance that the company can successfully use BSC. When using the BSC from an IT-investment perspective, an advantage is that it can provide quick and frequent information, which is required by management with an investment in this area. Another advantage with the BSC is that it provides a general level of information, and at the same time sets up goals for the different perspectives as well as providing the possibility to quantify the measures used. (Projekt Janus, 1999a)

Within each of these four perspectives, the purpose with the investment is stated but the problem is that there is a risk that these purposes may become internal when making an IT-investment as a result of the fact that the IT-department controls the whole process. Another problem is that the investment must be beneficial for the entire company, otherwise this method can not be used. Another disadvantage with this method is that there probably are no useful general measures for IT and this means that every company must create their own measures and methods, which might lead to uncertain results. (Projekt Janus, 1999b)

Options Thinking

A problem today is that many of the evaluation techniques tend to focus on the short-term. An alternative to this is to express strategic investments as real options, which means that the investments are made but seen as investments in physical, human or intellectual assets and not financial.

Options thinking (OT) is focused on three types of information, the present and future possible business strategies, desirable competencies, and different IT-investment costs and risks. (Projekt Janus, 1999b)

When using OT in regard to an IT-investment, the focus is on the ability of the company to create platforms that can be used to expand in new, but non-safe markets. These abilities are seen as options since they are investments in possibilities, but if the company does not make the first move there is a risk that the company will not have the option to take advantage of an opportunity when it arises. (Projekt Janus, 1999b)

Infrastructural IT-investments can be seen as platforms, which make them unpredictable when evaluating, however, it is likely that they prove to be more valuable than a ROI evaluation would suggest. These types of platforms are valuable in consideration of four conditions, uncertainty, possibility, time-dependency, and freedom of achievement. (Projekt Janus, 1999a)

An advantage with OT is that the investor avoids the delay or even not making necessary investments in abilities and platforms. This makes it possible for management to be able to adjust to changed business strategies using new IT-applications. The main problem with this method is that it is quite subjective in nature and it does not provide any guidance on how to discuss and combine different points of views concerning an investment. (Projekt Janus, 1999a)

Scenario Building

To avoid rejection of important information by using too narrow and formalised frameworks when analysing investment alternatives, scenario building (SB) can be used as a platform for decision making. Different assumptions concerning the environment, potential and present users and systems-related questions could be used for the base of building scenarios. This can be a useful method to provide

Theoretical Framework

information to be used in discussions and analyses concerning the connection between business strategy and IT-strategy, but also in investment evaluation. (Projekt Janus, 1999a)

The model as such may preferably be used when the company has a need for new and creative solutions and there is a great uncertainty about the future. It can be advantageous to use SB when the company is making infra-structural investments, which involve several parties since SB is an *ad-hoc* evaluation method. By using this model, it is likely that the actions taken are flexible enough to disclose all the information required to make it possible to see and understand all the complex and qualitative synergy effects that may be the result of an investment in IT. (Projekt Janus, 1999a)

The advantage with SB is that it can be used to challenge the basic assumptions made and hence parts of the mental models, which exist within the company making the investment. However, a problem with this approach is that it is wholly qualitative which means that it is all about constructing scenarios focusing on future events, and that will lead to difficulties in making any connection to financial methods. (Projekt Janus, 1999a)

Prioritising Based on Net Benefits (Prioritering Efter Nyttogrunder)

The idea of Prioritising Based on Net Benefits (PENG) is to provide a simple and usable model for evaluation and control of the benefits that the company has experienced as a result of an investment. The benefits of the investment are presented in monetary terms, but the aim is not to provide the exact value since the model is based on the idea that the environment is not stable, thus there is no need for this value. The model focuses on measuring and evaluating to what extent the benefits, which are a result of an investment, will affect the company, including qualitative beneficial effects. Due to the nature of the model, PENG can be used for both *ex-ante* and *ex-post* evaluation. (Dahlgren et al, 2000)

The model can be divided into three different phases, which in turn are divided into 10 steps, where the first phase includes the first five steps, which are focused on the strategy of the investment, e.g. purpose of investment, make limitations and a description of the object of investment. The second phase called the analytical phase includes the more practical side of the evaluation, i.e. the identification, grouping of, and valuation of the net beneficial effects, but also calculations of the costs which arise when making the investment. The third phase, which aims at determining the quality of the valuation includes a validation of the investment and also a risk and problem assessment together with a calculation of the net benefit of the investment. In the final stage of the evaluation, it should also be decided who has the responsibility for conducting the investment. (Dahlgren et al., 2000)

This model suits a situation where the environment of the company is unstable and there is no need for a specification of the value of the benefits, but it is rather suited for strategic investments. An advantage with PENG is that the model requires that both specialists and representatives from management are involved in the process, and hence the evaluation should be able to be holistic and at the same time be supported by the management, which can be crucial for the success of the investment. However, a problem with this model is that some values attached to the identified benefits are subjective which may lead to problems, due to the lack of trustworthiness. (Dahlgren et al., 2000)

3.9 Summary

An investment is an acquisition of something with a long-term perspective. When making the decision it is important not only to examine the investment itself, but also how the investor wants the investment to aid future development. However, investments are often based on guesses and thus, to invest can be considered similar to gambling. Due to the infrastructural nature of IT investments it is difficult to evaluate these, but by dividing this type of investment into necessary systems, rationalising systems, decision support systems and competitive enhancing systems, it becomes easier to identify, manage

Theoretical Framework

and evaluate the effects of the investment. An ERP-system investment spans all these groups, and it also has a direct impact on the company's organisation, structure, culture and strategy, which makes it difficult to evaluate this type of investment. The main costs element of this type of investment is not hard- and software, but rather implementation costs. When making an ERP-system investment it is common to do a BPR in tandem with the investment, and the investing company should consider all aspects of the architectural triad, if the BPR is to become successful.

When evaluating an investment, the standard of desirability and level of understanding will indicate if the investing company has a definite opinion of the investment or not. The purpose of the evaluation can be both predictive, *ex-ante*, and to assess the value of the existing situation, *ex-post*. The evaluation can also be divided into formative evaluation, i.e. learning evaluation or summative evaluation, i.e. the evaluator aims to assess the final value. When evaluating investments, it is also important to consider the risks that are related to these at all three levels, i.e. macro, meso and micro level. These levels are the same as the levels of evaluation. There are a number of models that can be used for evaluating investments and they can focus on the financial aspect (ROI), or the softer benefits (VA) or a combination (MOMC, PENG).

4 Results from the Empirical Study

In this chapter we will present the results from the interviews with the nine companies that participated in this study. Following the three different levels of evaluation identified in the theoretical framework (see 3.7) we have chosen to divide our questions into three main levels, i.e. macro, meso and micro level related questions. Hence, the questions address different levels of ERP-system investment evaluation. The results are then presented in a table format in order to clearly show the respondents' different answers, these answers were provided by the respondents themselves since no answer alternatives were given by us during the interviews. There are six macro level questions, six meso level questions and finally two micro level questions. This approach of presenting the results from the empirical study is chosen because it will present a more structured picture of the multidimensional nature of the ERP-system investment, and it is also in line with our theoretical framework. Finally, by presenting the results in this way it will be easier to discuss the details of the ERP-system investment in the analysis chapter.

Since all of the questions in the interview guide are not relevant for all three respondent groups, we have summarised the number of answers we received in regard to each question and each group of respondents in figure 4.1; this figure also shows the order in which the questions will be presented in this chapter.

Macro Level Questions:	Buyers	Consultants	Suppliers
What was the Purpose of the Investment?	5	1	2
Does an ERP-system Include a Strategic Element?	5	2	2

Results from the Empirical Study

Macro Level Questions:	Buyers	Consultants	Suppliers
Was the Investment Evaluated in Regard to the Company's Strategies?	5	2	2
Were the Effects that the ERP-system might have on the Company's Organisation and Culture Considered?	5	2	2
Were there any Risks Identified in Regard to the Investment?	5	2	2
Were Alternative Solutions to an ERP-system Considered?	5	2	0
Meso Level Questions:			
To what Extent was the ERP-system Implemented in the Organisation?	5	2	2
How Were the Costs and Benefits Related to the ERP-system Investment?	5	2	2
In which Areas were Tangible and Intangible Costs and Benefits Identified?	5	2	2
Was the Cost for Own Time during the Implementation Phase Included when Evaluating the ERP-system Investment?	5	2	2
How were the Residual Systems Looked Upon?	5	2	2
Was the Opportunity Cost of the Investment Considered?	5	2	2

Micro Level Questions:	Buyers	Consultants	Suppliers
On what Basis were the ERP-system Investments Evaluated?	5	2	2
Have any Additional Costs or Benefits with the ERP-system Investment Appeared to what was Planned?	4	2	2

(Figure 4.1, Summary of answers provided by the respondents)

As shown in the figure, there were only three questions that were affected by the differences between the respondents groups. Firstly, the reason for why the consultants have not answered the question concerning the purpose of the investment is that they work with many different customers and have hence encountered a number of different purposes for why companies chose to invest in ERP-systems. Due to this they were not able to provide us with any specific purposes for why investing companies undertake the investment, although one of them discussed system functionality as a common reason for the ERP-system investment. Secondly, both suppliers are aware of the alternative solutions available to the ERP-system, however since they supply ERP-systems they did not comment upon how alternative solutions could be used as an alternative to their product. Finally, since one of the buyers decided, after the evaluation process, not to invest in an ERP-system, the company could not have experienced any additional costs or benefits after implementing the system.

4.1 Macro level questions

Q. What was the Purpose of the Investment?

	Buyers	Consultants	Suppliers
One System, Functionality	4	1	
Central Information	1		
e-business			1
Make Standardised Processes more Efficient			1

Four out of the five buyers stated that the purpose of the investment was that they wanted to achieve a higher level of functionality, which they saw as the result of having one uniform ERP-system. Their reason for this was that there were communication problems between the different parts of the company and their systems. Two of the buyers were created through mergers and naturally there are communication problems when companies merge. Both of these buyers said that one of their main purposes with the investment was, besides the fact that many of the systems were obsolete, that by investing in an ERP-system, the company was able to create a feeling that they now were one company, thus facilitating company integration.

One of the companies in this category said that they wanted to collect and use some information centrally in order to be able to have efficient working processes in the order and invoice area, but also to create a smoother process in a geographical sense. This was the main reason why they evaluated ERP-systems, since they provide this opportunity.

ERP – More than just Ones and Zeros

One of the suppliers said that the main purpose today to invest in an ERP-system is to enable the company to work with e-business. This development is a function of the fact that most companies today already have an ERP-system, and the only companies that have no ERP-system are, according to both suppliers, the so called new 'dot.com' companies. The e-business area is one of the new areas where the buyers see the advantages with an ERP-system. This is supported by one of the buyers who stated that the new customer will not call the company to place an order, but they will rather log on to their website and order from there, and in order for that to work, there must be a central database that manages this information so that it is continuously updated. The other supplier was more focused on how the ERP-system makes standardised processes more efficient and stated that this was a common purpose for investing in ERP-systems.

Since the consultants work with so many different customers they have encountered a number of different purposes why companies chose to invest in ERP-systems. However, one consultant stated that in their experience the most common reason is to establish one system in the company and this is usually related to the investing company feeling that the functionality of the existing system is not meeting the demands of the company.

Q. Does an ERP-system Investment Include a Strategic Element?

	Buyers	Consultants	Suppliers
Yes	5	2	2
No			

Results from the Empirical Study

All respondents state that they see an ERP-system investment as a strategic investment, and the main reason for this is the widespread effect that the ERP-system has within the company, especially since all interviewed groups identified the need for organisational and process change that the ERP-system brings with it. Although the respondents also pointed out that the results of the ERP-system investment is usually related to operational goals and issues. One strategic reason to conduct an ERP-system investment provided by all buyers was that they wanted to achieve a uniformity in the IT-systems used within the company, this was in order to ensure that everyone within the company uses the same terminology as well as to improve the productivity of the company. The buyers all agreed that this would be the result of using the same information derived from one database. Another reason given for undertaking an ERP-system investment was to force everyone to work in a cohesive way in regard to a number of processes. Many of the buyers commented that it was a common problem that the different units within their company had different processes, and although this was a source of competitive advantage in some cases, many buying companies felt that they stood to gain from introducing cohesive processes, especially in regard to the administrative and the standardised business processes of the company.

However, one buyer identifies that a problem with an ERP-system investment having a strategic value, or at least being treated as a strategic investment, is that it creates a situation where what is considered strategically best for the company as a whole might not be the best for a separate unit of the company, i.e. there is always a local element. Depending on which level of the organisation the investment decision is taken, the harder it will be for the individual business unit to understand the underlying reason of the decision, especially since it might conflict with a particular unit's local strategy.

One supplier and both consultants say that there have to be connections between the strategic goals of the investor and the ERP-system investment or the aims of the investment will not be achieved. One of the consultants commented upon the importance that an investing company should not make an ERP-system investment because it

ERP – More than just Ones and Zeros

'amuses' the company. This is due to the traumatic experience that change brings to any company, and an organisational trauma 'amuses' nobody.

Q. Was the Investment Evaluated in Regard to the Company's Strategies?

	Buyers	Consultants	Suppliers
Yes	1	2	2
No	4		

Although all respondents perceive the ERP-system investment as a strategic investment, only one of the buying companies indicate that they have performed a strategic evaluation of their ERP-system investment. This evaluation included how the system would impact in both a direct and an indirect way and this was then related to a number of strategic issues, most of which in turn are related to how the investment would influence the company's owners. The remaining four buyers did not appear to have undertaken any sort of strategic analysis of the investment.

Although both the suppliers and the consultants state that they carry out a pre-study that includes a description of the current situation, as well as linking it to future goals. This is mostly done in regard to the ERP-system investment and how it will impact on the company's future strategic possibilities. However, there is a strong operational focus on the outcomes of the ERP-system investment, but both consultants stated that they try to establish a link between the investing company's strategy and its ERP-system investment.

Results from the Empirical Study

Q. Were the Effects that the ERP-system might have on the Company's Organisation and Culture Considered?

	Buyers	Consultants	Suppliers
Yes	5	2	2
No			

All the respondents agree that the organisation of the company is related to its strategies and thus, if the ERP-system investment is of a strategic nature, it will have organisational effects on the investing company.

The buyers were all well aware that when making an ERP-system investment, one must analyse the organisation to determine where there should be changes in order for the investment to be successful and for the company to be able to capitalise on the benefits generated by the investment. Since one aim of the investment has been to create a uniform system and terminology for the company, there must be alternations within, at least, parts of the company and its processes. Another reason for why there have been considerations of the effect on the organisation is as one buyer states, if one is to introduce a new ERP-system, then most investing companies should start with a Business Process Reengineering (BPR) in order to prevent the new system preserving the old way of working. Moreover, it is important that the investor keeps the ideal process in mind since it is possible to adjust the system so that it fits the process.

When it comes to the cultural aspects of the ERP-system, one buyer says that they altered the system to suit the cultures within the company since it is easier to make these adjustments to the system than it was to change the culture of the company.

Both consultants say that when evaluating an ERP-system investment, it is important that there is a business focus on the evaluation and not a system focus. One of the consultants also states that they often include representatives from the users when evaluating the ERP-system, in order to ensure that the investment suits the company, and that the re-organisations that are to be made are accepted at all levels of the company.

Both suppliers say that an ERP-system investment will affect the company's organisation and processes and hence, it is very important to consider this when making the evaluation. Moreover, both suppliers say that, if the people involved with the company do not accept the ERP-system, or understand the reasons why the investment is made, then the implementation of the ERP-system might fail.

However, all respondents agreed on the fact that there had to be alterations to the investing company's organisation and the ERP-system. But there was a difference of opinion when it came to what should be altered. One buyer says that there are a number of situations where the investing companies must decide on whether to alter the process or the system, but the investing company should keep in mind that by altering the system, problems with upgrades might arise. This statement is supported by two other buyers, and a third buyer said that it is very important to reflect over the possibilities to avoid alterations of the ERP-system. Both suppliers agree that the investors accept more and more standardised ERP-system solutions, but they also point out that their products are flexible and can handle alterations without them leading to difficulties when an upgrade is introduced. Furthermore, all respondents agreed that it is becoming more common to accept the system standard, and the suppliers think that this is partly due to the fact that investing companies are aware that they are buying a standardised product.

Results from the Empirical Study

Q. Were there any Risks Identified in Regard to the Investment?

	Buyers	Consultants	Suppliers
Yes	5	2	2
No			

According to one of the buyers, they always perform a risk evaluation when the projects are of a certain monetary size, and most ERP-system investments fall into this category. The buyers considered both the financial risks with the investment and the risks related to how the new system would be accepted in the company. The financial risks were considered in the earlier stages of the project, while the organisational risks were continuously updated and assessed throughout the project. According to one buyer, some of the suppliers provide the investing companies with risk assessment software that facilitates the quantification of the risks so that they can be monitored during the project. Another buyer performed a risk analysis on the risks inherent in the old system and if these risks could be eliminated by investing in an ERP-system, e.g. the knowledge of the old systems is declining, uncoordinated information that led to mistrust in the existing systems and technical risks. This was used together with a financial risk analysis, since there is a risk that the investment becomes so expensive that the company goes bankrupt. One buyer had discussions concerning the problems with changing the way people work within the company and how they would react to a system that was not tailor-made and thus could not perform every function at the optimum level. Then there was a risk analysis of the implementation process, and how that could be effected. One buyer said that they did not perform a risk analysis of the functionality of the ERP-system, but they did a financial risk analysis, which also included a number of technical elements.

ERP – More than just Ones and Zeros

One of the consultants said that a risk analysis is performed at the beginning of the investment process. This risk analysis examines the actual ERP-system, the supplier, the project-group's ability to make decisions, the organisation of the project and if the decision to invest in an ERP-system is strongly anchored within the company. The consultants also point out that it is usually easier for them, as an external party, to identify potential problem areas. One of the consultants offers to assist the investing companies in making a risk analysis, and this is done in most investment evaluations that the consultant performs.

Both suppliers' work with risk analysis related to the ERP-system investment, and one supplier stated that it is in their own interest to eliminate all risks related to the investment. One of the suppliers performs the risk analysis in the pre-study of the investment together with an analysis of the actual needs of the company and what alterations must be made within the company. One supplier works with external consultants to identify the risks related to the investment and then they create a plan to deal with these risks.

Q. Were Alternative Solutions to an ERP-system Considered?

	Buyers	Consultants	Suppliers
Yes	2	1	
No	3	1	

The three buyers that did not consider alternative solutions to the ERP-system investment were all primarily interested in investing in a system that would help the company to replace a number of old outdated individual systems. Many of these old systems could not communicate with each other and hence the company felt a need to

streamline its communications as well as removing a number of old residual systems. Thus, they never considered any alternative solutions since they were forced, by the state of the systems in use at the time, to replace them and instead of replacing all of them with new individual solutions that then had to be integrated, they saw an ERP-system investment as the most viable alternative.

The other two buyers did seriously consider a combination of top of the line individual systems, including existing systems, combined with middle-ware* software and datawarehousing as an alternative solution to the ERP-system investment. Both buyers realised that they had the opportunity to still use the existing systems and then connect these using middle-ware solutions, and then storing and retrieving all information by using datawarehousing solutions. One of these companies evaluated both the datawarehouse† idea and the ERP-system and came to the conclusion that an ERP-system investment was too expensive and too complicated to install, so they chose to standardise the small, individual systems and then use a datawarehouse to manage the information flows. The management of the second buyer that considered a datawarehouse, was pushing the idea of a central ERP-system very hard, at least on a regional basis, and they were able to get the needed support to perform the investment.

The consultants were both aware of the alternative solution to the ERP-system investment. However, only one of them had been engaged in a project where the investing company had started out with the intention to invest in an ERP-system, but actually ended up with an alternative solution.

* A fairly new type of generic application software that operates on the level above the operative system, but under specific applications. Ideally the middle-ware software should be able to run regardless of the technical platform. (Lingärde, 2000)

† Datawarehousing is a type of information storage and gathering technique rather than a computing model. By utilising information gathered from a number of sources the company can analyse different aspects of their business (Lingärde, 2000).

The suppliers were also aware of the alternative solutions to the ERP-system, and one of them stated that if the investing company is aiming at acquiring the best system for each of its processes they should not be looking for an ERP-system. The ERP-system strengths comes from that it is fully integrated and streamlines all the company's information flows and not from providing the best individual system solutions.

4.2 Meso level questions

Q. To what Extent was the ERP-system Implemented in the Organisation?

	Buyers	Consultants	Suppliers
Functions	1	1	2
Geographical Area	2		
Entire Company	2		
Depends on the Purpose		1	

The purpose of the investment in an ERP-system for one of the buyers was to create uniform processes within a specific function of the company. That was the reason why that buyer only implemented the ERP-system for that specific function. However, the buyer now sees the opportunity to expand the ERP-system into other functional areas. One reason given for this is that the investing company has had a fairly positive experience with the ERP-systems' functionality for a particular function and now sees the possibility to expand the scope of the system. Furthermore, as the ERP-system has been developed and improved by the supplier, the investing company feels that it might experience additional positive effects in other functional areas. Two of the buyers want the ERP-system to achieve a consistency within

Results from the Empirical Study

geographical areas. One of the buyers said that they considered which ERP-system was best suited for the given geographical areas, dependent on the demand on the system, but also the computer maturity in the areas, i.e. the lower the computer knowledge level is in an area, a less advanced system is introduced. The other two buyers had obsolete systems that were not compatible with each other and thus they needed to create a uniform system. As one of these buyers said that they started all over and one way to achieve the feeling of being one company was to invest in a new ERP-system. The same functionality problem was the main reason for the other buyer to make the investment. They wanted a completely new system that provided the desired functionality.

According to one of the consultants, most investors only buy the specific modules that they need in order to improve a particular process, which is very much a result of that most suppliers give them the opportunity to purchase modules and do not force the investor to invest in the entire system. The processes that there is a focus on are the most important processes for the success of the investing company, such as a specific production process. The other consultant say that depending on where there are opportunities to improve, if it is a particular process, then the investment should only focus on that process. If there is a potential to improve in geographical areas, then the investment should strive to achieve that.

One supplier states that the investing company should try to look at the process as a whole and not only focus on a certain module, e.g. if there is a problem with purchasing there are often also problems with invoicing and this supplier recommended that the investing company invest in the entire process. If the investor takes a process and only addresses one part of it, ignoring how it is linked to other processes, then the investing company will never achieve the full potential benefits of the investment. The other supplier said that the investing company always has the possibility to invest in the necessary components. However, the main point of the system is not to only to address certain specific processes or functions, but rather create the possibility to establish business networks.

Q. How were the Costs and Benefits Related to the ERP-system Investment Identified?

	Buyers	Consultants	Suppliers
Evaluation Seminars	1		
Business case	1		
Workshops		1	
Interviews		2	1
Business Investigations			1
Pre-study	3	2	2

One of the buyers said that they try to identify all costs and benefits of the ERP-system and then tried to quantify these in order to create a form of ‘business case’. The problem with this is that it can be hard to make people commit themselves to this form of evaluation. Another buyer said that they did not try to identify the benefits as such but rather focused on the functionality of the ERP-system. To be able to do this, they held seminars where the users had the opportunity to monitor the evaluated ERP-systems in different situations and graded the functionality of the systems. One of the buyers tried to quantify the changes in operations and focused on real cost reductions in a number of areas. Another buyer focused on identifying the costs and benefits related to the ERP-system investment by carrying out a pre-study that included contacting and interviewing other companies within the same group that had carried out an ERP-system investment.

Results from the Empirical Study

Two other buying companies also stated that they had used the pre-study as a tool for identifying the costs and benefits related to the ERP-system investment.

One of the consultants thinks that only feeble attempts are made by the investing company to quantify the costs and benefits of the ERP-system investment, moreover, due to it being considered as a strategic investment, it appears that the buyer has little energy to carry out any quantification. Another way to identify the costs and benefits, according to a consultant, is to do an analysis of the needs of the investing company, which can be performed in workshops and by interviewing the people involved in the investment project. After identifying the needs, it is preferable if the investing company creates metrics related to these needs, in order to be able to evaluate and measure the ERP-system investments. Both consultants also indicated that the pre-study can be a very useful tool when identifying the costs and benefits of the ERP-system investment.

According to one supplier the effects of an ERP-system investment are determined through business investigations and interviews and based on these it is possible to identify the costs and benefits derived from an ERP-system, which can then be quantified and measured. The suppliers argued for focusing on the improvement areas identified in the pre-study as a basis for identifying, and later on, measuring the costs and benefits related to the investment.

Q. In which Areas were Tangible and Intangible Costs and Benefits Identified?

Costs:	Buyers	Consultants	Suppliers
Hardware	5	2	2
Software	5	2	2
Consultancy Fees	5	2	2
Other IT Related Costs	1	1	1
Licences	5	2	2

All five buyers examined the tangible costs of the investment, i.e. hard- and software, licenses and consultancy fees. Furthermore, all of the buyers also included estimations of the costs for the time the company would spend implementing the system (see below). Some buyers stated that due to the multidimensionality of an ERP-system investment, there are usually no steps taken to identify and quantify any intangible costs. Only one of the buyers said that they included increased IT security costs in regard to the ERP-system investment.

According to both the consultants and the suppliers, the costs that are included in the evaluation are usually the tangible costs such as hard- and software costs, licences, education and safety. However, in their experience there is often a lack of consideration among the investing companies for tangible indirect costs, such as the time that the buyer spends during the investment project. Regarding the other IT related costs of the ERP-system investment, one of the consultants and one of the suppliers identified that the cost of security has increased and that few investing companies are aware of these security related costs.

Results from the Empirical Study

Tangible Benefits:	Buyers	Consultants	Suppliers
Logistics	2		1
Sales & Distribution	3		1
Finance & Control	4		2
Other IT Related Costs	3	1	1
Warehousing	1		
Reduce Lead-Times		2	1
Management Information	1		

When it comes to the benefits identified by the buyers, there is a strong focus on cost reducing tangible benefits. These cost reducing benefits appear in a number of areas, however some of the areas are more common than others. Firstly, by investing in an ERP-system, three buyers saw the possibility to reduce their costs for sales & distribution, as they were able to streamline their information flow leading to less time being spent on administrative work, as well as achieving an effective stock keeping. This leads to the investing company avoiding that any extra capital are tied up in stocks, the buyer also mentioned that the system reduces stock-outs as the ERP-system enables the company to track inventory levels across the whole company. Furthermore, by reducing the time spent doing administrative work the sales force would be able to spend more time selling the company's products. Secondly, in the area of finance & control, the ERP-system investment enables the buying company to reduce the time spent on preparing the financial reports, which creates a benefit for the investing company both in regard to the fact that management gets financial information more rapidly and that less time is spent preparing financial

statements. Thirdly, three buyers identified cost reductions in the area of other IT related costs. These cost reductions were predominantly due to decreased system maintenance costs. Other cost reducing benefits were identified in the areas of logistics and warehousing. In these areas the buyers often saw cost reductions related to a decrease of the fixed assets, e.g. fewer warehouses, leading to less capital being tied up in these fixed assets. Finally, one buyer identified the impact that the ERP-system had on making more qualitative information available to management and how this can affect the company's profitability.

Due to the fact that the consultants work with so many different companies investing in ERP-systems, they were not so specific when disclosing information regarding tangible and intangible benefits with the ERP-system investments. On a more general level, the consultants spoke at length on how the ERP-system investment affects the company's processes and how it reduces the company's lead-times. However, on the tangible level, one consultant stated that cost reductions in relation to other IT related costs was a common benefit experienced by investing companies.

According to the suppliers, a company that invest in an ERP-system can experience cost reductions within the areas of finance & control, sales & distribution and other IT related costs. One supplier also commented on the effects that the ERP-system could have on logistics, especially in regard to the possibilities of co-ordinating purchasing and buying in bulk leading to cost reductions. Furthermore, one supplier commented upon the effects that an ERP-system investment could have on reducing lead-times.

Results from the Empirical Study

Intangible Benefits:	Buyers	Consultants	Suppliers
Customer Relations	3		1
Flexibility	3		
Uniformity	4		
Strategic Enabler	3	2	2

The buyers also recognised some intangible benefits originating from the ERP-system investment. Three buyers identified better customer relations as a benefit of the ERP-system investment as the system enabled the company to have better customer information, due to the real time database. Furthermore, the real time database also assists the company to provide more accurate and timely deliveries. The buyers also identified that the ERP-system helped them to improve their quality of service. Another intangible benefit that three buyers saw in relation to their ERP-system investment was that the system made the company more flexible and hence, found it easier to adapt to changes in the company's external business environment. This flexibility was seen as a very important benefit and an advantage for the investing companies. Four buying companies stated that system uniformity, albeit on different organisational levels, was one of the expected benefits with the investment. These buyers strived to create uniform systems across a particular function, a geographic region or across the whole company. The main reason that was given by the buyers was that they felt the need to have an uniform terminology across their company. An additional intangible benefit acknowledged by three buyers was that the ERP-system investment proved to be a strategic enabler for the investing company, and this was predominately in regard to future e-business projects.

ERP – More than just Ones and Zeros

When it comes to intangible benefits both consultants focused on the strategic enabling effects of the ERP-system investment, and they commented that this usually was related to different e-business strategies.

According to the suppliers the intangible benefits of the ERP-system investment can mainly be identified in regard to the systems strategic enabling possibilities, and e-business was given as the most common example. Finally, one of the suppliers also stated that improving customer relations was a benefit that could be derived from an ERP-system investment.

Although the respondents identified numerous costs and benefits areas, few metrics for measuring these were proposed.

Q. Was the Cost for Own Time during the Implementation Phase Included when Evaluating the ERP-system Investment?

	Buyers	Consultants	Suppliers
Yes	5		1
No		2	1

All five buyers organised the ERP-system investment as a project with a budget connected to this, and all five buyers said that they considered the costs of their own time when evaluating the investment. This type of project involves many persons from the buyer in order for the investment to be successful and according to one buyer the costs of relieving employees from their ordinary duties in order for them to be able to work with the investment were quite substantial.

Results from the Empirical Study

According to one consultant, the buyers do not consider much more than the costs of hard- and software, and sometimes the fees to be paid to the consultants. The buyers' own time is not very often included in the evaluation and this is a problem since it is one of the major cost elements connected to an ERP-system investment. One consultant also pointed out that the costs for educating the employees is often disregarded, and this is a problem that sometimes leads to that the budget for the project is used up, but the employees do not know how to use the ERP-system. Furthermore, both the consultants saw an ERP-system investment as a project, and this corresponds with the buyers' views.

One supplier said that there is a risk that the buyer does not allocate the necessary resources when it comes to the own time that must be put into the project. The buyers often forget to consider the costs of own time and one of the suppliers stated that it is very important that the people involved in the project are released from their ordinary duties in order for the project to be successful. The other supplier indicated that it is common that the investing companies are aware that they will have to allocate time for the ERP-system implementation project. However, it is frequently so that the company disregards the fact that these people also have to take care of their ordinary workload. The company almost forgets that it also has its business to operate.

Q. How were the Residual Systems Looked Upon?

	Buyers	Consultants	Suppliers
Sunk cost	4	2	1
Sellable			1
Still in use	1		1

ERP – More than just Ones and Zeros

All four buyers that have invested in an ERP-system regarded the old system as a sunk cost. One of the buyers said that their old system ‘died’ as they were using an old mainframe computer based system and they were the last users of their specific software. Another point of view from a buyer was that even if the old system had its merits, it did not generate any value for the company since it had to be continuously repaired and maintained. One buyer said that they even reduced their costs for the licenses for the old system, even if these costs were fairly small. Their hardware was so old and out of date that it was not possible to sell anything off either. One buyer said that due to their residual system being so old, it had no value on the balance sheet it was considered as a sunk cost. Only one of the buyers still had its residual system as their main system, i.e. it is still in use.

Both consultants agreed that most of the time the buyers’ residual hard- and software is so old that it is not possible to recycle any of it or sell it off, but it should always be considered as a possibility. The most common situation is that everything is replaced. As one supplier said before, it is only the new dot.com companies that do not have any existing ERP-system, but it is common that the buyer has one or several residual systems that do not work properly and that is why they need to be replaced. One supplier considered the residual systems as either a sunk cost, something that could be sold off, or even partly recycled.

Q. Was the Opportunity Cost of the Investment Considered?

	Buyers	Consultants	Suppliers
Yes	3	2	1
No	2		1

Results from the Empirical Study

Out of the five buyers, three stated that they considered the opportunity cost of investing in an ERP-system. One buyer focused on the opportunity cost in relation to the cost of capital for financing the investment and took into consideration how the investment would influence the company's capital structure. Another buyer did not only focus on opportunity costs in relation to the financing, but also focused on how it would affect the company on a more operational level if they did not go through with the ERP-system investment. There was a strong focus on losing competitive advantages, and hence future cash flows, if they did not carry out this investment. The third buyer focused on yet another area, namely on how the company's IT functionality would be affected by an ERP-system investment. This was then related to the cost of making the investment. The buyers that did not include any consideration of the opportunity costs of the investment were generally less cost sensitive, and considered the ERP-system investment as a necessary investment. Therefore, it was not an option not to go through with the investment and because of this, the opportunity cost was never considered.

Both consultants stated that it was important for the investing company to include an opportunity cost evaluation of the investment. Both suggested that it was important to examine the opportunity cost in regard to the cost structure of the company, and make a comparison between how the investing company's capital structure would be affected if the company went through with the investment compared to if they did not. One of the consultants also commented that it was important to include the issue of the cost for the investing company's own time during the implementation phase, and how this would affect the company's cost structure.

The suppliers had somewhat different views on the importance of opportunity costs in regard to this type of investment. One of the suppliers thought that it was important to show the investing company how it would be affected if it did not go through with the investment in terms of lost revenue and the costs for maintaining the residual system. The supplier also pointed out that most investing companies realise that the ERP-system investment is so important for the company that

they have to go through with it. The other supplier stated that when the investing company contacts the supplier, then they have already decided to invest in an ERP-system, and thus the opportunity cost is not really an issue.

4.3 Micro level questions

Q. On what Basis were the ERP-system Investments Evaluated?

	Buyers	Consultants	Suppliers
ROI	3	2	
C/B analysis	1		
Functionality	2		
Suppliers	4	1	
Reporting Time	1		
Costs	1	1	
BSC		1	1
PENG	1		
Financial Result of Investment			1
Areas of Improvement			1

Results from the Empirical Study

One buyer that used the return of investment (ROI) as an evaluation tool and calculated the costs of the investment and the effects that the investment would have on the income statement. Based on this, they used a combination of net present value and the investment payback time. The company was then able to derive a number that they could compare the ERP-system investment alternatives with. The buyer also evaluated the supplier since making the investment would lead to a long-term relationship between the buyer and the supplier being created, and it is deemed as important by almost all buyers that the supplier will be able to provide support and service for the system. Related to this is the functionality of the ERP-system, which also was evaluated, but the main issue of this part of the evaluation was to look at the soft facts connected to which supplier was chosen.

One buyer focused more on the functionality of the ERP-system, and the functionality of the evaluated systems was weighed and compared and at the end of the evaluation there was a financial evaluation, but the main part of the evaluation was on the functionality of the ERP-system. The buyer that used the Cost/benefit (C/B) analysis with a focus on the cost reducing effects of the system, and based on the C/B analysis the company calculated the internal rate of return (IRR). Later in the project, cash flow and net present value was included in the evaluation. One reason for the company to use the IRR is that it is easy to comprehend as well as the possibility to manipulate it by altering the cash flow projections. This buyer also stated that many seem to believe that a high IRR is better than a low one, but that is not always the case. The buyer also pointed out that it is very difficult to quantify all aspects of an ERP-system investment and that this can lead to problems when using the IRR.

One buyer that also evaluated alternative solutions examined the costs of the investment, but also focused on the different suppliers that were contacted. However, there was no C/B analysis, and the buyer said that even if there was one, it is doubtful that the investment decision would be different, since this buyer stated that many of these kinds of calculations are based on too many approximations and are therefore unreliable. Another buyer that evaluated the functionality of the ERP-

systems examined which cost reductions the company could achieve by investing in an ERP-system and then used this information to do ROI calculation. But this buyer's main focus was on the functionality of the system and the capability of the supplier.

As indicated by the buyers there is traditionally a focus on cost reduction, which is a result of there being no reliable models that help the investing company to easily translate the intangible benefits into financial measures. One buyer said that it is more or less impossible to approve an ERP-system investment based on financial evaluation, and the investing company must look at both the hard and the soft facts and then make a decision concerning the proposed investment. To be able to look at both the tangible and the intangible aspects of the investment, one buyer mentioned the PENG model, but also emphasised that it is hard to use since it is based on a number of estimations. The important thing is to set up goals for what the investment is suppose to achieve and then do a follow-up.

One comment from a buyer was that if the ERP-system investment was to be evaluated, there are only a few, if any, ERP-system investments in large companies that can show a profitable result. This is due to the fact that so many buyers feel that it is so difficult to calculate the profit to be derived from the investment, and therefore they prefer to call the investment strategic and are thus not forced to try to prove that it is a profitable investment.

One of the consultants stated that it is very important to look at what evaluation models the buyer ordinarily uses, since it is important that the buyer recognises at least some of the evaluation models in order to trust them. However, in most investment evaluations a combination of models is used. There are a number of models that try to quantify the soft measures related to an IT-investment, but these must be combined with other models, as neither of them are considered to present an adequate picture of the actual investment. One approach that can be

Results from the Empirical Study

used for capturing the multidimensionality of the ERP-system investment is the balanced scorecard (BSC) as it combines both the hard and the soft aspects of the investment, but this model is not commonly used. One consultant said that the major focus is on the actual costs of the investment, as the benefits of the ERP-system investment are already identified when the buyer decides to make an investment with the purpose of eliminating the shortcomings of the old systems.

According to one supplier, the investing companies are very aware of the costs of the investment, but they try to also make them aware of the benefits related to the investment. By focusing on the improvement potential connected to the ERP-system investment, it is possible to quantify the benefits of the system. The aim of the evaluation is to be able to justify the investment and hence, there is a focus on the bottom-line result according to one supplier. But as it can be difficult to quantify all aspects of an investment in order to be able to perform a profitability calculation such as the ROI, the BSC could be used as an alternative evaluation method. One supplier agreed with the buyers that it is hard to quantify all costs and benefits related to the investment, but according to the supplier few customers used a ROI as a result of this, but if they did use a ROI calculation correctly, it would be possible to justify the investment.

Q. Have any Additional Costs or Benefits with the ERP-system Investment Appeared Compared to what was Planned?

	Buyers	Consultants	Suppliers
Yes	3	1	1
No		1	1
Not able to say	1		

Three out of the four buyers that invested in an ERP-system said that they have discovered additional costs and/or benefits derived from their investment. The other buyer said that the investment has been followed up, but the effects that the company has experienced after the investment can not be connected to the investment itself as they are not able to establish any connection between the changes and the ERP-system investment. Many of the benefits that have been experienced as a result of the investment, according to the other three buyers, are results of better utilisation of the ERP-system. Moreover, the fact that the system enables the company to widen the scope of its original ERP-system investment by introducing other modules that can then help the company to become more efficient. However, most of the ERP-system investment projects have gone over budget and taken a longer time to implement than expected, and this is an additional cost related to the investment.

One consultant agreed with the idea that once the ERP-system is in place it enables the company to continue to develop the system, but this is not something that is considered when the company makes the original evaluation of the investment. The other consultant is more restrictive in their approach and said that so few buyers evaluate the ERP-system on an *ex-post* basis and this can be a reason why there are not many comments concerning additional costs and benefits, i.e. there has never been any follow up on the investment so the investing company can not determine if it achieved its planned goals with the investment. A supplier said that the investing companies usually experience additional effects related to an ERP-system investment, and they are eager to point these out to the supplier. However, most of these benefits are identified at a higher level of the company, as the managers have access to more information compared to the people further down in the company hierarchy. The supplier thought that this might be a result of the fact that the buyer and the supplier speak different languages and have problems understanding each other leading to that they have different expectations regarding what the system actually can deliver.

5 Analysis

5.1 Macro Level Analysis

What was the Purpose of the Investment?

When companies started to work with Client/Server technology problems, fragmented information arose as the information was often spread across dozens or more separate and different computer systems. This became very expensive for the companies both in terms of direct costs for re-keying and reformatting data but also the intangible costs increased as problems with communication between ordering and manufacturing led to that customer responsiveness suffered. The idea of the ERP-system was to remove these problems by creating one central database to integrate the information from the different systems and make the information flow unhindered through the company.

This purpose correlates quite well with the purposes of the majority of buyers interviewed in this thesis, as four out of the five buyers aimed at creating one central system and by doing this improve the functionality of the information and the systems. One of the suppliers agrees that this is the most common purpose of the ERP-system investments today. However, one of the buyers' main purposes was to create a central database in order to increase the accessibility of information, thus improving the capabilities of the company. These purposes can be said to relate to an initial investment in an ERP-system. However, one of the suppliers states another reason as the most common purpose for making the investment, namely to enable the company to embark on e-business projects. This can also be the result of companies having made their initial investment and then deciding to expand their ERP-system into a new area in order to improve and develop their business. Many of the buyers also commented on this, although it was not the main purpose of the investment, it was still perceived as a future possibility.

When having a main purpose to improve the functionality of the system or to centralise the information, it is important that the evaluation of the proposed investment reflects the purpose of the

investment. As creating a higher functionality with one system can be seen as a strategic goal for the investment, the evaluation should not only focus on what financial returns this investment yields, especially since it is likely that the return will not be satisfactory. Therefore, it is important to also perform an evaluation that reflects the purpose of the investment and how well this purpose is achieved if the company carries out the ERP-system investment. If this is not done, then the result of the investment will not be satisfactory as it will not achieve the high profitability goals set by the buyer, or the proposed investment will be rejected in the initialising phase of evaluation as it does not provide the required level of profitability.

It is also important that the purpose of an investment is in line with the strategies of the company, or the strategies should be changed, especially if the investment is considered to be a necessary investment. This is the reason why it is important for companies to have IT-strategies, the buyer must be aware of what the company needs to continuously develop and be successful. If the company does not have an IT-strategy, then it might experience some problems since the right information at the right time is becoming more and more important for the survival of the company.

Does an ERP-system Investment Include a Strategic Element?

The nature of an ERP-system investment implies that it has a strategic element and this is something that all the respondents agree on. The underlying reasons that have been stated for carrying out the ERP-system investment is to create uniformity within the company, improve given processes and remove unnecessary levels of information. As stated by one buyer, the strategic goals of the investment might not be the best for every employee or process of the company and thus, it can be hard for the affected parties to accept and understand the motive for the investment.

Analysis

These factors emphasise the importance that the investment decision is made by the management of the company, since this is the organisational level at which the strategies of the company are developed. However, it is also important that all affected parties are involved in the investment process in order to understand the advantages the ERP-system investment will bring for the company.

However, as pointed out in the interviews, there has traditionally been a focus on the costs of the investment and it was also stated that because of the strategic nature of the investment, the buyers were not as rigorous with their evaluation, due to the fact that they deemed it strategic and hence said that it was difficult to evaluate the true value of the ERP-system.

Was the Investment Evaluated in Regard to the Company's Strategies?

Even if all of the respondents perceived the ERP-system investment as a strategic investment, only one of the buying companies performed some sort of evaluation of how the ERP-system would affect the company and its strategies. This is quite interesting, especially since so many of the buying companies saw the ERP-system investment as a strategic enabler, but it is likely that the investing company has performed this type of evaluation on an informal level.

The strategic nature of the ERP-system should not be seen as an excuse not to conduct a thorough evaluation, but rather the investment alternatives should be evaluated not only in financial terms, but also on a strategic level. This strategic evaluation should be conducted to enable the investing company to identify the full value of the investment. What is very important to evaluate is if the proposed ERP-system investment is in line with the present strategies of the buyer or if there might have to be adjustments made to the strategies. One strategic and well-known model that could be used to evaluate the ERP-system investment is to use critical success factors, but a problem with this method is that it can not be used to deal with future strategic opportunities or identify information that supports or creates

advantages compared to the investors competitors. During the interviews it has been discovered that an ERP-system investment actually can be seen as an enabler, as it is possible to expand the system with new modules and it is also possible to use the ERP-system as a platform for launching e-business projects, and these possibilities were not always considered at the time of the investment. In order to capture these aspects the investing company could consider using options thinking as an alternative evaluation model, since it allows management to adjust to changed business strategies using new IT-applications, especially since it perceives the investment as an investment in possibilities.

Were the effects that the ERP-system Investment might have on Company's Organisation and Culture Considered?

The organisation of a company and its culture is closely allied with the strategies of the company, and as all respondents agreed that since the ERP-system investment is of a strategic nature, the organisation and culture of the company will be affected by the investment. All of the buyers were well aware of the fact that they should go through the organisation and the processes of the company when making the investment, as it might require certain adjustments. As one respondent said, a purpose for making an ERP-system investment is to create uniformity within the company as there were problems with split information, there had to be adjustments, at least within parts of the company. However, the culture of the company is more perpetual and thus, more difficult to alter, and it is often considered easier to adjust the ERP-system to suit the culture than the other way round. It is also stated by a buyer that an investigation concerning the processes of the company should be conducted when making an ERP-system investment in order to prevent the new system preserving the old way of working.

As one consultant points out, the fact that the buyer is evaluating the option to invest in an ERP-system shows that the buyer is aware of the fact that the company is not working at its optimal level. Furthermore,

Analysis

both consultants highlight that it is important for the buyer to have a business focus and not a system focus when evaluating the ERP-system investment so that the buyer is able to find the optimal solution. It is also pointed out by one of the consultants and both suppliers that the evaluation and the re-organisation of the company should be discussed with the affected parties in order for the investment to be accepted within the company. However, when it comes to alterations to be made in the organisation or the ERP-system, there is a difference of opinion between the suppliers and the buyers, where the suppliers say that there are no problems related to upgrading the ERP-system connected to alterations made in the system, while the buyers said that they tried to avoid ERP-system alterations in order to avoid problems related to future up-grades.

All of the investing companies have identified that investing in an ERP-system is not the same thing as investing in other types of IT-systems. The difference is that the ERP-system is very multidimensional and infrastructural in nature and will therefore affect the company's organisation, structure and culture.

In our opinion Cules (1995) architectural triad clearly describes how the processes, organisation and information systems are correlated to each other, and when considering the nature of an ERP-system, it is expected that there are organisational changes done within the company related to the investment. Moreover, we believe that, due to the fact that many of the processes affected by an ERP-system are of such a standardised manner, it is preferable if the company makes the alterations within the organisation and its processes in order to prevent future problems with the ERP-system. However, since an ERP-system investment is often connected to a Business Process Reengineering (BPR), it is difficult to evaluate the system as such and hence, it is very important that the alterations of the company's processes and organisation are well thought through and that consideration is taken to these, when an evaluation is made.

One buyer actually suggested that one way of evaluating the ERP-system effects on the company could be to focus on the re-organised processes and then do an *ex-ante* and *ex-post* investment evaluation in order to determine the effects that can be attributed to the system.

Were there any Risks Identified in Regard to the Investment?

As stated by Bergknut et al. (1981) all investments are related to risks, as they demand substantial amounts of resources and include a level of uncertainty. This is concurred by the respondents, as they all see risks related to an ERP-system investment. However, there was a difference in what risks were considered. All buyers considered the financial risks, which is natural due to the large amount of resources that are put in a project of this magnitude. There was also consideration taken to risks related to the old systems, the suppliers and their ability to provide the buyer with both the system and assistance was also included in the risk analysis. How the system is to be accepted within the organisation and risks related to the implementation of the ERP-system was also considered. One of the consultants also points out that there are risks related to the implementation of the ERP-system and how the users will accept the system.

There is no doubt of the fact that by taking the decision to invest in an ERP-system, the buyer automatically exposes the company to a number of risks. It is very important that these risks are not neglected as these risks are a threat to the buyer that might, in a worst case scenario, lead to bankruptcy. We believe that it is very important that the buyer performs a thorough risk analysis that takes into consideration all risks that the buyer identifies as related to the proposed ERP-system investment in order to make a good and fair evaluation of the investment. However, there was little discussion about strategic risks of investing in an ERP-system, and this is an area that should not be neglected. The strategies are the guidelines to how the company should continue to develop in the future and if the risks with an ERP-system investment are not considered at the strategic level the company might experience problems in the future.

Analysis

The strategic risks related to an ERP-system investment can be identified with an alternative analysis where the environment is assumed to be continuously changing and as a result of this, the evaluation performed concerning the ERP-system investment will prove to be incorrect. The buyer can then evaluate if the investment can be used for different purposes than it was originally intended for and this will create a more flexible investment. Another way to analyse the strategic risks is to perform a liquidation analysis, which assumes the worst case scenario, i.e. that the company goes into bankruptcy, and what would then happen to the value of the ERP-system, can it be sold off, and how will this affect the investing company.

To be able to assess the risks at the meso and micro level, the buyer can perform a sensitivity analysis where the buyer will alter the parameters of the cash flow calculations separately and then study the results of these alternations. By performing this analysis the buyer will be able to study a limited number of uncertain parameters and the effects if these are altered. The problem with this approach is that a number of parameters can not easily be connected to the financial aspects of the investment.

It is important to remember that risk analysis is only the obvious financial and technical risks, but also the risks related to embarking on a long-term relationship with an outside party that will affect the company for many years, and this was also an area that all buying companies did consider. After the risk analysis is conducted, the buyer should create a plan on how to deal with the identified risks.

There are currently many different models available for identifying and evaluating risks related to an ERP-system investment. However, due to the multidimensional nature of the ERP-system it is important that the investing company takes a wide approach to identifying the risks associated with the investment. Based on the empirical findings, this appears to be the case and the only risk that is not included by the investing companies is the strategic risk.

Were Alternative Solutions to an ERP-system Considered?

There are a number of problems with having a number of separate systems in an organisation, especially if the systems are unable to communicate with each other, the information might be in different places and this can lead to the information not being continuously updated and hence, there might be faulty information within the systems. Problems like these can lead to distrust of the information generated by the systems, which can lead to other problems, e.g. the employees start to keep individual records. But the question is if an integrated ERP-system is the only solution to these problems or if they can be solved by using some sort of middle-ware software and datawarehousing solution.

Two out of the five buyers that were interviewed evaluated alternative solutions too an ERP-system investment, and one of these two respondents chose to invest in the alternative solution rather than an ERP-system as the costs of the ERP-system was considered too high and it was too complicated to implement. The key factor to why they evaluated datawarehousing as an option to an ERP-system was that they both had systems that they felt served their purpose very well. On the other hand, the three buyers who stated that their residual systems were so old and that there was no more use for these systems felt that they had to replace them in order to attain an acceptable level of functionality, i.e. they did not have the opportunity to choose an alternative solution.

When investing in an ERP-system, the buyer will not have a system that is the best system for every specific area, but it is rather the complete ERP-system that is better than a number of customised systems, the sum is greater than the parts. When making the decision to invest or not to invest in an ERP-system, the buyer must be aware of the alternative solutions and the effect that can be expected from an investment in for example a datawarehouse solution. If the present systems are old and there are integration problems, and the knowledge of them is low within the company, it would probably be preferable to

invest in an ERP-system, however, all available options should still be considered. If the present systems have the capability needed then a better solution could be to invest in some sort of middle-ware and datawarehousing and hence use the potential within the existing system. The comparison between an ERP-system and an alternative solution should be conducted as a comparison between two ERP-systems, as the alternative solution is an option to an ERP-system. However, the financial side of the investment should be included in the comparison due to the extensive amount of resources that this type of an investment demands. Although it appears that the buying companies have made careful considerations in regard to which system solution they should chose, they have primarily focused on functionality. This is partly because the investment is perceived as a necessary investment and it is therefore a focus on function rather than costs. However, one of the buyers pointed out that although his company would be able to keep the old system operating at a fraction of the cost of a new ERP-system, it would not be of any real strategic value for the company since the system would not be able to deliver any additional benefits to the company. This is an important aspect of the ERP-system investment and we think that it is important to consider the net benefits of the ERP-system compared to what level of functionality the residual system can provide.

It is interesting to see that the investing companies put a lot of effort into identifying and evaluating viable alternative solutions to the ERP-system, particularly since this is an area that is not covered by the available literature. Based on this pattern it would appear that the investing companies have become more aware of what functions they really need and what solutions the available options present to them.

5.2 Meso Level Analysis

To what Extent was the ERP-system Implemented in the Organisation?

When deciding upon the extent to implement an ERP-system it is of importance to evaluate the need within the company and what the costs and benefits of the ERP-system will be. The nature of ERP-systems

suggests that they should be implemented over the whole company, but the fact is that the entire company might not have a need for an ERP-system, but rather it might be certain functions or parts of the company that need to make this investment. This is an issue to consider as an ERP-system investment is both expensive and complicated to implement and it should not be performed if there is not any need for it, as one supplier said one does not perform an ERP-system investment just for the fun of it.

The buyers had identified their needs for the ERP-system investment as one buyer said that their need for an ERP-system was limited to only one function, while two buyers evaluated the system on a geographical basis and the remaining two buyers saw the need to introduce the ERP-system throughout the entire company. Both suppliers and one consultant say that most ERP-system investments focus on separate functions of the system, i.e. the functions that the buyer needs. However, one consultant takes a more restricted standpoint and says that the purpose of the buyer differs and hence, so does the extent of implementation of the ERP-system.

In order to conduct a true and fair evaluation of the ERP-system investment, it is necessary that the investing companies consider the size of the ERP-system and the extent to which its implementation affects the costs and benefits that can be realised as a result of the investment. It is important to identify what costs and benefits are related to the ERP-system investment and if the size of the system is not considered, then the evaluation will not be truthful. This is of course a problem that is not new to the area of evaluating ERP-system investments, but if a buyer is to be able to perform an evaluation that is useful, then all aspects of the investment must be identified and included and the size of the investment will definitely affect the result of the investment.

Analysis

When performing a strategic evaluation the discussion about what the investment will achieve is more elusive and this should then be broken down to more tangible costs and benefits in order for the buyer to put a value on the effects, however, it must not be a financial value in order to make a correct judgement. As we can see, the size of the investment differs from buyer to buyer and one reason for this can be that one buyer previously has made an ERP-system investment and only adds one function to the existing system while another makes the first investment. Naturally, the evaluation of these two situations would have to be different and this also points out the importance of taking the full scope of the ERP-system investment into consideration when making the evaluation in order to identify all costs and benefits related to the investment and by this achieve a correct picture of the effects of the investment.

One reoccurring theme of the empirical findings is the focus that the investing companies have on system functionality. This appears to have created a situation, partly due to that the suppliers now offer their ERP-systems on a modular basis, where the investing company only invest in the functions they identify as important for the company's processes. We feel that this approach is very advantageous for the investing company since it exposes them to fewer risks and makes the implementation project more manageable.

How were the Costs and Benefits Related to the ERP-system Investment Identified?

The purpose of an evaluation is to assess the value of an investment, and if the evaluator is to achieve a true and fair value of the investment then all costs and benefits ought to be included in the evaluation. The problem is to be able to identify all costs and benefits related to an investment and to put a value on them, even if the value does not have to be of a financial nature.

The usage of evaluation seminars for the users of the evaluated ERP-systems have been conducted by a buyer in order to attain the users' views on what are considered costs and benefits according to them.

Other ways of assessing the costs and benefits related to an ERP-system investment is, according to the consultants, to have workshops and interviews with the people who are affected by the ERP-system. One supplier also uses personal interviews to obtain the impressions of the people of the investing company regarding the ERP-system, but another way is to conduct business investigations to attain the costs and benefits derived from the ERP-system.

In order to perform an evaluation that is useful, it is important that as many costs and benefits related to the evaluated investment are identified. It is important that the decision-makers are aware of the costs and benefits of the investment even if they are not affected themselves. Therefore, the persons who are affected by the investment in anyway should also be involved in the investment evaluation process, so that they can point out costs and benefits that otherwise might be neglected. Many of the tangible costs and benefits of an ERP-system are probably known to management, however, the intangible costs and benefits are not always considered, and since these costs and benefits make up a central part of the ERP-system it is important that management becomes aware of these. There is also another reason why all levels of the company should be included in the evaluation process, namely that many of the people within the company might have difficulties to accept the investment if they feel that they have been neglected and they do not understand the purpose of the investment.

One problem that can occur when inviting numerous levels of the company to participate in the evaluation process is that they might sense that they are under pressure to accept the suggested investment. If they experience pressure from management, this can result in the evaluation of the ERP-system suffering. Therefore it is important that the evaluation of the ERP-system investment is done without singling-out a certain person and the opinions provided by this person, but it should rather be the opinions of the evaluating group that can be used to make a better evaluation.

Analysis

One way to do this is through evaluation seminars where the users have the opportunity to see and reflect over the processes provided by the ERP-system and comment upon these.

In which Areas were Tangible and Intangible Costs and Benefits Identified?

Investing in an ERP-system leads to that the investing company will experience numerous tangible and intangible costs and benefits. In order to perform a holistic evaluation, it is important that all these variables are considered. When it comes to the costs of the investment, the majority of the respondents have focused on the tangible costs related to the investment. These tangible costs were predominately identified in the areas of hard- and software, consultancy fees, licenses and other IT related costs. The only tangible cost that is not fully considered by the buyers is the increase in IT related security costs. One of the consultants pointed out that this is an area that few buyers consider. Furthermore, the IT security costs are made up of two different elements, i.e. a technical and a human element. It is usually more costly and harder for the investing company to establish effective security routines compared to introducing various technical solutions. One of the suppliers states that over the last couple of years, more and more money is used for increasing the level of IT security within the investing companies, and this is predominately due to that they expose themselves on the Internet.

Although the investing companies appear to have a firm grasp on the tangible costs related to the ERP-system investment, few indirect tangible costs are considered. However, one indirect tangible cost that all the investing companies included as a cost element is the cost for their own time during the implementation of the system. This is not supported by the consultants and suppliers that state that the investing company often disregards this cost (see below). None of the respondents have stated that they included any costs related to the BPR done in tandem with the ERP-system investment, and none of the consultants and suppliers seems to include this in their own methods.

In general it appears that buyers, consultants and suppliers are well aware of the tangible costs related to the ERP-system investment. The only cost element that is disregarded by the buyers is the increased IT security costs, especially if the company chooses to expose itself on the Internet. The indirect tangible costs are generally not considered, with the exception of own time. It is quite surprising that although most of the respondents identify the importance of redesigning processes in order to experience the benefits of the ERP-system investment that they do not include any costs related to the BPR when evaluating the investment. One reason for this could be that the investing company does not see the BPR project as a part of the ERP-system investment. Moreover, this could also be due to the company finding it too hard to identify any direct cost elements related to the BPR project and hence, it is considered as a general change project.

When it comes to the benefits related to the ERP-system investment, the tangible aspects are given more attention than the intangible ones, this is similar to how the costs are treated in the evaluation process. The benefits that the buyers primarily focus on in the evaluation are cost reductions in nature. These cost reductions are connected to different administrative processes within the company. One of the reasons for this is that the ERP-system is predominately a transactional system and hence, many of its effects will materialise in these areas. Moreover, since the buyers often prefer to evaluate their investments on a financial basis, they identify benefits that they are able to quantify and assign a financial value to. However, the buyers also identified a number of intangible benefits related to the ERP-system investment, but these were seldom part of the evaluation. These benefits were often related to the general strategic discussion regarding the investment and hence, they are rarely quantified.

The consultants and the suppliers do not describe any specific areas of benefits, however, they do identify that cost reduction is the most common benefit related to this kind of investment. On the other hand, this group tends to emphasise the intangible benefits related to the

Analysis

ERP-system investment and especially its strategic dimension. Both the consultants and the suppliers state that the ERP-system is an important part for the investing company if it is interested in launching an e-business project. Although some of the buyers also identified the ERP-system as a strategic enabler, and then often in regard to e-business projects, this is rarely given as a main benefit of the investment.

It would appear that the main reason for the focus on the tangible benefits, in terms of cost reduction, is that the buyers prefer to evaluate their ERP-system investment by using a quantitative and financial approach, often with a focus on a bottom line value. As the intangible benefits are difficult to quantify in a non constructed way, these are seldom included in the evaluation. Furthermore, there is little or no attention given to the ERP-systems revenue increasing possibilities and this is probably because it is harder to predict increases in revenue compared to reduction of costs. Unfortunately, by taking this approach to evaluating an ERP-system investment, the investing company might fail to capture the multidimensional nature of the system and hence, not include all the benefits that the system might yield. There is also a tendency among the investing companies to firstly focus on implementing the system and then during the second phase achieve the expected benefits. The problem with this approach is that the investing company, due to the long-term nature of an ERP-system investment, will not conduct a holistic evaluation of the investment.

Although the respondents were able to identify a wide range of cost and benefit areas related to the ERP-system investment, few metrics for these areas were put forward. One possible reason for this could be that since the investing companies focus on the cost reducing effects of the ERP-system investment, the only metrics needed are the estimated or real cost reduction. However, it is more likely that the investing companies find it difficult to establish usable metrics for certain costs and benefits areas. This could indicate a need for establishing a number of possible metrics for these costs and benefits areas so that they can be properly measured and analysed.

Was the Cost for Own Time during the Implementation Phase Included when Evaluating the ERP-system Investment?

This is one of the costs that must be included in the evaluation of the proposed investment in an ERP-system, as this type of investment demands much time from the buyers primarily during the implementation phase of the project. What is important to keep in mind is that it is not only the salary for the people working with the project that should be covered in the evaluation, but also the cost of replacing these people in their ordinary duties.

All of the five buyers say that they included the cost of their own time in the evaluation, and four of the five buyers organised the ERP-system investment as a project. However, in some of the investment projects the people were working with both the project and had their ordinary duties, which puts them in a difficult position as an investment in an ERP-system demands much effort from the buyer. The consultants do not agree with the buyers on this and both state that this cost was in most cases not considered a point that was supported by one of the suppliers.

One very interesting point is that although all buying companies that participated in the study state that they included the cost for their own time in the investment evaluation, whereas both consultants and one supplier state that the investing company rarely does this. The fact that buyers, according to consultants and suppliers, forget to consider the cost of their own time when evaluating an ERP-system investment can lead to serious problems for the buyers as an ERP-system investment consumes much time from the buyer, both when implementing and also when training the users. If this is the case, then the company will not have a correct picture of what resources the investment demands and this can lead to disastrous decisions, as the company might go bankrupt as a result of the investment becoming too expensive. One way to avoid this is to organise the investment as a project, which the interviewed buyers have, and relieve the people involved in the project of their ordinary duties and put their salaries as a cost of the project.

Analysis

What is important to remember is that these persons must be replaced with someone else that can perform their ordinary duties and this cost must also be included or the evaluation will not include all relevant cost elements and thus, be less useful.

How were the Residual Systems Looked Upon?

When performing an evaluation of an investment, it is important to include all aspects of the investment and when making an investment in IT, the residual system should be considered. If the system is very old, there is probably little chance to sell anything off, or to use it as a base for the ERP-system, but this possibility should always be considered.

The four buyers that invested in an ERP-system took the residual system into consideration and they all saw the old system as a sunk cost as it was of no future value for them. One buyer pointed out that they actually saw the investment as a cost reduction for the residual system, as they paid a license fee for the system, and even if it was insignificant, it was still a cost that the buyer was able to eliminate. Both consultants, state that in most cases, the residual systems are so old that they can not be used for anything so they are considered as sunk costs. One supplier also agrees on this, but the other is a little more optimistic and says that in some cases the old systems, or parts of them, have some realisable value and this should be taken into consideration in the evaluation.

The residual systems should naturally be included in the evaluation, these systems will have a part in raising the question to invest in an ERP-system, and should therefore be included in the evaluation. They can be used as a base for evaluating the functionality of the evaluated ERP-systems, but also in terms of the financial impact that they will have if the company decides to invest in an ERP-system. It might be possible to use parts of the old hardware for the new system or the company might be able to sell parts of it.

However, the majority of the respondents agree that the residual system usually has little or no value for the investing company and because of this it should be considered as a sunk cost.

Was the Opportunity Cost of the Investment Considered?

In order for an investing company to get a complete picture of an ERP-system investment, the investments opportunity cost must be considered. This appears to be an area where the buying companies have primarily focused on the underlying reason for the investment, i.e. the two buyers that felt that their ERP-system investment was a necessary investment which did not include any opportunity cost in their evaluation. The buyers that did include the opportunity cost did not only focus on the cost of lost interest rate for the money used for the investment, but they also examined how its strategic capability would be affected and how this would effect future cash flows.

The consultants stated that it was important to include the opportunity cost during the evaluation process, and they emphasised that the capital structure of the investing company should be considered and related to the ERP-system investment.

While the consultants and the buyers had a similar view on the importance of the opportunity cost, the suppliers focused more on the fact that the ERP-system was usually a necessary investment and due to this, the opportunity cost was not a real issue to consider, since there basically was no real alternative to the investment.

However, in general it seems like the opportunity cost of the investment is included in the evaluation and we feel that this is a very important aspect to include in the ERP-system investment evaluation. If this cost element is not included, the evaluation will not reflect the effects that it will have on the investing company.

5.3 Micro Level Analysis

On what Basis were the Investments Evaluated?

When evaluating an investment, the evaluator has a number of models or techniques that can be used in order to see which investment is preferable. There are a number of models that are based on traditional calculations as well as models that have a qualitative approach. Because of the multidimensionality of the ERP-system investment, a number of problems regarding the possibility to carry out a fair evaluation of the investment have led to that a number of hybrid models, that include both qualitative and quantitative elements, have been developed. One important thing to remember when choosing what evaluation model to use is that it should reflect the nature of the investment, but it is also important that the model is well known within the company, so that there is trust in the results that it generates.

When examining what evaluation models the buyers have used and what they have based their evaluation on, it becomes clear that it is mostly tangible costs and benefits that have been used for the evaluation. Three out of the five buyers have used some kind of a ROI method, as this is the most well known evaluation model today; furthermore, this is also the most widely adopted model for evaluating traditional investments. Other tangible aspects of the investment that have been used for evaluation are functionality and reporting time, and one buyer evaluated the direct costs of the investment. However, a more qualitative aspect that has been evaluated by four out of the five buyers is the suppliers and their abilities to provide a high level of service, as well as their reliability. This aspect has been included since the buyers want to have confidence in a partner that they choose to work with for a long period of time, but also due to the vast amount of resources that are to be put into this investment.

Both consultants also state that the buyers often use the ROI as it is a common evaluation model, but the reasons for using this are not only that it is a well established model, but also that it is easy to manipulate, this is an issue that some of the buyers also point out. Many buyers have certain profitability goals set up for their investments, e.g. the

ROI should be 25%, and this can be manipulated by including a positive cash flow in the early part of the calculation since that will increase the ROI. Other evaluation criteria that the consultants have experienced that the buyers use are to evaluate the supplier and also to evaluate the costs connected to the investment. However, one consultant commented upon the possibility to use the Balanced Scorecard as an evaluation model, as it includes more qualitative elements as well as the financial side of the investment, an opinion shared by one of the suppliers. Other evaluation bases used according to the suppliers are the bottom line result of the investment and evaluation of the areas of improvement that the ERP-system investment offers.

Based on this it can be said that most ERP-system investments are evaluated based on costs and cost reduction. The problem with this approach is that the ERP-system is not only designed for lowering costs, but also to strengthen the company by improving its business processes and making it more competitive. Moreover, the investment is also intimately related to the strategies of the company, which suggests that even if the system is not cost efficient, it might have a strategic value for the company. An example of this can be that the company is interested in launching an e-business project and in this situation, the ERP-system can be seen as an enabler as it provides the opportunity to develop this service.

An ERP-system is quite expensive to purchase and implement and the investment in a system often leads to alterations of the organisation and processes of the company which makes it very difficult to relate the effects that the company will experience to the system. Due to the infrastructural and multidimensional nature of the ERP-system investment, it is very difficult to identify and evaluate the effects that the investment will have on the company. However, because of this very problem, it is vital that the investing company conducts a thorough evaluation of the investment in order to identify the costs and benefits that the company will experience. Moreover, it is also very

Analysis

important that the evaluation models used reflect the purpose of the investment, or there is no point in conducting the evaluation at all. This should not be used as an excuse to perform incorrect evaluations but rather, it is important to catch all aspects of the ERP-system investment and by using both qualitative and quantitative models or a hybrid model, this can be achieved.

Have any Additional Costs and Benefits of the ERP-system Investment Appeared Compared to what was Planned?

The idea of evaluation is to assess the value of an investment, but when the evaluation is performed in a non-satisfactory manner, then the end result of the investment will not be similar to the proposed result. As stated by the respondents, the evaluation of an ERP-system investment is seldom complete or takes into consideration all aspects of the investment and thus, the actual results of the investment are not in line with the expected results according to two of the buyers, one consultant and one supplier, but the other supplier said that no additional costs or benefits have been observed.

The fact is that most, if not all, ERP-system investment projects go over budget and it has happened that companies have gone bankrupt as a result of their ERP-system investment. However, there are also additional benefits realised in connection to an ERP-system investment. The problem is that if the evaluation does not provide a good picture of the result of the investment, then what is the purpose of evaluation? Then it will just be a process that uses up scarce resources that could be used for the purchase of the ERP-system or in another project.

This indicates the importance of conducting an evaluation that provides management with a fair indication of how the investment will affect the company, not only financially but also in regard to the organisation of the company and its processes. The fact that an ERP-system can be tied to the strategies of the company proves that an evaluation of the costs related to the investment will not provide an adequate picture of the ERP-systems potential value. It is a difficult

task to create a holistic picture of the effects of the ERP-system investment, which shows most of the costs and benefits, but even if it is time-consuming and possibly expensive, it is still better to perform a satisfactory evaluation since it helps a company to avoid investments that the company is not able to carry out. However, one problem with ERP-system investments is that the investing company often considers them a necessary investment and hence the company does not have any real option not to invest. Nevertheless, even if this is the case it is still important that the company evaluates the available alternatives and compares these in order to invest in a system that is in line with the company's needs.

5.4 A Comparison between the Empirical Findings and the Theoretical Framework

Apart from analysing the empirical findings, a comparison between these findings and the theoretical framework will be carried out. The reason for this is that we want to draw attention to any discrepancies between the empirical findings and the recommendations given in the literature.

In general it can be said that most of the areas covered in the empirical study correspond well with what is recommended in the literature used in the theoretical framework. However, there are some areas that depart from these recommendations, and we have decided to focus on discussing these. These areas are summarised in the figure 5.1.

Does not Correspond with the Literature
Macro Level Questions:
Was the Investment Evaluated in Regard to the Company's Strategies?
Were Alternative Solutions to an ERP-system Considered?

Meso Level Questions:
To what Extent was the ERP-system Implemented in the Organisation?
How Were the Costs and Benefits Related to the ERP-system Investment?
In which Areas were Tangible and Intangible Costs and Benefits Identified?

(Figure 5.1, Summary of differences between literature and empirical findings. Source: Our own)

The first area is if the ERP-system investment has been evaluated in regard to the company's strategies. While the literature puts quite a lot of emphasis on the importance of conducting a formal evaluation of how the ERP-system investment will affect the company's strategies, few companies do this in reality. However, even if the empirical evidence indicates that it is uncommon to make this comparison, it is possible that the investing company uses an informal evaluation process.

The second area focuses on if the investing companies consider alternative solutions to the ERP-system. This area is not covered in the literature and it appears that little attention has been paid to this particular area. However, in practice, two of the buyers did seriously consider alternative system solutions and compared these to the ERP-system. Furthermore, both the consultants also indicated that it is becoming more common for investing companies to consider alternatives to the ERP-system. This issue is interesting since it indicates that the buying companies are more conscious of their options and are prepared to make comparisons between different system solutions.

The third area is relate to what extent the ERP-system is implemented in the organisation. While the literature has focused on full-scale implementation, i.e. across the whole company, the empirical findings suggest that the investing companies primarily focus on the system

functionality and this is related to the company's processes. This development is probably due to that most ERP-system suppliers can deliver their product based on a number of modules. Although this is not a very new concept it appears that literature has disregarded it, while the investing companies have embraced this opportunity to minimise the risks and the problems related to doing a full-scale ERP-system implementation.

The fourth area to discuss is how the costs and benefits of the ERP-system investment were identified. In this case, it appears that the literature has developed a large number of normative methods that can be used for identifying these costs and benefits. The literature focuses on structured and holistic methods, whereas the empirical findings suggest that the investing companies are fairly unstructured in their approach and tend to use a variety of pre-studies to identify these areas.

Related to the identification of the costs and benefits areas is how these should be measured. In this area, the literature presents a large number of models that are designed to identify tangible and intangible costs and benefits, as well as suggesting how these should be measured. Although the literature does not present an all-inclusive list for costs and benefits related to the ERP-system investment, it does suggest many different metrics that can be used for measuring these. On the other hand, although the empirical study identified numerous cost and benefit areas, it did not find many metrics that were used to measure and evaluate these.

5.5 Summary

This chapter has focused on analysing the empirical findings. This analysis was organised in the same fashion as the empirical findings were and the results were therefore analysed and presented on a macro, meso and micro level.

Analysis

Based on this analysis a comparison between the theoretical framework and the empirical findings was conducted. This comparison focused on the areas where we had identified discrepancies between the empirical findings and the theory.

6 An ERP-system Investment Evaluation Method

Based on the findings in the theoretical framework, the empirical study and the analysis, we can conclude that although there are many different models available for evaluating an ERP-system investment, few of them are holistic in nature or contain too many assumptions making them unreliable for capturing the multidimensionality of the ERP-system investment. From the empirical study it has become clear that investing companies seldom perform an evaluation designed to capture the full effects of the ERP-system investment. In order to address this problem, we propose a method that is based on evaluating the investment in three different steps, these steps correspond to the three levels of evaluation identified in the theoretical framework as well as the levels used to present the empirical findings. It is important to keep in mind that these three levels are not mutually exclusive, but have to be used as three steps in an evaluation process. We have chosen to call our approach a method rather than a model since it includes some of the models presented in 3.8.

6.1 Elements Included when Developing the Method

Before moving on to outline our suggested method for evaluating the costs and benefits related to an ERP-system investment we will describe which sources of information we have utilised when designing the method. During the collection of the empirical data, we became aware that the respondents had a very strong focus on measuring cost reductions, and hence used few other types of metrics for evaluating the ERP-system investment. This pattern also became evident in regard to how the tangible costs of the investment were perceived, i.e. the actual costs were the main cost element considered. The intangible costs and benefits were rarely measured but rather identified and discussed on a more abstract level.

Due to this it was concluded that we would use the empirical findings for identifying which costs and benefits areas to include in the method, whereas the metrics for quantifying these would be derived from the theoretical framework. Based on this we decided to develop our method by using a combination of empirical and theoretical material. The theoretical material used in the method is based on ideas, methods and metrics presented by numerous independent authors, such as Banks et al. (1999), Farbey et al. (1999), Marvin et al. (1999), Remenyi et al. (1997), Towell (1999), Wehrs (1999), Wen & Sylla (1999) and Willcocks (1996). It could therefore be said that we use a cross-section of what is currently considered, in the literature, to be the most useful metrics for measuring the different aspects of costs and benefits related to an ERP-system investment in our method.

Due to the time constraint we have been forced to restrict the number of cost and benefit areas included in the method to the ones that the respondents have tended to primarily focus on, i.e. the areas that figured most frequently in the empirical findings. It is therefore important to point out that the method does not include all possible costs and benefits areas, but should be perceived as a temporary method that companies can use until a new and more holistic method can be developed.

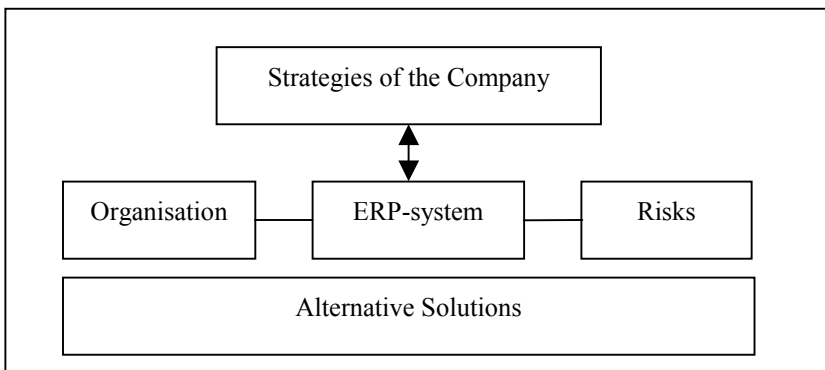
6.2 Macro Analysis

All the companies that participated in this study perceived the ERP-system investment as a strategic investment. Therefore, we suggest that this should be the first level of evaluation. At this level the purpose of the investment should be represented in general terms; it is also important that the investing company manage to accomplish a high level of conceptual clarity in order for all people involved to understand what exactly is being proposed, how it is envisaged that it will work and what the expected costs and benefits will be.

Due to the strategic nature of the ERP-system investment, it is important that the purpose of the investment is related to the strategic goals of the company, by doing this the macro analysis might serve as

a filter that prevents ideas that are not in line with the company's strategies from being pursued. Furthermore, based on the empirical findings we suggest that the investing company also should perform a risk analysis at this level. The risk analysis will also serve as a filter since it will identify risky projects that are not suitable for the investing company. It is also important that the investing company considers the effects that the ERP-system investment will have on its organisation and culture.

It is important to remember that at this level of evaluation there is no quantification of costs and benefits as macro evaluation is based on a general discussion concerning the purpose of the investment. Furthermore, the macro level analysis focuses on how well the investment is in line with the strategies of the company, and how it will affect the organisation and its culture as well as potential risks related to the investment. Moreover, what is important to remember is that this level of evaluation should serve as a guideline for identifying the investment alternatives that are of interest for the company, and it does not incorporate the identification and quantification of the costs and benefits related to the investment. A macro level analysis is described in figure 6.1.



(Figure 6.1, Example of a Macro Level Analysis. Source: Our own)

6.3 Meso Analysis

After conducting a macro analysis, the investing company is able to see if the investment is in line with the company's strategies and this is then followed by the second step of our proposed method, the meso analysis. In this part of the evaluation, the company should try to identify the costs and benefits related to the investment and quantify these.

The aim of the quantification process is not to put a monetary value on all costs and benefits, but rather to find a measure suitable for the effects, i.e. it depends on the nature of the cost or benefit if a binary, qualitative, numeric, financial or other type of scale should be used. Moreover, it is also essential to remember that all costs and benefits should be included, both the tangible and the intangible if the evaluation is to present a true and fair view of the effects of the investment. When working with the identification of the costs and benefits related to the ERP-system investment, the investing company should also consider the measurability of these costs and benefits. If it is not possible to quantify a cost or benefit, it should not be included in the evaluation, as it does not improve the evaluation but rather makes it less useful.

Having discussed the general issues of the meso level analysis, it is now time to move on to the actual cost and benefit areas identified in the empirical study and the metrics used for quantifying and measuring these. The method also includes if the cost and benefit areas could be evaluated on an *ex-ante* and *ex-post* basis. However, it should be pointed out that the cost and benefit areas included and their specific metrics suggested are not the only cost and benefit areas related to ERP-system investments. But there might be other cost and benefits areas related to a specific ERP-system investment and thus, it is important that the investing company identifies their specific investment evaluation.

6.3.1 Intangible Costs

Cost	Type of Metric	Input	Specific Metric	Ex-ante, Ex-post Evaluation
Opportunity Cost	Financial	Cost of the Investment	Lost Received Interest Rate on Cost of Investment	Both
Changes in Working Environment	Qualitative	Employee Satisfaction Surveys	Qualitative data to be analysed using interpretative techniques	Both

The main problem with the intangible costs is that it can be difficult to quantify them, especially since it is hard to identify causal relationships for these costs and how they affect the profitability of the investment. Based on the empirical findings we have included the two most frequently identified intangible costs related to an ERP-system investment.

6.3.2 Tangible Costs

Cost	Type of Metric	Input	Specific Metric	Ex-ante, Ex-post Evaluation
Hard- & Software	Financial	Offer by Supplier	Actual Cost	Both
Consultant Fees	Financial	Offer by Consultant	Actual Cost	Both

An ERP-system Evaluatin Method

Cost	Type of Metric	Input	Specific Metric	Ex-ante, Ex-post Evaluation
Licenses	Financial	Offer by Supplier	Actual Cost	Both
Own Time	Financial	Estimation of Hours to put in the Project	Cost for Salaries	Both
Security Costs	Financial	Budget & Income Statement	Increased % of Total IT budget/spending	Both
Education/ Training	Financial	Estimation of Hours Needed for Education/ Training	Cost for Education and Training programme	Both

The tangible costs of the ERP-system investment are the ones that can be identified as having a direct impact on the profitability of the investment. Furthermore, it is usually quite easy to quantify as well as assign financial values to them. Based on the empirical findings all the respondents appears to have identified the importance of including the indirect tangible costs of the investment, such as cost for own time and education and training. By doing this the investing company will get a clearer picture of the investments cost structure.

6.3.3 Intangible Benefits

Benefit	Type of Metric	Input	Specific Metric	<i>Ex-ante,</i> <i>Ex-post</i> Evaluation
Strategic Enabler	Binary or Qualitative	System Capacity	Qualitative and interpretative evaluation linking system capacity to strategic goals	Both
Flexibility	Qualitative		Qualitative evaluation leading to a value that can be compared over a period of time	Both
Uniformity	Numeric	Level of System Uniformity throughout the Company	% of Uniformity for a Certain System Functionality	Both
<i>Customer Relations;</i>				
Better Customer Information	Qualitative	Sales Force Surveys	Internal Benchmarking based on Sales Force perception of Quality of Customer Information	Both

An ERP-system Evaluatin Method

Benefit	Type of Metric	Input	Specific Metric	<i>Ex-ante,</i> <i>Ex-post</i> Evaluation
<i>Customer Relations;</i>				
More Accurate Deliveries	Numeric	Delivery Statistics	Reduced % of Incorrect Deliveries (On Time, Right Products etc.)	Both
Quality of Services	Qualitative	Customer Survey	Internal Benchmarking based on Customer Surveys	Both

An ERP-system investment is traditionally evaluated with a focus on reducing costs, but there are also a number of intangible benefits related to an ERP-system investment. Due to the ERP-systems multidimensional nature, it will affect many aspects of the investing company. Although it is hard to assign any financial values to these intangible benefits, at least without stretching assumptions beyond an acceptable level, it is still important to quantify them. The most common metrics used for these benefits are binary, numeric or qualitative in nature and by using these it is possible to identify and evaluate how they will impact on the investing company.

6.3.4 Tangible Benefits

Benefit	Type of Metric	Input	Specific Metric	<i>Ex-ante,</i> <i>Ex-post</i> Evaluation
Better Information	Qualitative	System Outputs	Perceived Increase in Information Quality	Both
<i>Sales & Distribution;</i>				
Improved Admin. Processes (cost reducing)	Financial	Time Spent on a Specific Task	Reduced Cost for Performing a Specific Task	Both
Improved Admin. Processes (revenue increasing)	Financial	Time Spent on a Specific Task	Increase in Sales	Both
Effective Stock-keeping	Financial	Financial Reports	Increase in Stock Turnover, Reduced Number of days Stock in Inventory	Both

An ERP-system Evaluatin Method

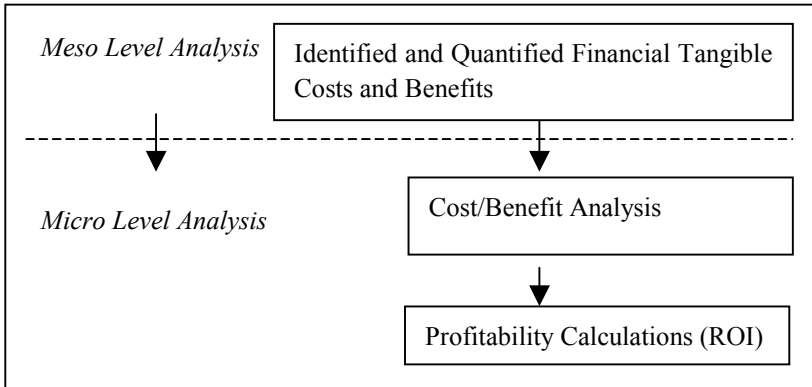
Benefit	Type of Metric	Input	Specific Metric	<i>Ex-ante, Ex-post Evaluation</i>
<i>Finance & Control;</i>				
Reduction of Time Spent	Financial	Time Spent on a Specific Task	Reduced Cost for Performing a Specific Task	Both
<i>IT related Benefits;</i>				
Lower System Maintenance	Financial	Financial Reports	Reduced Cost for Maintenance as a Percentage of IT budget	Both
<i>Warehousing;</i>				
Decreased Fixed Assets	Financial	Balance Sheet	Less Capital Tied up in Assets	Both
<i>Logistics;</i>				
Co-ordinated Purchases	Numeric/ Financial	Invoices	Reduced Number of Purchases Made, Reduced Cost per Purchase	Both
Buying Bulk	Financial	Invoices	Discounts Received	Both

Based on the empirical study it was identified that the majority of the benefit areas related to the ERP-system investment are of a tangible nature. These tangible benefits have a direct impact on the investing company's profitability and hence it is possible to evaluate them based on a financial or numeric level. However, some of the tangible benefits can have a direct impact on the profitability of the company although this can be difficult to measure using financial based metrics, and in this case the company should explore the possibilities to using alternative metrics.

6.4 Micro Analysis

The micro analysis takes the issues identified in the meso analysis and attempts to quantify them, using the metrics assigned to each cost and benefit. The main aim of this calculation is not to present an accurate and definite value, but rather to get an indication of the general direction of what type of results the ERP-system investment might generate. Based on the three levels of analysis it is possible for the investing company to compare different ERP-system investment alternatives.

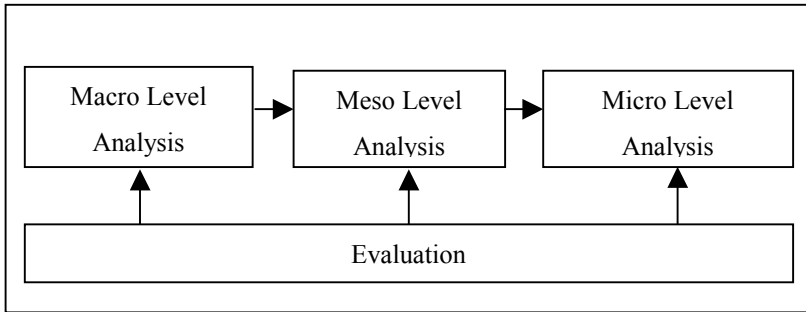
At the micro level it is common to use different types of investment performance indicators, and this has been done by most of the respondents in the empirical study. The most common performance indicator used is return on investment (ROI), based on a Cost/Benefit (C/B) analysis. In order to be able to do the ROI calculation the investing company has to make estimations regarding costs and benefits, and based on these estimations it is also possible for the company to calculate the ROI as well as the payback time of the investment. Although many of the respondents are aware of the limitations of the ROI, they still state that this is an important aspect of the evaluation since most companies require a certain level of return on their investment. Furthermore, many investing companies have doubts regarding the newer evaluation models and hence prefer to evaluate the investment based on a performance indicator that they recognise. A micro level analysis is described in figure 6.2.



(Figure 6.2, Example of a Micro Level Analysis. Source: Our Own)

6.5 Summary of the Methods Main Features

Our method is based on capturing the multidimensional nature of an ERP-system investment. In order to do this, we suggest that three different levels of analysis are used. The macro level analysis relates the investment to the company's strategies and is thus predominately qualitative in nature. The meso level analysis expands and operationalises the perceived costs and benefits of the ERP-system investment. At this level the cost and benefit areas are identified, quantified and possible metrics are suggested. The cost and benefit areas are divided into intangible and tangible costs and benefits and this division is primarily based on how these areas will affect the profitability of the investing company. Finally, the micro level analysis is carried out and it is now that the actual calculations are done. These calculations usually result in some sort of performance indicator being calculated, e.g. ROI. However, having gone through the three levels of analysis, the investing company has to combine the different levels of results and then analyse these in order to identify how the ERP-system investment will affect the company. A description of this evaluation method is presented in figure 6.3.



(Figure 6.3, Description of the Evaluation Method. Source: Our own)

6.6 The Method's Strengths and Weaknesses

Having outlined our proposed method for evaluating an ERP-system investment we will now discuss its strengths and weaknesses. The method's primary strength lies in that it examines the ERP-system investment on three levels, i.e. macro, meso and micro. By taking this approach, it is possible to capture the multidimensionality of the ERP-system investment. Furthermore, this also leads to the method using a number of different types of metrics, including the qualitative, financial, strategic and organisational aspects of the ERP-system investment making the evaluation multidimensional in nature. However, it should be pointed out that each of these three levels of analysis are necessary, and it is not until they are connected that they can be used as a satisfactory base for evaluating an ERP-system investment.

The second strength of the method is that it focuses on quantifying the costs and benefits of the ERP-system investment, based on the nature of the cost or benefit leading to that non-financial benefits are quantified using non-financial metrics. This leads to the method not forcing the investing company to try to construct financial values for all costs and benefits. Moreover, this can result in the investing

company trusting the outcome generated by the method since it has not been forced to stretch its assumptions regarding certain costs and benefits beyond an acceptable level.

Another strength with this method is that it is based on a combination of empirical findings and theoretical framework. The costs and benefits areas identified by the respondents of the study have been used for identifying the relevant areas to measure. However, since the empirical study generated few results reading specific metrics used for measuring these areas it has been combined with a cross-section of what the literature recommends to use as metrics for the different costs and benefits areas related to an ERP-system investment.

The method is fairly easy to understand and has an inherent logic to it, and this makes it easy for the investing company to start using it. Furthermore, since the method includes traditional performance indicators like the ROI, it makes it easier for the investing company to accept the generated results. The method is also easy to expand, i.e. including more costs and benefits areas, as well as adjusting for a specific company's needs. We can not see that the results generated by the method will be less reliable if the method is expanded or adjusted making it a fairly flexible method. Finally, the method can be used to carry out ERP-system investment evaluation on both an *ex-ante* and an *ex-post* basis.

Although the method has a number of strengths, it also has some weaknesses. The methods main weakness is that the results generated by the method have to be analysed by the investing company, i.e. the method does not provide a simple and final value. The investing company could experience this as a problem since they might find it complicated to compare results generated at three different levels using different types of metrics.

A second weakness of the method is that it could be fairly time consuming. Although the macro analysis is quite easy and quick to conduct, the meso analysis can be time consuming, especially when the company tries to quantify the different costs and benefits related to the ERP-system investment.

Thirdly, the method developed in this chapter is temporary in nature, since it does not include all possible costs and benefits areas that can be related to the ERP-system investment. This means that the method might have to be adjusted for each ERP-system investment. Moreover, since the method is partly based on the empirical findings of this study, the method will not be generic, i.e. it might have to be adjusted to be able to be used in different industries. This also leads to that the method can be perceived as time consuming.

The final weakness of the method is that it includes a large number of subjective elements, especially in regard to identifying and measuring the costs and benefits areas. However, due to the nature of the ERP-system investment it is hard to be objective when it comes to quantifying and evaluating the different costs and benefits areas.

Based on the above discussion of the method's strengths and weaknesses it can be concluded that although the method is flawed in regard to that it being temporary in nature, time consuming, complex and generic, it still contains some attractive features. The main strength of the method is that it supports the investing company in identifying and quantifying the costs and benefits of its ERP-system investment. Furthermore, due to the method being based on three different levels of analysis, it captures the multidimensionality of the ERP-system investment. Thus, it can be said that this method could be a useful tool for evaluating ERP-system investments.

6.7 Summary

This chapter has presented a method for evaluating ERP-system investments. The method was developed using a combination of the empirical findings of the study and the theoretical framework. The method is primarily designed to capture the multidimensionality of the ERP-system investment and is based on evaluating the investment on three levels, i.e. the macro, the meso and the micro. The costs and benefits areas included in the method are based on empirical findings, whereas the metrics are derived from theoretical framework. The strengths and weaknesses of the method were discussed and it was concluded that although the method is flawed in some areas it still presents a viable alternative for evaluating ERP-system investments.

7 Conclusions and Reflections

In this chapter, we will present our conclusions drawn from the analysis of the theoretical framework and the empirical study and comment upon these. We will also present suggestions for future research based on this study.

Traditionally there has been a focus on the profitability of a particular investment when it is being evaluated. There have been debates on the usefulness of ERP-systems and how an investment in an ERP-system does not lead to an increase in profitability and that the need to invest in ERP-systems has been questioned. After studying the theoretical framework related to ERP-system investments, we are certain of the fact that an investment in an ERP-system can not be evaluated as an ‘ordinary’ investment since the desired effects of an ERP-system investment do not correspond to the usual investment objectives. We discovered that an ERP-system investment will affect the investing company in many different ways, and this is identified in the literature. Due to the multidimensional nature of the ERP-system investment, it generates a wide base of costs and benefits related to their specific effect, making it impossible for us to provide a complete guide, at least in this thesis, to all costs and benefits related to the ERP-system investment and how these should be measured. Therefore, in order for us to answer our research questions, we have chosen to work with identifying the general cost and benefits areas related to an ERP-system investment, as the specific costs and benefits are different for each investing company.

When investing in an ERP-system, the investing company not only invests in an infrastructural technical solution, but the ERP-system will also have an effect on the company’s organisation, structure, culture and strategies. This means that the investing company not only should evaluate the ERP-system, but also its organisation and its processes in order to see what can be internally transformed so that the investment

Conclusions and Reflections

will have a positive result. Furthermore, due to the multidimensional nature of the ERP-system the investment will affect the company in several aspects, which makes it difficult to evaluate the investment in a holistic manner.

The empirical study shows that all investing companies are aware of the multidimensionality of the ERP-system, and that it will affect the investing company's organisation, culture and strategy. Moreover, the investing companies had identified a number of costs and benefits that reflected these effects, but the evaluation was often limited to the financial impact that the investment would have.

Based on these findings we were able to answer the first research question, what cost and benefit characteristics are related to an ERP-system investment. An interesting issue to stress is that even if the literature often presents a large number of possible costs and benefits areas, as well as numerous models for capturing these. However, these lists and models can not be considered exhaustive. Nevertheless, considering the limited resources that the investing companies are able to use for evaluating an ERP-system investment, the companies in this study had identified costs and benefits connected to the ERP-system investment that were not identified in the literature. By focusing on aspects such as the functionality of the ERP-system and the suppliers, the investing companies were able to improve the evaluation compared to the evaluation suggested by the literature.

We find it very interesting that the investing companies appear to have a strong focus on functionality, as this topic is not emphasised in the literature. This can be due to most suppliers offering their product as modules and hence, they do not force the investing company to purchase the complete system but rather present them with possibility to buy the functions that they really need. Even if this possibility is not a new phenomenon, since the suppliers have offered their products on a module basis for a couple of years, we were surprised to find out that this is an area that has not been highlighted in the literature. This implies that the investing companies are performing an evaluation of

the investment at a higher level of quality compared to the evaluation models presented in the literature. Furthermore, the investing companies are evaluating aspects of the ERP-system investment that are not covered in the literature. Related to this issue is that the development of ERP-systems has led to an expansion of the systems, and new types of modules have been added to the original ERP-system. One of these newer modules is related to e-business, and it is discovered in the empirical study that this function is one reason why many companies choose to invest in an ERP-system. Although there is a lot of literature concerning the development of e-business, we found that there has been little attention paid to the relationship between e-business and ERP-system investments.

Another interesting issue to highlight from the empirical study is that the evaluation used by the investing companies preceding an ERP-system investment appears to have numerous flaws. Many of the respondents stated that identifying costs and benefits related to the ERP-system investment after the system has been implemented is not an uncommon scenario. This indicates that the evaluation of the ERP-system investment is not complete and thus, needs to be improved in order for the investing company to be able to assess a true and fair view of the value of the ERP-system. However, we felt that the investing companies probably would identify more additional costs and benefits related to their ERP-system investment if they performed some sort of *ex-post* evaluation.

To answer our second research question, i.e. what should be included in an evaluation model used for ERP-system investment evaluation, we combined the empirical findings with the theoretical framework. Using the cost and benefit areas identified in the empirical study, we combined these with a cross-section of what is currently considered the most useful metrics for measuring the different aspects of costs and benefits related to an ERP-system investment. We decided to do this division between empirical findings and the theoretical framework since the respondents appeared to lack the specific metrics to use for

Conclusions and Reflections

quantifying and measuring the costs and benefits areas identified. The problem of quantifying the strategic consequences, identifying where they occurred and how to evaluate these led to that the ERP-system investment predominately was evaluated on the tangible costs of the investment, whereas the evaluation of the effects derived from the investment was of a more intangible nature.

To evaluate an ERP-system investment is a very difficult task as the system is of an infrastructural and multidimensional nature and affects the investing company in such extensive ways. The problem is often that there is a lack of quantification being carried out, especially since the companies are able to identify the cost and benefit areas but are experiencing problems quantifying these. Furthermore, today most investment evaluation is based on the profitability of the investment and these models fail to capture the intangible aspects of the ERP-system investment. However, we believe that by evaluating an ERP-system investment on three levels, i.e. macro, meso and micro, the investing company will be able to achieve a more complete image of the effects that the investment will have. Moreover, it is important that the investing company works with identifying the costs and benefits related to their specific ERP-system investment, as the cost and benefit areas provided in this study should be used as guidelines. The reason for this is that the costs and benefits that a company will experience related to its ERP-system investment are not the same costs and benefits that another investing company might experience. Furthermore, the method that we have proposed are temporary in nature, i.e. it should be complement with additional costs and benefits areas as well as with more metrics in order to be generic in nature.

7.1 Suggestions for Future Research

Although the research about the costs and benefits of IT-system investment in general is quite extensive, surprisingly few theoretical and empirical studies have focused on the ERP-system investments effects on the investing company. However, this vast area needs to be more fully explored, and more empirical studies ought to be conducted. Based on the findings in our empirical study, it appears that the companies that invest in ERP-systems lack usable metrics to measure

the costs and benefits of the investment, therefore we suggest that it could be of great interest both to the investing companies and academics to try to establish a number of metrics that companies really could use. Secondly, we believe that it would be interesting to explore how the companies have changed their perception of the ERP-system over a period of time and why this is the case, e.g. have they moved from perceiving them as cost reducers to revenue generators. Thirdly, we think that it could be interesting to explore, in depth, how a certain process within a company is affected and improved by an ERP-system investment. This would also lead to the possibility of identifying the costs and benefits related to a specific process. Finally, and on a rather personal note, we think that it could be interesting to continue on our path and by conducting more empirical studies develop our method for evaluating the costs and benefits related to an ERP-system investment.

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Appendix

Interview Guide

Background/ General Questions

What Enterprise Resources Planning (ERP) System do you employ?

When did you decide to invest in an ERP?

Who was involved in taking this decision, which organisational levels was involved?

Did you consider alternative solutions?

Macro

Why did your company invest in an ERP?

Did you feel that you might lose some of the company's strategic potential if you did not invest in an ERP?

Did you consider the effects that the ERP might have on the organisation and its culture?

Did you consider any risks associated with investing in an ERP?

Did you consider the potential costs of the investment?

Did you consider the possibility that the logic of the system may conflict with the logic of the business?

Does the system fit the organisation or the other way around?

Meso

To what extent did you consider the need to extend the system in the organisation?

Which applications were focused upon? Why? And how did you reach this conclusion?

Were these applications related to the company's and/or the investment's critical success factors?

What steps were taken to identify costs and benefits?

Which applications were seen as costs and benefits?

Did the company specify any particular functions that the system was required to perform?

Did you consider organisational and/or departmental needs?

Was the opportunity cost of the investment considered?

Did you include the cost of your residual systems (including operational costs during a transition period) when comparing the alternatives?

Did you view the disposal of the old system as a sunk cost or not?

Micro

How were the investment alternatives compared?

Did you use any specific investment evaluation models?

What measures or metrics did you use?

How did you quantify the measurements used in the comparison?

Did you use different models for justification and evaluation of the investment?

Did you find it hard to identify certain qualitative aspects of the investment, and if yes which type of aspects?

Were future operational and maintenance costs included in the evaluation model?

How did you estimate the lifetime of the new/old system?

Did you consider that costs and benefits might occur at different points of time during the investment project?

Have you identified any additional costs and benefits that you did not originally measure?

Implementation

At what stage of the implementation process is your company?

How long do you estimate the implementation time to be?

How is the investment/implementation managed?

What sort of problems has occurred during the implementation process?

Have the company experienced similar problem in other lengthy projects?

What has the company learnt during the project?