ERP System Effects

- A Comparison of Theory and Practice

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ABSTRACT

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Titel: ERP System Effects – A Comparison of Theory and Practice

Background: Information Technology (IT) is becoming increasingly important for companies and enormous amounts of money is spent on implementing Enterprise Resource Planning Systems (ERP), i.e. a software which integrates all functions and processes within a company. Therefore, the need to evaluate these investments is also increasing. Previous research has primarily focused on evaluating IT and ERP investments in financial terms. Therefore, there is a need for studies dealing with non-financial issues.

Research Question: To what extent do ERP Systems in practice achieve the effects that are most frequently related to such systems in theory?

Objective: The objective of the study is to explore the congruence between theory and practice concerning effects of an ERP System implementation.

Delimitations:
We have chosen only to examine companies who are using SAP R/3. Furthermore, we have only examined the effects of R/3 in the Swedish activities of the companies, even though most of them operate worldwide. The number of companies included in the study is also delimited to seven companies, due to the limited scope of a master thesis.

Methodology: Literature dealing with ERP effects have been summarized and six categories of effects and 25 aspects have been identified. Moreover, respondents at seven companies that have implemented at least six of twelve SAP R/3 modules and have experienced effects of this ERP investment have been interviewed regarding these effects stated in theory. Finally, theory and practice have been compared.

Results and Conclusions: All of the identified categories from the ERP literature exist within the responding companies, but only to a certain extent. Within each category, the importance of each aspect also varies. Some aspects are not planned at all and some are planned in almost all of the seven companies. Furthermore, some companies experienced bonus effects that they were not expecting.

Suggestions for Further Research: We suggest a case study of one or two companies or broaden the study, investigating a large number of companies, so that statistical generalization can be made.

1. Introduction

This is a master thesis in Business Administration, within Management Accounting, at Göteborg University School of Economics and Commercial Law. Tutor is Christian Ax. The thesis deals with issues within the subjects Enterprise Resource Planning and Management Accounting.

The first chapter provides an introduction to the thesis. First, the background to the research problem is presented, followed by a discussion of the research issue, in which the relevance of the thesis is discussed. Then, the research question and the objectives of the study are presented. The introduction is concluded with a presentation of the scope and delimitations of the thesis as well as a disposition of the remaining chapters.

1.1 Background

> Many studies show that nine out of ten IT projects fail. If we instead focus on costs, it is not impossible that 80 per cent of all IT investments are wasted money . . . In other words, 20 per cent benefits and 80 per cent waste.[1]

In this manner, the debater Harald Eide comments the discussion of the concept of IT benefits presented in a series of articles in Computer Sweden (February 2003).

Nowadays, the function of information technology is becoming more and more important for companies, permeating everything within an organisation such as flows, processes, information, strategic decisions and day-to-day work. Therefore, it becomes increasingly important to measure the outcome of used resources as well as the effects of the IT investment. Thereby, the concept of IT benefits has become a central notion for enterprises as they realise this.[2]

An Enterprise Resource Planning System (ERP System) has the potential to integrate all processes and functions of a company, and to present a comprehensive picture of the entire organisation. ERP promises "seamless integration of all the information flowing through a company"[3] by using a single database that enables the various departments within an organisation to effectively share information and communicate with each other.[4] The number of companies adopting ERP Systems is increasing rapidly[5]. The sales of the largest vendor, Germany's SAP, have increased from less than $500 million in 1992 to approximately $7,4 billion in 2002[6], making it the fastest-growing software

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[1] Eide, 2003-02-28, (translated from Swedish)
[2] Wallström, 2003-02-24
[3] Davenport, 1998, p. 121
[4] Hedman & Kalling, 2002
[5] Granlund & Malmi, 2002
[6] SAP Annual Report, 2002

company in the world. SAP's competitors, including such companies as Baan, Oracle, and People Soft, have also seen rapid growth in demand for their packages. An enormous amount of money is spent on implementing these systems. This is an additional reason for evaluating the large investments in order to ensure that they are profitable.[7]

However, the need of evaluating IT investments is nothing new. As Dehning and Richardson (2002) state: "Understanding the return on investments in information technology (IT) is the focus of a large and growing body of research."[8] Still, earlier researchers have primarily focused on evaluating the effects of IT investments in financial measures, such as impact on shareholder return and profitability ratios (ROA, ROE etc.)[9]. There are a few studies dealing with the effects of ERP Systems in the field of management accounting. However, these studies have primarily focused on ERP in relation to management accounting methods and ERP in relation to the role of the management accountant.[10]

1.2 Research issue

There is a large body of literature dealing with the subject of ERP. A large amount of this literature advocates these systems and benefits and anecdotal success stories are frequently presented. What is interesting is that there is a lack of systematic research of the actual effects of ERP, and therefore, it is not clear whether or not these benefits are achieved in practice. Thus, we find it important to compare theory and practice in order to determine whether or not the literature reflects a correct picture of ERP System effects. Granlund and Malmi (2002) state that: "Still, we know very little about the practical consequences these new systems have. . ."[11] and explains this shortage of research with the fact that only a few firms have experienced ERP Systems for a longer time period. However, since many companies implemented ERP Systems during the 1990´s, effects ought to be visible by now. Therefore, we consider it very interesting to identify the effects that are most frequently pointed out in theory, and investigate whether or not these effects are realized in practice, since this is a new and unexplored research area.

The above discussion results in the research question stated below.

1.3 Research question

To what extent do ERP Systems in practice achieve the effects that are most frequently related to such systems in theory?

1.4 Objective of the Study

In order to answer the research question, the following objective of the study is formulated: *To explore the congruence between theory and practice concerning effects of an ERP System implementation.*

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[7] Davenport, 1998
[8] Dehning & Richardson, 2002, p. 7
[9] See for example: Floyd & Wooldridge, 1990, Kettinger et al, 1994, Barua et al 1995 and Weill, 1992
[10] See for example: Granlund & Malmi, 2002, Thranegaard, 2000
[11] Granlund & Malmi, 2002, p. 299

To be able to achieve the stated objective, our aim is to:
- Identify the effects most frequently related to ERP Systems in theory.
- Evaluate to what extent companies succeed to realize planned effects in practice.
- Compare effects most frequently pointed out in theory and practice.

1.5 Scope and Delimitations

To delimit the study, we have chosen only to examine companies that are using SAP R/3[12]. Expanding the scope of the thesis and including more ERP vendors would probably result in more comprehensive findings. However, we do not find this relevant in order to be able to provide an answer to the research question. Moreover, we consider R/3 to be the most relevant choice of system due to the fact that R/3 is the most commonly used system on the market[13]. Furthermore, we have only examined the effects of R/3 in the Swedish activities of the companies, even though most of them operate worldwide. The number of companies is also delimited due to the limited scope of a master thesis.

1.6 The Disposition of the Thesis

Chapter 2 deals with how the study was conducted. The chapter includes discussions of research approach, data collection, sources of data and sample. Moreover, an evaluation is made of possible sources of errors as well as of the validity and reliability of the thesis. Finally, a discussion is made of analysis methodology.

In *chapter 3*, the concept of ERP is introduced. First, there is a presentation of a number of different characteristics we find relevant in order to enhance the reader's understanding of ERP and ERP implementations. Thereafter, a short description of the history and future of ERP is provided, followed by a short presentation of reasons for why companies decide to implement an ERP System and why not. Finally, a number of possible ways of evaluating IT investments are discussed.

In *chapter 4,* the theory that forms the basis of our research question is presented. Six different categories of aspects are identified and described. The chapter is terminated with a summary of the effects most frequently related to an ERP System described in the literature.

In *chapter 5,* the companies included in the thesis and their R/3 investments are presented. The chapter begins with short presentations of the companies and respondents included in the study as well as basic facts of their R/3 implementations. The second half of the chapter deals with the companies work with their ERP Systems. This is presented as a compilation of the answers, in order to provide an overview of each question. The purpose of this section is to offer more background information about the ERP Systems of the responding companies.

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[12] See Appendix 1 for more information about SAP and R/3.
[13] www.SAP.com

The empirical findings of the thesis are presented in *chapter 6*. The six categories of effects most frequently related to ERP Systems in the literature are dealt with. Finally, there is a section dealing with whether or not effects have been measured.

In *chapter 7*, the empirical findings are analyzed, i.e. how the categories most frequently pointed out in theory regarding ERP effects actually are affected in practice. First, we discuss the congruence of theory and practice. Moreover, the effects that were planned by a majority of the companies are determined. After this, these planned effects are discussed on the basis of whether or not they are realized in practice. Furthermore, ERP effects that have emerged but were not planned are also commented. The chapter is terminated with a discussion of negative effects and measurement of effects.

In *chapter 8*, we return to the research question of the thesis. The conclusions drawn from the study are presented. We end this section with suggestions for further research.

1.7 Key Concept

Since we are dealing with the subject of Enterprise Resource Planning, this is a key concept in the thesis. Throughout the thesis we have used different terms for defining this and used them interchangeably. The terms we have applied are:

- Enterprise Resource Planning System
- ERP
- ERP System

2. Methodology

This chapter deals with how the study was conducted. The chapter includes discussions of research approach, data collection, sources of data and sample. Moreover, an evaluation is made of possible sources of errors as well as of the validity and reliability of the thesis. Finally, a discussion is made of analysis methodology.

2.1 Research Design Approach

There are four different types of research design approaches: descriptive, explanatory, explorative and predictive. The descriptive approach is primarily used when the researcher is interested in showing the facts and characteristics of a specific and often well-defined problem area. The explanatory approach implies that the researcher wants to establish causal relationships between a number of variables in order to show connections and influences between these variables. The explorative approach is used when the researcher only has limited knowledge of the subject area and there is a need to identify what research issues to address. Therefore, this approach is also commonly used during the initial phase of larger research projects, i.e. the researcher aims to specify the research problem. The predictive approach is used when the researcher aims to make a prognosis of the future development of a phenomenon.[14]

2.1.1 Choice of Research Design Approach

The starting point of this thesis is the explorative research approach, since we do not have sufficient knowledge of the subject area and there is a need to identify what research issues to address. After we have gained sufficient knowledge of the subject area, the research approach changes into a descriptive approach, as we are interested in showing the characteristics and facts of the chosen problem area.

2.2 Data Collection Techniques

Data collection is generally split into two different methodological approaches; quantitative and qualitative methodology. The main difference between these two methodologies lies in the way numbers and statistics are used. Which methodology that should be chosen depends on the chosen research question. However, these two approaches do not have to be parted, but can in some cases be advantageous to combine.[15]

2.2.1 Quantitative Data Collection

Quantitative data collection techniques have an explanatory purpose. Characteristic of quantitative data is that it is measurable and can be presented as numbers, and can be analysed using different statistical methods. The researcher using quantitative methodology is interested in width and wants little information about a large number of units. Quantitative data is collected using, for example, questionnaires with fixed answers and

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[14] Lekvall & Wahlbin, 1993
[15] Holme & Solvang, 1991

inquiry forms. Therefore, quantitative data collection techniques are formalised and structured. These techniques are useful when the researcher wants to make statistical generalisations from gathered information.[16] However, quantitative data can only tell us where we are, not why, because attitudes and feelings cannot be expressed[17].

2.2.2 Qualitative Data Collection

The primary purpose of qualitative data collection techniques is to understand the phenomenon that is studied. Characteristic of qualitative data collection is that the researcher wants much information on only a few units. Qualitative data is collected from personal interviews using for example in-depth interviews or interview guides without fixed questions or answers. The answers given in a qualitative interview therefore often give a more actual picture of reality and a deeper understanding of the subject studied. Consequently, qualitative data collection techniques are less formalised and more flexible than quantitative data collection techniques. However, statistical generalisations cannot be made using qualitative techniques.[18]

2.2.3 Choice of Data Collection Technique and Method

In this thesis we have chosen the qualitative data collection technique since that gives us the opportunity to use in-depth personal interviews. The reason for our choice of in-depth personal interviews of a small amount of selected respondents is that we wished to gain as much flexibility as possible in the communication with the respondents. Furthermore, in-depth personal interviews make explanations and clarifications possible, which may enhance the quality of the data collected. Personal interviews also make it possible to go into details about the subject in question, which leads to greater understanding of the research problem. The choice of in-depth personal interviews also give the opportunity to correct and adjust the questions and ask additional questions during the course of the interview. However, in order to simplify the analysis of the information, we have followed the questionnaire as closely as possible. Furthermore, personal interviews minimise the risk of a reduction of respondents when a time and date is set for an interview.

In the course of the interviews we encouraged our respondents to speak as freely and openly on the subject as possible, giving us the possibility to discover nuances and attitudes not explicitly asked for. During the interviews we also used a tape recorder. This was done in order to be able to present the answers as correctly as possible as well as helping us to facilitate the analysis of the data collected.

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[16] Holme & Solvang, 1991
[17] Kinnear & Taylor, 1996
[18] Holme & Solvang, 1991

2.3 Sources of Data

There are two fundamental categories of data available: primary data and secondary data[19].

2.3.1 Primary Data

Primary data is information gained from original sources that has been collected for a specific research question and that is used for the first time. Consequently, primary data is collected by the researchers and has not been gathered for other purposes. Examples of such information can be interviews or observations. The most frequently used method of collecting primary data is through interviews.[20]

2.3.2 Secondary Data

Secondary data is data that has been collected prior to the specific research project by someone else for some other purpose. Examples of secondary data are books, research reports and articles. Secondary data can be divided into internal and external data. Internal secondary data originates from inside an organisation, e.g. annual reports, sales statistics etc. The benefits of this kind of information are that it generally has a low cost and a high availability. External secondary information, on the other hand, is information gathered outside an organisation, e.g. official statistics, articles, books etc. Possible disadvantages of secondary data may be the difficulty of finding information that suits the specific needs of the actual research, as well as the reliability, accuracy and actuality of the information.[21]

2.3.3 Sources of Data in the Thesis

In our thesis we have used both primary and secondary data.

Primary Data

The thesis is to a large extent based on primary data collected during face-to-face interrogations with respondents at the selected companies. However, in one case we considered the geographical distance too large to be able to conduct a face-to-face interview. Consequently, a telephone interview was conducted in this case. Furthermore, two complementing interviews were made by telephone. Moreover, complementing questions to the respondents were also sent and answered by e-mail. The respondents of the interviews are presented later on in this chapter, as well as the companies they represent. A more thorough presentation of companies and respondents is found in chapter 5.

Secondary Data

The secondary data used in this thesis is primarily different articles and books dealing with Enterprise Resource Planning Systems and related subjects. This secondary data is mainly used to form the theoretical framework, but also to form the methodology of the thesis. An additional external source of information used is the Internet where we have

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[19] Dahmström, 1996
[20] Ibid.
[21] Kinnear & Taylor, 1996

been able to both search for and find suitable information. The words we have used when searching for information are:

- Effects (Effekter)
- Enterprise Resource Planning
- Enterprise Resource Planning System
- Enterprise System (Affärssystem)
- ERP
- ERP System
- ERPS
- Evaluation (Utvärdering)
- Information Technology (IT)

Different combinations of these words have also been used. The search bases used were GUNDA (search base at the library of Göteborg University), EBSCOhost and Google. We have also used internal secondary data in the form of official information on the chosen companies, such as annual reports and internal material regarding the individual companies' R/3 implementations. In those cases where we find an explanation of some words unnecessary in the text, explanations are provided in Appendix 2.

2.4 Sample

There are two principal types of sampling procedures, probability sampling and non-probability sampling. The choice between these two methods depends on the purpose of the study. When using probability sampling, every unit of the entire population stands a known chance of being selected. Therefore, this procedure makes it possible to calculate statistical inferences. When using non-probability samples, the sample is, to some extent, based on the researcher's subjective judgements and the method is also based on more qualitative and intuitive estimations. Judgement sample is a non-probability sample that implies that the sample is chosen on the basis of specific criteria that beforehand are judged to be of particular importance to the study.[22]

2.4.1 Choice of Sampling Procedures and Sample

The sample method chosen in the thesis can be characterised as a non-probability judgement sample. We have chosen criteria on the basis of the objective of the study. These criteria are stated below.

2.4.2 Target Population

The target population of the thesis is companies that have implemented at least six of the twelve R/3 modules at a minimum two years ago *and* have experienced effects of the system. The number of modules is important in order for us to be sure that the system operates as an Enterprise Resource Planning System within the company integrating functions and processes. Therefore, we have required more modules than just the two financial ones (FI and CO). An overview of the R/3 system and its modules is presented

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[22] Lekvall & Wahlbin, 1993

in Appendix 1. No consideration has been taken to company size, i.e. turnover, number of employees, or industry. In this manner, the spread of the population has been increased.

In order to find suitable companies for our sample we contacted a former guest lecturer and consultant at SAP Svenska AB and asked for his help. We were given a number of suggestions, and were also recommended to contact consulting firms that work with SAP implementations, which we did. These sources gave us the names of a number of potential companies. We then proceeded to get in touch with potential respondents at each company. Our first aim was to make sure that the companies fitted the request profile and the second aim was to set dates for interviews with representatives from each company.

2.4.3 Responding Companies

The companies and respondents included in the thesis are:

- Abu Garcia, Pure Fishing: Nils-Erik Janhall, Manager of Logistics, Jan Sjöblom, Manager of Production and Per Smalander, Chief Information Officer (CIO).

- Arvid Nordquist H.A.B.: Urban Brytting, Senior Consultant.

- Borealis: Anders Fröberg, Chief Financial Officer (CFO).

- Elfa: Johan Forssberg, Manager of Business Development.

- Ericsson Microelectronics: Henning Robach, Business Process Development Manager

- Gambro Renal Products: Klas Arildsson, Senior Vice President of Global Supply, Mats Lindeberg, CIO and Zlatko Rihter, Marketing Director.

- Volvo Aero: Dennis Samuelsson, Project Manager and Hans Widerberg, CIO.

At the time of the interviews, the respondents were given the opportunity to be anonymous in the thesis, but none of them felt that this would be necessary. However, since our aim is not to make case studies, we have chosen to present the answers anonymously anyway.

2.4.4 Reduction of Respondents

We have been in contact with 30 companies by e-mail and telephone. We were eager to get an answer from all of them, and finally we ended up with 15 companies. After a more detailed examination of the companies' R/3 implementations, four of them fell off since they did not fulfil the criteria of the target population. In addition, two companies fell off since they did not have the time for an interview. Thereby, we have conducted interviews with nine companies. During one of these interviews, we realised that the company did not fulfil the criteria, and during another interview, the respondent was not able to give us answers to all of our questions. We have tried to reach other persons within this company, but without success. Thus, there are seven responding companies as the basis to our empirical findings. Since we have chosen to conduct in-depth interviews, we find the number of respondents acceptable.

2.4.5 Questionnaire

During the in-depth interviews, we have used a questionnaire (appendix 3) as a checklist, of the categories that were to be dealt with. The purpose of the questionnaire is to simplify the interviews. The questionnaire consists of questions dealing with the subjects we need to gain information of in order to be able to answer our research problem. We have chosen to use a structured questionnaire with open-ended questions. This kind of questionnaire is often referred to as a free-response questionnaire. It requires the respondents to provide their own answers to the question.[23]

The questionnaire is divided into three parts. The first section of the questionnaire deals with background questions connected to the company's choice to go ERP and which of the R/3 modules that were chosen. The purpose of this section is to offer more background information about the ERP Systems of the responding companies. In the second section, we present six categories of aspects that are generally affected by ERP implementations according to theory. These six categories, as well as the following questions, were chosen on the basis of the theoretical framework discussed in chapter 3. In the final section, we ask the respondents whether or not effects of the ERP System have been measured or secured. This is done in order to question the credibility of the realized and not realized effects.

2.5 Research Evaluation

2.5.1 Sources of Error

While collecting data, many different types of errors can occur. It is of great importance to be aware of how these errors occur and how they can be avoided. Sources of error can be divided into measuring errors, inference errors, and processing and interpretation errors.

Measuring errors are errors that can occur during the collecting of primary data and during interviews. Measuring errors are divided into respondent errors, instrument errors and interviewer errors. Respondent errors occur when the respondent is unable or unwilling to give the correct answer. Instrument errors occur when the measuring instrument is inadequate; e.g. wrongfully formulated questions. Interviewer errors are errors that occur due to the interviewer's influence on the respondent.[24]

Inference errors, on the other hand, are errors connected to the difficulty of making statements about what really has been measured to the circumstances in reality that the researcher is interested in. This problem is most obvious in surveys, where the researcher cannot investigate all units in the entire target population. Inference errors can be divided into frame errors, non-response errors and sampling errors. Frame errors occur when the chosen sample is either too small or too large in relation to the target population. Non-

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[23] Kinnear & Taylor, 1996
[24] Lekvall & Wahlbin, 1993

response errors arise when respondents cannot be reached or do not answer. Sampling errors occur when the sample is not representative of the target population.[25]

Finally, processing and interpretation errors occur when the data collected is processed in a way that generates erroneous conclusions. Processing and interpretation errors are divided into managing errors, analysing errors and interpretation errors. Managing errors may arise when collected data is transferred to process data. Analysing errors include calculation errors and insufficient analysis methods. Interpretation errors occur when incorrect conclusions are made regarding the results of the study.[26]

2.5.2 Evaluation of Our Data

Regarding potential measuring errors, we are of the opinion that respondent errors have been avoided to a large extent, since we have guaranteed respondents full anonymity if they wanted this protection. Thus, the respondents have been able to speak as freely as possible, without risking that the information they give us can be directly linked to the respondent or the company. The respondents have also received the questionnaire before the interview, to be able to prepare their answers. In order to avoid instrument errors we have thoroughly evaluated the questions in the questionnaire so that they suit the research questions as much as possible and so that misunderstandings are avoided. If the respondents did not understand a question, we explained it in order to avoid unnecessary misinterpretations. On the other hand, the time perspective might have affected the respondent's ability to answer correctly, since questions concerning expectations on the ERP System require the good memory of the respondent. When it comes to interviewer effects, we cannot be one hundred per cent confident that we have not affected the answers of the respondents in unintended directions. During the interviews we have not apprehended that the respondents felt obliged to answer the questions in a certain way. However, the risk of interviewer effects cannot be excluded, since we may have influenced the respondents subconsciously, for example by letting our subjective opinions be reflected in the way we ask the questions.

Regarding inference errors, the risk of frame errors exists due to the small size of the sample. We have experienced non-response errors, since a number of companies declined participation in our study. We have also experienced partial non-response errors in one case. This interview is not functioning as a basis for the empirical findings. It cannot be stated that the study is without inference errors, since we have not been able to map the entire population that satisfy our criteria due to our limited knowledge of what companies that use R/3. However, we are confident that our sources have tried to provide us with suitable companies in order to avoid possible sampling errors.

Concerning processing errors, we have tried to avoid these primarily by using a tape recorder during the interviews. We have then transcribed the entire interviews. This material has been the basis of the analysis. However, since we have chosen to use a qualitative research method, which implies elements of subjectivity in the analysis, we believe that processing and interpretation errors may have occurred in spite of our

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[25] Lekvall & Wahlbin, 1993
[26] Ibid.

caution. However, we have tried to avoid these errors by analysing and interpreting our results as consequently and accurately as possible, taking our research question, objective and theoretical framework as our point of departure.

2.6 Validity and Reliability

To be able to achieve a high level of credibility for the conclusions presented in a thesis, it is important to demonstrate that the research was designed and conducted in a way so that the phenomenon investigated is accurately identified and described. It is therefore important to be conscious of problems and insufficiencies connected to the chosen research methods in order to be able to minimise the errors and increase the quality of the study.[27] Measuring errors may occur due to imperfect measuring methods e.g. the measuring instrument and how it is used. These shortcomings may be of two kinds, low validity or low reliability. It is more important to gain high validity than high reliability. This is because it does not matter if one hundred per cent reliability is gained, if the study does not measured what it aims to measure.[28]

2.6.1 Validity

Validity is an expression of whether or not the chosen measurement tool measures what it aims to measure, and is not affected by errors. However, it is almost impossible to judge if a research method has high validity or not. To be able to do this, the result of the study has to be compared with the result from another study using another research model that gives the absolutely correct results. In order to gain high validity it is important that the questions are formulated in accordance with the theoretical framework and that the respondents are able to understand them. The validity of secondary data is judged by its relevance in comparison with the information needed.[29]

2.6.2 Reliability

Reliability is concerned with the measurement instrument's ability to resist random errors, and the extent to which the findings can be replicated. Thus, reliability describes the stability and trustworthiness of the research method and the secondary data. The reliability is high if the measurement tool will generate the same or similar results if another researcher follows the same procedures. A number of factors that may impact on the reliability of a study are the changeable characteristics of an individual, such as health, tiredness, motivation, stress, and random factors, such as the risk of the respondent guessing.[30]

2.6.3 Validity and Reliability in the Thesis

The validity of a measurement method is as stated above impossible to measure. We have aimed to reach a high validity in the thesis by thoroughly studying the ERP literature before designing the questionnaire in order to be able to formulate questions that generate as accurate information as possible needed to answer the research question. We have also chosen respondents with great knowledge of the research issues in question, due to their

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[27] Ryan et al, 1992
[28] Lekvall & Wahlbin, 1993
[29] Ibid.
[30] Ibid.

position and company knowledge. We also gave them the possibility to prepare their answers in advance by sending them the questionnaire beforehand. In spite of our efforts, we are aware of the fact that there may be some potential shortcomings and that the validity of the thesis could therefore be improved.

Concerning the reliability of the thesis, there are a number of potential sources of errors (presented in 2.5.2 Evaluation of Our Data). We consider the main sources of error to be the difficulties in judging whether or not the respondents have answered the questions truthfully and in accordance with their real opinions. Since it is a major investment, the answers can be slanted to protect an investment decision in some cases. There is also a value in questioning whether the respondents are the right persons to answering the questions, regarding their own personal opinions and not their professional one.

2.7 Analysis Methodology

When making the analysis of the empirical study, we will compare the theoretical findings with the empirical ones. This is done in order to actually see what is most frequently pointed out in theory and if these aspects are expected and/or realized in practice within the responding companies. In this manner, we will pave the way for being able to answer the research question of the thesis.

First of all, we will discuss the congruence of theory and practice. This is done in order to determine which categories and aspects in theory that exist in the companies and were planned to be affected in a majority of the responding companies. These aspects will thereafter be discussed on the basis of whether or not they are realized in practice. ERP effects that have emerged but were not planned will also be commented to find out the bonus effects and the reasons for these. We will also conduct a discussion of negative effects in order to identify what the respondents have experienced in favour for their old systems. An analysis of measurement of effects ends the analysis section in order to provide background information about whether or not the respondents actually are able to have a comprehension about the effects of the ERP System.

3. Enterprise Resource Planning

In this chapter, the concept of ERP is introduced. First, there is a presentation of a number of different characteristics we find relevant in order to enhance the reader's understanding of ERP and ERP implementations. Thereafter, a short description of the history and future of ERP is provided, followed by a short presentation of reasons for why companies decide to implement an ERP System and why not. Finally, a number of possible ways of evaluating IT investments are discussed.

3.1 What is ERP?

3.1.1 Definitions
The concept of Enterprise Resource Planning (ERP) can be viewed from different perspectives. First of all, ERP is a product in the form of computer software. Second, it can be seen as a means of mapping all processes and data of an organisation and create a comprehensive integrative structure.[31]

Furthermore, there are several ERP definitions that are all more or less similar. Klaus et al (2000) define ERP as:

> comprehensive, packaged software solutions [which] seek to integrate the complete range of a business's processes and functions in order to present a holistic view of the business from a single information and IT architecture[32].

Yen et al (2001) refer to ERP as:

> software that can be used to integrate information across all functions of an organisation to automate corporate business processes… a business management system that integrates all facets of the business[33].

What is clear in both of these definitions is that the issue of integration is central to ERP. An ERP System has the potential to integrate all processes and functions of a company, and to present a comprehensive picture of the entire organisation. ERP promises "seamless integration of all the information flowing through a company"[34] by using a single database that enables the various departments within an organisation to effectively share information and communicate with each other.[35] The single database approach means common access to a single set of data. Therefore, all departments access the same information and thereby the need for redundant data entry is eliminated (figure 1).

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[31] Klaus et al, 2000
[32] Klaus et al, 2000, p. 141
[33] Yen et al, 2002, p. 337
[34] Davenport, 1998, p. 121
[35] Hedman & Kalling, 2002

Moreover, data quality is improved. Before ERP, companies often maintained and processed multiple versions of data leading to poor data quality and poor decision support.[36]
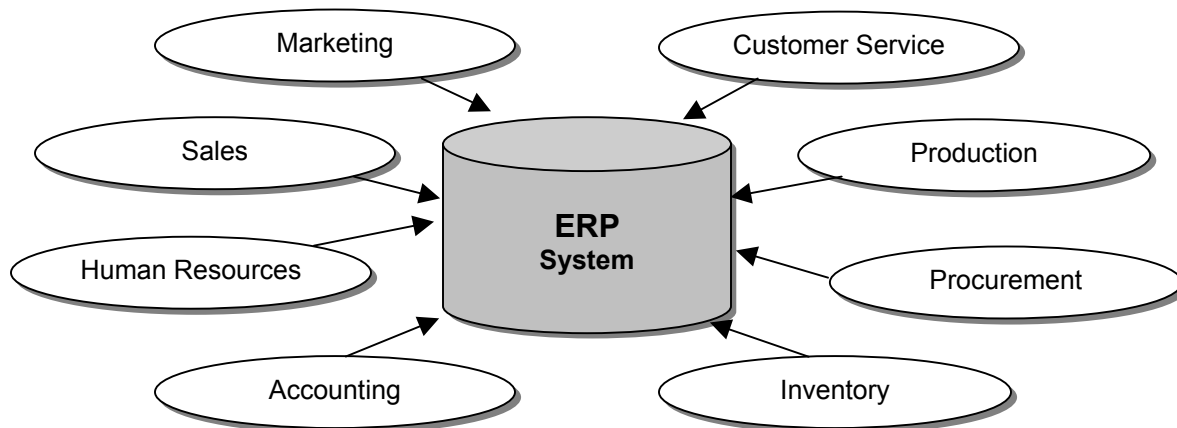
Figure 3.1: Departments and ERP System; All departments access the same information. (Hedman & Kalling, 2002, p. 194)

3.1.2 History and Future of ERP

ERP originate from the large packaged application software that have been widespread since the 1970´s. Among the first packaged business applications available was Material Requirement Planning (MRP), introduced in the 1950´s. This software only supported material handling. During the 1970´s the MRP packages were extended and further applications were added. The extended MRP resulted in the MRPII Systems. This development continued in the 1980´s, as more and more functions were added. The first ERP Systems were introduced in the 1990´s. The term ERP was introduced in 1992 and the name can probably be derived from the MRP and MRPII Systems. [37]

Ever since the 1970´s, the vision of a single integrated Information System covering all functions and processes of a company, "one-company, one-system"[38], has been present. At this time, Information Systems were seldom integrated and when new applications were added they were programmed as discrete new Information Systems and only loosely integrated to existing systems. Over the years, this practice resulted in the creation of a loose patchwork of overlapping or even redundant systems. This fragmented system architecture resulted in a number of difficulties. For example, analyses could mainly be performed at a summary level and data quality was poor because the different legacy systems were seldom updated simultaneously. The term legacy system refers to software that precedes ERP Systems. These systems are often mainframe software and have typically been developed by the individual firm for its specific needs. As time passed, the costs of maintaining these legacy systems grew rapidly, often using all funds allocated for

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[36] Yen et al, 2002
[37] Klaus et al, 2000
[38] Markus & Tanis, 2000, p. 174

building new ones.[39] In this context, the introduction of ERP-packages in the 1990's, that promised seamless integration, was the fulfilment of a dream[40].

However, ERP Systems, like all information technology, are rapidly changing. During the 1980's, ERP Systems were designed for mainframe computers, in the 1990's this was abandoned and replaced by the client-server architecture and nowadays newly released web-enabled versions become more and more widespread. Moreover, the functionality of ERP Systems is also evolving as extensions to the original packages such as Supply Chain Management (SCM)[41], Customer Relation Management (CRM)[42], and data warehousing[43] are added.[44]

3.1.3 Configuration

Whether or not the integration promised by ERP is achieved depends on how the ERP System is configured, or set up. In this context, configuration means which modules that are chosen and in what way software parameters such as products, customers and accounts are set. Furthermore, Markus and Tanis (2000) argue that it is possible to configure an ERP System in a way so that the benefits of integration are not achieved. This is especially evident in large complex organisations. Companies may, for example, choose only to install the financial modules of an ERP System, thereby finding themselves deprived of the potential advantages of integrating all functions within the organisation. Moreover, integration benefits may also be lost if business units are allowed to adopt different systems or are allowed too much freedom to configure or customise the system.[45]

3.1.4 Packages

ERP Systems are commercial packages that are bought from software vendors, and therefore they do not meet all the needs of an organisation[46]. It is argued that ERP packages can only meet about 70 per cent of an organisation's needs. Therefore, an organisation has three options: It can change its processes and conform to the package, it can customise the package to make it suit its needs, or it can choose not to bother about the missing 30 per cent.[47] Adopters of ERP Systems often choose to adjust their processes and ways of working to fit the package[48]. This is due to the fact that custom-misation of ERP packages often has a number of negative consequences. Customisation generally increases the cost of implementation, increases the amount of time required for the implementation and makes upgrading and maintenance more expensive and difficult.[49]

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[39] O'Leary, 2000
[40] Markus & Tanis, 2000
[41] See Appendix 2
[42] See Appendix 2
[43] See Appendix 2
[44] Markus & Tanis, 2000
[45] Ibid.
[46] Harrell et al, 2001
[47] Al-Mashari, 2001
[48] Al-Mashari, 2001, Markus & Tanis, 2000
[49] Al-Mashari, 2001, Harrell et al, 2001

3.1.5 Best Practice

ERP packages are designed to fit the needs of many organisations, and therefore support generic business processes. ERP vendors therefore claim to have designed "best practices". By looking at academic theory and individual companies, they claim to have designed the best way to do business.[50] Best practices in an ERP System are captured in the different choices that must be made when implementing the system. An ERP System generally has a number of different best practices available, which implies that a company can customise the software to a large extent and make it fit the specific needs of the organisation. For example, SAP´s R/3 system offers more than 1.100 best practices. Because such a large number of best practices are available, virtually each implementation is unique. Since, the portfolio of best practices chosen varies from implementation to implementation.[51]

However, since ERP packages are based on best practice they are of a normative nature. Because of the normative nature of ERP, the implementation often requires changing business processes and therefore includes at least some degree of Business Process Reengineering (BPR).[52] BPR is a process oriented enhancement methodology that includes a fundamental rethinking and radical restructuring of business processes in order to improve aspects such as costs, quality, service and speed[53]. However, the inclusion of BPR in the implementation of ERP adds considerably to the risk and expense of the implementtation[54].

3.2 Why ERP?

Firms may have several reasons for deciding to adopt ERP Systems depending on for example industry and size. According to a survey regarding R/3 cited in Al-Mashari (2001), the most common reason for implementing ERP, as well as its most achieved benefit, is standardisation of processes and systems. Another much cited reason for implementing ERP is the integration benefits of the system[55].

Other reasons for implementing ERP is problems of fragmentation due to legacy systems and to solve the year 2000 problem. The year 2000 problem is a term for the problems that could occur at the turn of the millennium. This meant that when the clocks struck midnight on Jan. 1, 2000, many computers would produce wrong answers or fail to operate properly unless the computers' software was repaired or replaced before that date.[56]

O´Leary (2000) states that "one of the primary reasons for the movement toward ERP is that the competition has it [and that] a lot of ERP purchases are premised on the need just

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[50] Markus & Tanis, 2000
[51] O´Leary, 2000
[52] Hedman & Kalling, 2002
[53] Rentzhog, 1998
[54] Markus & Tanis, 2000
[55] Al-Mashari, 2001, Yen et al, 2002, O´Leary, 2000
[56] www.eb.com, 2002-03-28

to stay in business"[57]. Thus, the implementation of an ERP System can be seen as a competitive necessity.

3.2.1 Reasons for Not Adopting ERP

Although the implementation of an ERP System brings many advantages, it may also bring disadvantages. One of the main disadvantages is the lack of feature-function fit between available packages and company needs.[58] As mentioned earlier, Al-Mashari (2001) states the fact that even the best product available can only fit 70% of all company processes.

Further reasons for not adopting ERP are the high costs of the infrastructure and the implementation. This reason is most commonly stated regarding small firms. The implementation is not only costly, but also requires much time and patience. It also disturbs the routine work within an organisation and many hours of education is needed.[59]

Finally, some writers state competitive reasons for not implementing ERP Systems. Davenport (1998) argues that the implementation of an ERP System may result in the weakening of important sources of competitive advantage, because it pushes a company towards generic processes, even if the company's competitiveness lies in its unique, customised processes. An implementation that has not been carefully considered may therefore bring disaster rather than the much-sought benefits.[60]

3.3 Existing Models for IT Investment Evaluation

The most common way of evaluating an IT-investment is to focus on financial aspects. But, there are also a number of methods focusing on non-financial aspects or a combination of both financial and non-financial aspects. Below, some of the methods used when evaluating IT-investments in general are presented.

3.3.1 Return on investment (ROI)

The ROI method focuses on financial aspects and is the approach most frequently used when evaluating IT investments today. The approach includes a number of techniques that attempt to estimate what financial return an investment will generate. ROI is based on the idea that all costs and benefits are quantified in monetary terms, which makes the investment easier to comprehend for the people involved in the decision making process. The main benefit by using this technique is that it is relatively easy to rank the different investment alternatives. The disadvantage is that it is difficult to identify qualitative benefits.[61]

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[57] O´Leary, 2000, p. 95
[58] Markus & Tanis, 2000
[59] Yen et al, 2002
[60] Davenport, 1998
[61] Ohlsson & Ollfors, 2000

3.3.2 Multidimensional Evaluation Method

According to Ohlsson & Ollfors (2000), ERP investments cannot be evaluated as ordinary investment since the desired effects of an ERP investment do not correspond to the usual investment objectives. Furthermore, the evaluation of an ERP 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 authors suggest a method of evaluating ERP investments, taking both business economical and economical aspects into consideration. Hereby, the investing company will be able to achieve a more complete image of the effects of the investment. Moreover, it is important that the investing company works with identifying the costs and benefits related to their specific ERP investment, as the cost and benefit vary between different companies.[62]

3.3.3 EVA

EVA is equivalent with operative profit minus capital costs. The idea is that if a company use capital it has to pay for it. For companies that evaluate a new ERP System EVA demands that you comprise all investments, including original investments, maintenance, internal and external education costs and that the costs are compared with expected benefits such as increased incomes or decreased costs. The benefit of EVA is that it is a tool to use when determining the effects of an IT investment on an aggregated level. However, EVA is difficult to connect with non-financial aspects.[63]

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[62] Ohlsson & Ollfors, 2000
[63] Wallström, 2003-02-03

4. Enterprise Resource Planning Effects

In this chapter the theory that forms the basis of our research question is presented. Six different categories of aspects are identified and described. The chapter is terminated with a summary of the effects most frequently related to an ERP System described in the literature.

4.1 Categories most Frequently pointed out in Theory

In this section we have attempted to summarize the potential effects on an organisation due to the implementation of ERP. During this work, six categories of effects frequently related to ERP investments emerged: *Accounting, Costs, Manufacturing and Logistics, Customer and Supplier Relations, Information Management and Organisation and Culture.* The potential effects of ERP, which are stated in the literature, are categorized under each heading and discussed. This section is a compilation of the work of the following researchers: Al-Mashari (2001), Al-Mashari (2002), Davenport (1998), Granlund & Malmi (2002), Hedman och Kalling (2002), Markus & Tanis (2000), O´Leary (2000), Skok & Legge (2002) and Yen et al (2002).

4.1.1 Accounting

The introduction of an ERP System may lead to the reduction of days needed for closing the books, which implies that the costs of closing the accounts are also reduced. This is primarily due to the integrated nature of the system, and the elimination of multiple and redundant data sources. Companies therefore have more time and resources that can be devoted to other areas of interest. The integration of financial information, as a result of ERP, also creates a unified understanding of financial position when all data is available in one system, which may result in better forecasts. ERP Systems may also provide the company to reduce the time spent on financial reports and improve the quality of the reports. Thus, the identified aspects that are affected by an ERP implementation in this category are:

- Closing the Books
- Forecasts
- Financial Reports

4.1.2 Costs

The implementation of ERP may result in reduced costs in general, and a reduction of IT operating and maintenance costs in particular. Maintaining many different systems leads to enormous costs; for storing and rationalize redundant data, for rekeying and re-formatting data from one system for use in another, for updating and debugging obsolete software code, for programming communication links between systems to automate the transfer of data.

The above-mentioned costs are the direct IT costs, but more important are the indirect costs. A company's manufacturing productivity and customer responsiveness will suffer

if sales and ordering systems cannot communicate with its production-scheduling systems. Moreover, if sales and marketing systems are incompatible with financial-reporting systems, management is left to make important decisions by instinct rather than based on a detailed understanding of product and customer profitability.

The streamlining of information flows, due to the automatic updating of information, may result in less time being spent on administrative tasks. In some cases, the reduction of administrative personnel is stated to be up to 70 per cent. Thus, administrative costs are reduced. The standardisation of processes may lead to reductions of number of staff. Personnel costs may therefore be reduced. Sales costs may potentially decrease due to improved product quality, improved time to market cycles and increased customer satisfaction. Production costs may also decrease. This is primarily due to increased productivity, increased flexibility and reduction of rework. The aspects we have identified in this category are:

- IT Costs
- Administrative Costs
- Personnel Costs
- Sales Costs
- Production Costs

4.1.3 Manufacturing and Logistics
The effects of ERP on Manufacturing and Logistics are potentially great, since ERP is aimed at optimising the entire supply chain. This is primarily due to the real-time access to data and information that ERP Systems entail.

ERP Systems may affect logistics in regard to the possibilities of co-ordinated purchase management. This is due to increased visibility within the ERP System. Moreover, the systems will potentially reduce inventory levels by improving visibility of orders and by making the manufacturing process flow more smoothly. This may lead to reductions of lead times and raw material inventories as well as finished goods inventories, since planning of customer deliveries is improved. Thus, material planning and material management, i.e. warehouse management, is potentially improved by ERP. An ERP System may also keep track of goods and process movements in corporate warehouses.

Furthermore, an ERP System may simplify production planning because ERP can perform capacity planning and create a daily production schedule for manufacturing plants. The standardisation of processes that ERP brings can save time and increase productivity and improve efficiency of operations. Productivity improvement due to ERP may be the result of global economies of scale, which may lead to the reduction of number of warehouses needed and lower plant maintenance costs.

Other potential effects are reduction of rework and improved product quality. Product quality may be improved due to standardisation of production processes. Production flexibility may also be increased, since access to real time information render faster production adjustments to changing demand possible. An ERP System may also facilitate

order entering due to its ability to automate data entry, process customer ordering and keep track of order status. Thus, order management may be affected. The identified aspects within this category are:

- Purchase Management
- Warehouse Management
- Production Planning
- Product Quality
- Production Flexibility
- Order Management

4.1.4 Customer and Supplier Relations

The introduction of ERP may improve delivery precision due to increased visibility of orders. The system may also facilitate interorganisational communication and collaboration with other organisations e.g. suppliers and customers. Integration of information on customer orders facilitates co-ordination of manufacturing, inventory and shipping, which may result in increased customer satisfaction. Improved customer relations may also be the result of better product quality, increased flexibility and better-planned customer deliveries, which are also potential effects of ERP. Due to the real time database, the system enables companies to have better customer information, which may result in better customer service. Supplier relations may also be improved, since better visibility of orders has the potential to facilitate deliveries. Thus, the aspects identified in this category are:

- Delivery Precision
- Customer Relations
- Customer Service
- Supplier Relations

4.1.5 Information Management

The introduction of ERP reduces redundant information handling because of its integrated nature. This may result in enhanced information flow and data quality. ERP also facilitates intra-organisational communication and collaboration between different functions and locations and eliminates information asymmetries, since all information is available in the same underlying database. The content of the information, such as data quality and the reliability, is also improved. Since an ERP System streamlines a company's data flows and provides management with direct access to real-time operating information, access to information is opened up to those who need it and decision-making will be improved. Identified aspects within this category are:

- Information Flow
- Availability of Information
- Content of Information
- Data for Decision-making

4.1.6 Organisation and Culture

The introduction of ERP often has a paradoxical impact on an organisation, because it supports both increased centralisation and increased flexibility. On the one hand, ERP has been used as a means of injecting more discipline into decentralised organisations. One side of ERP therefore implies centralisation through standardisation of processes and centralisation of control over information. On the other hand, ERP has also been used as a means of breaking down hierarchical structures and freeing employees to become more innovative and flexible. By providing real-time access to data, streamlining management structures, flatter, more flexible, and more democratic organisations are created. This side of ERP, implies lesser need of middle managers. However, the standardisation may also be achieved at the cost of flexibility

The introduction of ERP involves a large cultural change and often acts against the prevailing company culture. The implementation of ERP often includes a shift from a functional to a process-oriented organisational structure, which may result in massive changes of responsibilities, roles and work routines. The aspects we have identified in this category are:

- Centralisation
- Responsibility
- Work Routines

4.2 Summary of Identified Categories and Aspects

In table 2, the identified categories and aspects that are affected by an ERP System according to theory are summarised. These are the aspects we will present in the empirical findings in the thesis.

Identified Categories and Aspects that are affected by an ERPS according to Theory
Accounting
Closing the Books
Forecasts
Financial Reports
Costs
IT Costs
Administrative Costs
Personnel Costs
Sales Costs
Production Costs
Manufacturing and Logistics
Purchase Management
Warehouse Management
Production Planning
Product Quality
Production Flexibility
Order Management
Customer and Supplier Relations
Delivery Precision
Customer Relations
Customer Service
Supplier Relations
Information. Management
Information Flow
Availability of Information
Content of Information
Data for Decisionmaking
Organisation and Culture
Centralisation
Responsibility
Work Routines

Table 4.1: Identified Categories and Aspects that are affected by an ERP System according to Theory

5. Company Overview

In this chapter the companies included in the thesis and their R/3 investments are presented. The chapter begins with short presentations of the companies and respondents included in the study as well as basic facts of their R/3 implementations. The second half of the chapter deals with the companies work with their ERP Systems. This is presented as a compilation of the answers, in order to provide an overview of each question. The purpose of this section is to offer more background information about the ERP Systems of the responding companies.

5.1 Companies and Respondents

5.1.1 Abu Garcia, Pure Fishing

The Company
Abu Garcia is a part of the group Pure Fishing, headquartered in USA[64]. The company produces fishing reels and also offers lures, rods, and clothing. Abu Garcia started as a watch factory in 1921, but the company redirected its production and began producing precision fishing reels in the 1930's. The company is situated in Svängsta, Sweden, and is famous for their state-of-the-art, Ambassadeur Mörrum casting reel series.[65] The turnover of the group is MUSD 220, and for Abu Garcia MSEK 330 (approximately MUSD 39[66]). At Abu Garcia, 250 of the 1400 employees of the Pure Fishing group work.[67] There are three global actors in this market, Pure Fishing and two Japanese companies. When it comes to fishing reels, Abu Garcia is a leading developer.[68]

R/3 Implementation
The ERP implementation project started in 1997 in the group, and the technical implementation was carried out in 1998 in the U.S. During 1998 and 1999 the project was rolled out to companies outside Europe within the organisation. In the year of 2000, R/3 was implemented in the Nordic countries and England, and during the summer of 2002 the system was implemented in France, Italy and Germany as well. In a way, the R/3 implementation project within the Pure Fishing group is still in the rollout phase, but for our responding company, the implementation is completed and effects are noticeable. The company is working in the modules FI, CO, PM, QM, PP, MM, SD and WM[69].

Respondents
The respondents at Abu Garcia are Nils-Erik Janhall, Manager of Logistics, Jan Sjöblom, Manager of Production and Per Smalander, CIO. All three of them took active part in the implementation of R/3.

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[64] www.purefishing.com, 2003-03-10
[65] www.abu-garcia.com, 2003-03-10
[66] www.rb.se, 2003-04-09, exchange rate USD 1=SEK 8.5050
[67] www.purefishing.com, 2003-03-21, Janhall et al, 2003-03-05
[68] www.abu-garcia.com, 2003-03-10
[69] See Appendix 1 for an explanation of each module abbreviation.

5.1.2 Arvid Nordquist H. A. B.

The Company
Arvid Nordquist H.A.B. was founded in 1884, and started as a small delicacy store. Today, the company is still owned by the Nordquist family, but there are no longer any stores. Instead, the company is divided into four business areas: Coffee, Wine and Spirits, Restaurant and Agency. Arvid Nordquist H.A.B. has 230 employees and a turnover of MSEK 1,6.[70] The company is primarily active on the Swedish market, but has started to expand its agency division to the entire Nordic region.

The agency division imports and distributes well-known brands such as Del Monte, Campbell's, Green Giant and Maryland Cookies to grocery chains. The restaurant division is a wholesaler to restaurants and offers a full line of products, for example wine and spirits, fresh meat, game and delicacies. The wine and spirits division imports, distributes, and markets a selection of wines and spirits. The coffee division produces Classic Kaffe in its own roasting house and distributes the coffee to grocery chains, restaurants and wholesalers.[71] Considering the different activities within the divisions, Arvid Nordquist H.A.B has several competitors that differ from each other to a great extent.

The coffee production at Arvid Nordquist H.A.B. makes up a very small part of the total activities of the company. The production is craftmanlike, even though R/3 is used in the production (PP). Moreover, the respondent felt he could not answer questions regarding production due to the limited production of the company. Therefore, Arvid Nordquist is in this thesis seen as a distributing company only.

R/3 Implementation
The R/3 project at Arvid Nordquist H. A. B. began in 1997 and the system went live in 1998. The implementation in 1998 included the modules FI, CO, AM, MM and SD. During 2000, the module PP was introduced as well. The company is now looking at upgrading to the latest version and adding one additional module, WM.[72]

Respondents
The respondent, Urban Brytting, is a Senior Consultant working for Nordman AB, a sister company to Arvid Nordquist H.A.B that developed out of the former IT-department. The respondent only works with Arvid Nordquist H. A. B., but Nordman AB also serves external customers. The respondent took active part in the implementation of R/3 at Arvid Nordquist H.A.B.

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[70] www.arvid-nordquist.se, 2003-03-10
[71] www.arvid-nordquist.se, 2003-03-10
[72] Ibid.

5.1.3 Borealis

The Company
The main business of Borealis is the production of plastics raw materials: polyethylene and polypropylene. The headquarters of Borealis Group is located near Copenhagen, Denmark. Production sites are located primarily in Europe, but also in Brazil, the US and The United Arab Emirates. Sales companies are located all over the world. The Borealis Group has 5000 employees; 1000 in Sweden, and net sales 2002 of MEUR 3,5.[73] Borealis is the European leader in polyethylene, serving the film, extrusion coating, blow moulding and rotational moulding industries. Polypropylene is a fast growing polymer that is replacing many conventional materials in for example packaging. Borealis is also a leader in polypropylene applications like thin-wall packaging.[74]

R/3 Implementation
The R/3 implementation at Borealis began in 1994/95, but the implementation did not start until 1996. The implementation began at the sales companies and included the SD module. During 1997 the FI, CO, PP and MM were implemented at the production plants and in 1998/99 AM, PS and PM were implemented. Parts of HR were also added in 2000/01. The implementation is completed and the company is now looking at upgrading and adding more parts of the HR module.

Respondents
The respondent Anders Fröberg is CFO at Borealis in Stenungsund. He took an active part of the R/3 implementation.

5.1.4 ELFA

The Company
ELFA is a Swedish owned family company established in 1945, dealing with catalogue distribution of electronics. ELFA is present in Sweden, Norway, Denmark, Finland and Poland, and have representatives in the Baltic States, Russia, Turkey, Hungary, Slovakia and the Czech Republic. ELFA has 380 employees and a turnover of SEK 600 million. ELFA offers more than 40.000 items ready for delivery from their warehouse.[75] Competitors to ELFA are both a few local actors and two global ones. ELFA is positioned somewhere in between these competitors. ELFA is the leading distributor in the Nordic countries, but small in comparison to the global actors that operate worldwide. Since ELFA offers a wide range of products, their competitors vary from case to case.

R/3 Implementation
The ERP implementation project began in 1998. At the time of the interview, the implementation was completed and the next phase is to carry out improvements and fine-tune their processes. ELFA has implemented the modules FI, CO, SD, MM, HR and WW within their R/3 system. Since ELFA is a distribution company, and therefore have not

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[73] Borealis Annual Report, 2002
[74] Borealis Annual Report, 2001
[75] www.elfa.se, 2003-03-21

implemented the modules concerning production, they are not able to comment on the questions regarding this.

Respondent
The respondent at ELFA is Johan Forssberg, who is Business Development Manager. Although Forssberg did not take an active part of the implementation of ERP he could provide us with useful information and he had a good apprehension about the thoughts and expectations pre-ERP. In those cases when he could not respond to a question, he asked for help from a colleague of his.

5.1.5 Ericsson Microelectronics

The Company
Ericsson Microelectronics was formed in 2000, when Ericsson Components AB was split into two units. In 2002 the company was split up again, this time into three different companies. The respondent is presently working at one of the companies originating from Ericsson Microelectronics, Infineon Technologies. Depending on business area, Ericsson Microelectronics had a market share of 5-15 %. There were 5-10 competitors in the market. We have chosen to take Ericsson Microelectronics as the starting point of the analysis, because of the fact that the expectations of the ERP System arose within that entity. The effects are also derived from this entity.

R/3 Implementation
The ERP project began in 1997 and the system went live in the beginning of 1999. At the time of the interview, the implementation was completed and the work with the system has continued at Infineon Technologies. Ericsson Microelectronics had the modules FI, CO, AM, WF, PM, QM, PP, MM and SD.

Respondents
The respondent at Ericsson Microelectronics, Henning Robach, has worked within the company since 1996 as a Business Process Development Manager.

5.1.6 Gambro Renal Products

The Company
Gambro is a global company organised into three different business areas, which are related to medical technology and healthcare services, Gambro Healthcare, Gambro Renal Products and Gambro BCT. The company has more than 20.000 employees in 40 countries and had revenues of MSEK 27.000 in 2002.[76]

Gambro Healthcare operates 675 clinics, the majority of these are located in the United States. Gambro Renal Products develops, manufactures and supplies dialysis equipment. Gambro BCT provides technology, products and systems to blood centers and hospital

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[76] Gambro Annual Report, 2002

blood banks. Of the three business areas, it is only Gambro Renal Products that use R/3 to a large extent.[77] Therefore we have concentrated on Gambro Renal Products.

The market for renal products is characterised by a stable increase that is virtually unaffected by economic fluctuations. The number of patients grows annually by seven per cent, although growth rates vary considerably between different geographical regions. The three largest companies dominate the business and have two-thirds of the total market. Gambro Renal Products is third in the total market with a market share of more than 15 per cent.[78]

R/3 Implementation
The R/3 implementation started in 1998 at the headquarters in Lund and included the modules FI, CO, AM, PM, QM, PP, MM, and SD. During 1998, R/3 was implemented at a number of European sales divisions. During 2001/2002, R/3 was also implemented in a number of Asian sales divisions. The Gambro Renal Product implementation is still in the rollout phase. Sweden is completed, but three European countries, Germany, France and Italy as well as Asian countries such as Japan and Australia remain. Approximately one third of the project is completed.

Respondents
The respondents at Gambro are Klas Arildsson, Senior Vice President of Global Supply, Mats Lindeberg, CIO and Zlatko Rihter, Marketing Director and project leader of the 1998 R/3 implementation. Lindeberg and Rihter were both active in the R/3 implementation.

5.1.7 Volvo Aero

The Company
Volvo Aero is a part of the Volvo Group and consists of five business areas: Aerospace Components, Aviation Services, Engines Services, Military Engines and Land and Marine Gas Turbines. Volvo Aero employs 3600 people and had a turnover of MSEK 8,8. Volvo Aero operates world wide, but production is only located in Norway and Sweden.[79]

The aviation industry is in a crisis. The plummet of the industry was reinforced by the terrorist attack of September 11th and the decline of the market has continued. Volvo Aero, as an engine and spare parts producer, was strongly affected by this decline. The main competitor of Volvo Aero is a German company, MTU that is structured in the same way as Volvo Aero.[80]

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[77] Gambro Annual Report, 2001
[78] Ibid.
[79] www.volvo.com, 2003-03-10
[80] Ibid.

R/3 Implementation
The R/3 project at Volvo Aero Trollhättan began in 2000. In the Trollhättan and Kongsberg plants, Volvo Aero has used R/3 for two years. The modules that were implemented were FI, CO, AM, PS, WF, IS, HR, PM, QM, PP, MM, SD and TR The FI and CO modules were part of the corporate finance project and include the entire Volvo Group. R/3 is fully implemented in Trollhättan and Volvo Aero is now working on upgrading and adding of Business Warehouse.

Respondents
The respondents at Volvo Aero are Hans Widerberg, CIO, with some help from Dennis Samuelsson, Project Manager. Both of them took an active part of the R/3 implementation.

5.2 Background Information of the Companies' ERP Investments
In this section, a compilation of the background information of the companies' ERP investments is presented. The answers to each question are compiled in a table in order to enhance the reader's understanding and create an overview of the answers. The purpose of this section is to provide more background information about the ERP Systems of the responding companies. When studying the answers, we found no existing pattern between companies depending on industry or size.

5.2.1 Motives of the ERP Investments

Motives	Main Motive	Sub Motive
	Number of Companies	
Legacy Problems	4	1
Need of Company Wide System	3	2
Year 2000 Problems		5
Rationalise/Streamlining		4
Real Time Integration		4
Initiative of New Executive		1

Table 5.1: Motives of the ERP Investment

Four of the companies stated legacy problems as their main motive of implementing an ERP System. Three of the companies felt that their legacy systems could not support the companies much longer, due to rapid growth or great problems of inaccurate data. One of the companies stated that the ERP System replaced about 30 different legacy systems that were outdated, not supported by the supplier and had limited functionality. Therefore, the company was vulnerable, because it was dependent on a few key people to support the systems. All of the companies had long experience of systems developed in-house, and wanted a system that was easier to upgrade and to handle. Another company stated legacy problems as a sub motive.

Three of the companies stated the need of a company wide global system as the main motive of their ERP implementations. One of these companies had a history of decentralised decision-making at the business level, and resulting fragmentation because

of this, as the reason for the need of a new global system. Two of the companies had a history of mergers and acquisitions, which had resulted in the need of a global company-wide system that would connect all business units and enable them to share data. There was also a need to break up local structures, standardise processes and gain visibility of financial information and inventory levels. Furthermore, two of the companies stated the need of a company wide system that would enhance co-operation and communication as a sub motive for implementing an ERP System.

Five of the companies indicated the sub motives year 2000 problems, while four companies respectively stated rationalisation and real time integration as sub motives. One of these companies indicated both internal and external demands of rationalisations as a sub motive for going ERP. Another company stated that the ERP implementation coincided with a logistics project, which aimed to considerably reduce the number of warehouses in Europe. The ERP implementation was in this case also used as one of the means of reaching this aim. Real time integration was expected to enhance data quality and accounting accuracy.

One of the companies also indicated an unofficial main motive. This unofficial motive was the fact that a new CIO was hired who made the implementation of an ERP System his top priority. This unofficial motive is categorised as a sub motive.

5.2.2 Motives for Implementing the Chosen Modules

Motives	Number of Companies
Integration	5
Keep Functionality	1
Improve Customer Service/ Change Initiative	1

Table 5.2: Motives for Implementing the Chosen Modules

Five of the companies stated integration as the motive of implementing the chosen modules, and not a specific business strategy. One of the companies stated that they have a platform strategy and that they therefore wanted to implement as many modules as possible, but only limited parts of each module. According to this company the essential functionality of SAP R/3 is the integration between the modules and the fact that you only have to register data once into the system, in order to access it from all modules. Another company argued that the most important consideration was that they implemented as many modules as possible, since, a basic condition was that the system would be completely integrated, and not like earlier legacy systems with many interfaces that were difficult to maintain. According to one company the vision was to have a fully integrated system. One company stated that their processes include all activities from procurement to product development, production and maintenance. Consequently, they needed almost all of the modules included in R/3. They also considered it more cost efficient to use R/3 all the way, than using best of breed solutions, which may enhance functionality but to a much higher price. The integration strategy was also in this case important.

One of the companies had implemented a new system only a couple of year earlier, and therefore chose their R/3 modules in a way so that they would be able to keep the functionality they had in the previous system. However, they also added new functionality. Finally, one of the companies indicated that an underlying motive for implementing the chosen modules was the strategy to enhance customer service. The company therefore began with the SD module in order to get a grip of customer related processes, including inventory management, invoicing and order management. The FI and CO modules followed shortly after as a means of following up the customer service strategy. The implementation also coincided with a change management project with the purpose to standardise processes among others order, sales and R&D processes.

5.2.3 Motives for not Implementing Specific Modules

Motives	Main Motive	Sub Motive
Module Insufficiency	3	
Satisfied with Existing System	1	2
No Need for non chosen Modules	3	2
Too Extensive Change		1

Table 5.3: Motives for not Implementing Specific Modules

Three of the companies found insufficiencies in some of the R/3 modules. These insufficiencies were primarily found in the HR module. One company argued that the R/3 HR module is not used by many Swedish companies due to lack of accordance with Swedish law concerning collective agreements and contracts. Another company claimed that the SAP HR module still struggles with problems within its salary system.

Three companies were satisfied with existing systems and therefore choose not to implement all modules. For example one company paid SEK 1500 for their existing HR System and to replace that with SAP´s HR module would cost about SEK 200 000. For them, this was out of the question.

One company chose not to implement the Production Planning (PP) module. The reason for that was that the change was considered to be too extensive with too many people involved and the benefits would not exceed the costs. A majority of the companies did not see a need for all the modules, and therefore chose not to implement them.

5.2.4 Modules Customisation

Module Customisation	Number of Companies
No, Not at All	3
Yes, to a Certain Extent	3
Yes, to a Great Extent	1

Table 5.4: Module Customisation

Three of the companies had not customized the modules at all. Three of the companies said that they had customized the modules to a certain extent, due to lack of SAP func-

tionality. One of the companies had made more than 500 customizations. The companies that had not made any customizations at all claimed that SAP is a very flexible system. Therefore, there should be no need for customization, since the modules can be configured in a number of different ways. Thus, these respondents argue that SAP covers the needs of customization within the modules themselves.

Most of the companies that had customized the system to a certain extent intended to increase standardization in the future. Some of them claimed that if they would make the implementation today, they would not have made any tailored solutions at all. The reason for this is the fact that upgrading is problematic and expensive. It is also difficult to maintain the knowledge of each tailor made solution.

The company that had made 500 customizations stated that the SAP System had a number of insufficiencies and that they therefore had to make all the customizations. Though, the respondent admitted that not all of these customizations were desired, but that the management were not aware of the fact that co-workers got desired customizations from consultants without authorisation.

5.2.5 Process Change

Process Adjustment	Number of Companies
Yes	5
No	2

Table 5.5: Process Change

The majority of the respondents adjusted their processes considerably in order to fit into the R/3 system. Everything from process flows to the tasks of individual workers had to be changed in most of the cases. One of the companies admitted that they were not very good at processes before the R/3 implementation. They did not have any thoroughly worked out company specific processes. Therefore, establishing new work procedures that followed R/3 was not difficult for them to do.

Two of the companies did not change their processes at all in order to fit R/3. One of the companies chose to customize the modules to a great extent instead of changing the processes. The other company transferred their old processes to the new system, but soon realized that the processes in the new system had the same insufficiencies as in the old system. As this respondent said "we moved in to our new house with our old furniture".

5.2.6 Market Position Change

The Market Position has:	Number of Companies
Not been Affected by R/3	6
been Affected by R/3	1

Table 5.6: Market Position Change

A majority of the companies stated that their market positions had not been affected by the implementation of R/3. They stated that factors not related to R/3 influence the market position such as fierce competition and the nature of the industry, e.g. if the industry is cyclical or not. One of the respondent stated that it would be very difficult to prove or show that the market position of a company has been affected by the introduction of R/3.

On the other hand, one of the companies tripled its turnover during the period 1998-2001, and according to them that would not have been possible if they had kept the old systems. The R/3 system therefore did not prevent the company from growing. One of the companies indicated that it might be that it has been easier to reach new markets and to integrate new sales divisions into the company. However, this was not merely the effect of R/3, but also due to the fact that the company now has an infrastructure, in which R/3 is run, that is global. One of the companies stated that the software system support is nothing a company can compete with; the customer does not choose a company because of its software system. Therefore, they do not see any connection between the R/3 implementation and the market position.

One of the companies stated that their market position had been somewhat affected by the introduction of R/3. Due to problems when the system was implemented, many customers were lost and the company was because of this forced to increase product prices.

6. Empirical Results

In this chapter, the empirical findings of the thesis are presented. The six categories of effects most frequently related to ERP Systems in the literature are dealt with. Finally, there is a section dealing with whether or not effects have been measured.

6.1 Evaluated Categories and Aspects

The investigation shows in what way an ERP System affects the identified aspects most frequently discussed in theory. A table is compiled for each category and includes its aspects. All the tables are designed in the same way. First, we present whether there were any planned effects or not on the specific aspect, through the columns No Expectations and Planned. Each figure corresponds to the number of companies having expectations or not. When summarizing these two columns for each aspect, you will see that they will contain seven companies, which represent the responding companies within the survey. In four cases, they will only contain five companies since there are two distributing companies within the survey that cannot comment on questions regarding manufacturing. This is described later in the text.

Thereafter, the Planned effects are divided into two groups: Planned/Realized and Planned/Not Realized. When summarizing these two columns they will be equivalent to the number of companies having Planned effects. In some cases, companies have partly fulfilled their expectations and thereby placed themselves in both Planned/Realized and Planned/Not Realized columns. These cases are indicated by asterisks and commented below the specific table. Furthermore, these columns are marked with grey font and white pattern to make the table easier to read. The lasting column, Not Planned/Realized, is the one that represent how many companies that did not have any expectations on the aspect but received one(s), or had expectations but not the specific one that they experienced. Negative non-expected effects are indicated by parentheses.

6.1.1 Accounting

Effects	No Expectations	Planned	Planned/ Realized	Planned/ Not Realized	Not Planned/ Realized
Closing the Books	1	6	6		1
Forecasts	5	2		2	2
Financial Reports	5	2		2	1

Table 6.1: Accounting

Closing the Books
One company did not have any expectations on closing the books, while all other companies in this survey had. The expectations were based on the possibility to simplify and make the work with closing the books more effective. This would lead to the ability to close to book using fewer employees and fewer resources. The costs would therefore also be reduced. One thing that was also mentioned was the advantage of working in an

integrated system, since less time is spent making transactions between different systems. All seven companies have seen effects on closing the books due to their ERP System. The process has been simplified and time and costs have decreased. Two of the companies also find it easier and more convenient to summarize all figures of the companies within the group due to the ERP System.

Forecasts

Two companies had expectations on their future work with forecasts. They thought the system would make the work with forecasts more effective and make them more qualitative and accurate. None of these companies felt that they attained what they expected. They claimed that the reasons for this were primarily the complexity of the system and difficulties learning it. Two companies experienced bonus effects when working with prognoses. Due to the more effective work with closing the books, they are now able to study the figures much earlier than before, and can therefore base their prognoses on more actual data. Thus, the forecasts have become more accurate.

Financial Reports

Concerning the effects on financial reports, two companies had expectations on making it easier to receive reports from the system and that the reports would present more accurate figures. However, the complexity of the system has made it more difficult to find reports because you have to know exactly what you are asking for, and you have to have great knowledge in the area in order to understand it. One of the companies experienced an unexpected positive effect, derived from the fact that all companies in the group now use the same chart of accounts, which they find advantageous. As the respondent stated: "we will get a report that can be used as basis for the report system of the group, with better quality and content than earlier."

6.1.2 Costs

Effects	No Expectations	Planned	Planned/ Realized	Planned/ Not Realized	Not Planned/ Realized
IT Costs	5	2	1	1	1(1)
Administrative Costs	3	4	3	1	1(1)
Personnel Costs	2	5	2	3	1(1)
Sales Costs	6	1		1	1(1)
Production Costs*	4	1		1	

*The survey includes two distributing companies with little or no production. Therefore, they cannot comment on possible effects concerning production.

( ) Within these areas one or more company/ies experienced negative effects, which is indicated by the parenthesis.

Table 6.2: Costs

IT Costs

Two companies expected information technology costs to decrease. One of them justifies this with the fact that it would be cheaper to maintain one system instead of many different systems. However, information technology costs were not affected in this case. Costs for development are still high, but this does not necessarily originate from the ERP

System itself. It could instead be caused by the routines at the IT department. The other company believed that the integration would lead to the use of less hardware, which it did. One of the companies experienced a positive unexpected effect derived from the fact that the maintenance of the system is much simpler today, and resources can therefore be devoted to other areas. Another company experienced negative unexpected effects. The total cost of the implementation project turned out to be much higher than budget. This was primarily due to high consulting costs. However, they do not blame this entirely on problems related to the system, it was also a management problem.

Administrative Costs
Four companies expected administrative costs to decrease. These expectations were based on the assumption that administrative work would be more effective and stream-lined using an ERP System. Three companies did experience decreased administrative costs to a certain extent. One of these companies believed that better coordination between order, warehouse and delivery due to the ERP System was the reason for the diminished administrative costs. The fourth company experienced increased admini-strative costs due to the ERP implementation. They claimed this was due to the fact that the implementation project was poorly managed. The R/3 system was customized to fit old processes, and almost no processes were changed. This resulted in more complicated processes and need of more administrative personnel, which resulted in increased administrative costs. One of the companies experienced positive non-expected effects since the administrative work have become more efficient.

Personnel Costs
The two companies that did not have any expectations on personnel costs were the only companies that did not expect cost effects from their ERP System. Cost reductions were not the main motives for implementing the system, therefore they did not consider that possibility. The main reason for the ability to reduce personnel costs was the assumption that administrative work would be made more efficient. Five companies saw the possibility to reduce personnel costs due to the expectation that fewer people would be needed for administrative work. Two companies realized these expectations to a certain extent. Fewer people were needed to perform the same tasks. However, the main reason for the personnel reductions was the fact that when an employee retired no one was hired to do his/her job. This was also the case for the company that did not expect a cost reduction but experienced one.

Two companies did not meet their expectations regarding personnel cost reductions due to different market conditions. One company has experienced a considerable growth, which makes it difficult for them to connect personnel costs with their ERP System. The other company was forced to discharge a number of employees because of a decline in their industry. This market decline also makes it difficult to relate personnel reductions to the ERP System. One company expected reduced personnel costs, but experienced the opposite. Costs increased because of a great need for hiring additional people after imple-menting the system. Purchasing, sales and administrative departments have had some problems with the system and needed reinforcement.

Sales Costs

Only one company expected the system to help them reduce sales costs. This was due to the real time data, which would facilitate decision-making due to more updated facts and more actual information. With this information as a base, they believed that they would be able to plan their sales more accurately and thereby decrease expenses. However, this expectation was not met. This was primarily due to lack of personnel training and understanding of the system. Still, the company believes this will be achieved in a couple of years. On the other hand, one company did receive this effect. Once again, one of the companies experienced increased costs in this area as well, because of management problems when implementing the system.

Production Costs

The company, which expected reduced sales costs, also hoped for decreased production costs. The assumption was the same as for sales costs, that better decision would be made based on actual facts. These expectations were not met either, for the same reasons.

6.1.3 Manufacturing and Logistics

Effects	No Expectations	Planned	Planned/ Realized	Planned/ Not Realized	Not Planned/ Realized
Purchase Management**	2	5	3	4	(1)
Warehouse Management	2	5	5		2
Production Planning* ***	1	4	3	2	2
Product Quality*	5				
Production Flexibility*		5	5		
Order Management	1	6	4	2	

*The survey includes two distributing companies with little or no production. Therefore, they cannot comment on possible effects concerning production.
**Two of the companies both experienced planned/realized and planned/not realized effects.
***One of the companies both experienced planned/realized and planned/not realized effects.
( ) Within these areas one or more company/ies experienced negative effects, which is indicated by the parenthesis.
Table 6.3: Manufacturing and Logistics

Purchase Management

Five of the companies expected positive effects on purchase management due to a simplification and increased visibility over the purchasing process. Only one of the companies considered these expectations to be completely fulfilled. This company justified their satisfaction with increased efficiency due to automatization. Everything from purchase requests to supplier invoices is after the implementation of R/3 electronic. Two of the companies partly realized expected effects on purchase management. For one of these, expectations were fulfilled regarding purchase management of material used for manufacturing, but not regarding purchase management of other materials such as office materials. The reason for this was according to the respondent lack of user training. These two companies are categorised as both having planned/realized and planned/not realized expectations.

The two companies that were not satisfied stated that R/3 was more complicated to use than expected, and that they therefore in some cases were forced to go back to a paper based variant. One company did not have any expectations on purchase management but experienced negative effects they did not count on. They argued that it is easier to make serious mistakes than they had anticipated. For example, "if the wrong price is entered into the system during the purchasing process, the consequences can be enormous. The inventory values become incorrect, and then you try to correct it in the wrong way." However, they admit that this problem is due to lack of employee training, none the less; the problem is greater than expected.

Warehouse Management
Five of the companies had expectations on warehouse management. These expectations included the ability to consolidate the amount of warehouses, increase inventory turnover velocity, routine simplification and increased quality of inventory inspections. All of these companies considered their expectations to be fulfilled. Two of the companies experienced positive non-expected effects, the possibility to standardize entire document flows and better inventory quality inspections.

Production Planning
Four of the companies expected effects on production planning. These expectations were mainly the ability to forecast purchase, production and inventory levels and also to improve visibility of the production plan. Two of the companies regarded their expectations to be met. One company expected the production to be more focused on customer orders. This was only partly achieved. The reason for this was that the change was too extensive and the organisation did not manage to adjust in this case. Moreover, the machines used in the manufacturing could not be adopted to work only after customer orders. One company had some hopes on reducing the number of employees working with production planning by automizing the flow. However, this turned out not to be possible. This was primarily due to employee resistance. Since the expectation was to decrease the number of personnel, and the employees knew this, they operate the system in a way so that it does not function as it is designed to in order to make sure that their work is still needed. Two companies experienced an effect they did not expect. This effect was the ability to make improved simulations.

Product Quality
None of the companies expected effects on product quality, and none of them experienced effects either.

Production Flexibility
Five of the companies expected effects on production flexibility. One of the expected effects was, due to shorter lead times, the ability to quickly adjust the production to changed demand. Another planned effect was increased visibility, which would result in increased production flexibility. All of the companies fulfilled their expectations.

Order Management

Six of the companies expected effects on order management. These expectations included simplified order management due to integration between sales offices, online order confirmation and the benefit of working in only one system. One company also expected decreased time and costs for order management, which after five years was realized.

Four of the companies considered their expectations to be fulfilled, while two of them did not. The companies that were not satisfied stated that it was now more complicated for the order receiver to register an order, more different steps have to be made in the R/3 system than in previous systems.

6.1.4 Customer and Supplier Relations

Effects	No Expectations	Planned	Planned/ Realized	Planned/ Not Realized	Not Planned/ Realized
Delivery Precision	4	3	1	2	
Customer Relations****	6	1	1		3
Customer Service	6	1	1		2
Supplier Relations	7				1

****One company both stated planned/realized effects and not planned/realized effects.
Table 6.4: Customer and Supplier Relations

Delivery Precision

Three companies expected effects on delivery precision. One company had the expectation that delivery precision would be improved, and these expectations were realised. Once the company learned how R/3 worked delivery precision improved considerably. One of these companies had great expectations on improving delivery precision and simplifying delivery management, but these expectations were not realised. This was due to problems with the chosen module that supported deliveries. This module was only used for one week because the problems were so severe that another, less advanced module, was chosen instead. Another company had great expectations on improved delivery precision and these expectations were realised. However, they argue that the improvement was not due to R/3, but due to improved processes and an increased focus on delivery precision. Therefore, this company has been categorised as experiencing planned but not realized effects.

One of the companies had no expectations on delivery precision but experienced positive effects on delivery precision. However, they do not believe that this can be traced back to R/3. Therefore, this company is not categorised as experiencing not planned but realized effects due to R/3.

Customer Relations

One company expected R/3 to improve customer relations since R/3 is more flexible than the legacy system and would enable sales personnel to handle discounts and price agreements more easily, which was realized. This company also stated non-expected positive effects due to R/3 such as fewer price errors, higher quality of data and higher quality of order flow. Two additional companies experienced non-expected positive

effects due to the ERP System. One of these companies indicated that R/3 supports electronic suborders and electronic invoicing, which has simplified order management for customers. The other company stated that customer relations had improved due to faster order management, faster delivery, more accurate information to customers, and more efficient routines.

Customer Service
One of the companies expected ERP to improve customer service, primarily regarding the compilation of reports and statistics that customers demand. These expectations were realised. However, this was not the result of R/3 alone, other factors also influenced this result.

Two companies saw non-expected improvements due to the ERP System. One of these companies stated that the improvements were due to easier access to information for all employees that resulted in the fact that all employees were able to answer questions about prices, not only sales personnel. In general customers have become less dependent on specific sales persons since information is accessible to all employees in the R/3 system.

Supplier Relations
None of the companies had any expectations regarding supplier relations. However, one of the companies experienced positive non-expected effects on supplier relations in the same way as regarding customer relations, as noted above.

6.1.5 Information Management

Effects	No Expectations	Planned	Planned/ Realized	Planned/ Not Realized	Not Planned/ Realized
Information Flow	7				
Availability of Information	6	1	1		(3)
Content of Information	5	2	2		1(2)
Data for Decision Making	6	1	1		2

( ) Within these areas one or more company/ies experienced negative effects, which is indicated by the parenthesis.
Table 6.5: Information Management

Information Flow
None of the companies had any expectations regarding information flow, and none of them experienced any effects in this area.

Availability of Information
One company saw the opportunity of being able to increase the availability of information for employees, and also experienced this effect. The information in the system is always available for anyone who has got access to it. This fact has made it easier when doing business, because the necessary information is always available in your lap top, no matter where you are. Three companies have experienced negative

unplanned effects in this area, and refer to the complexity of the system, which makes it difficult to find the sought-after information.

Content of Information
The planned effects regarding the content of information were for two companies the possibility to receive right and accurate data at any time. The effects in this case were better quality of data and therefore more reliable information, as long as users are willing to learn the system. Companies have experienced both positive and negative unplanned effects in this area. Two companies experienced negative effects, due to the fact that mistakes are easily spread throughout the system. When typing wrong figures, this will spread through the entire system and result in misleading data. However, one company turned the complexity of the system into something positive, and claimed that it only makes you work with the information you know how to find and are familiar with. "I think that is a good thing, you should only use the information you need."

Data for Decision-making
Only one company had expectations on receiving better basic data for decision-making. The time required for this process is unchanged, but the information available is more accurate, even though the company refers to difficulties finding the right information. The two companies that experienced non-expected effects in this area refer to improved data quality leading to improved decision-making. Additionally, one company claimed to have better data for decision making nowadays, but "that did not derive from R/3, but the process..."

6.1.6 Organisation and Culture

Effects	No Expectations	Planned	Planned/ Realized	Planned/ Not Realized	Not planned/ Realized
Centralisation	5	2	1	1	3
Responsibility	5	2	2		2
Work Routines	5	2	2		1

Table 6.6: Organisation and Culture

Centralisation
Two companies had expectations on the ERP System regarding centralisation. One of these companies expected the mother company to gain more control over its subsidiaries, using a common ERP System. In the other company, the expectation with centralisation and ERP was related to making companies within the organisation less independent and to standardise processes within the system. Whether or not the first company had become more centralised was not clear to the respondent. The respondent therefore argued that centralisation had not been affected. The respondent stated no reasons for this failure. In the other company, there was a strong feeling of increased centralisation due to the fact that decision-making was partly moved to the head office. Three companies did not expect a shift towards centralisation, but felt this shift in the form of less independence. One of the respondents said: "to move from a very decentralised organisation, where

decision-making is delegated down in the hierarchy…. And then, suddenly, you move to a very centralised world."

Responsibilities
One of the companies that expected changes regarding responsibilities did not have a comprehension in what way this would change, only that it would. The other company had great expectations on giving responsibility concerning their IT-Systems to more people, than just those few who had developed the old systems. The responsibility for the IT-System was passed on to SAP consultants, something the company believed was better than relying on individual persons. The first company mentioned began to work in processes and responsibilities were transferred to so called process owners. Two companies experienced non-expected changes of responsibilities. One of these did not anticipate a shift of responsibility concerning the IT-System, and the other one experienced this shift in a more centralised organisation.

Work Routines
Due to changes of processes when implementing the system, two companies knew that they were going to experience changes of work routines as well. One of them also referred to the centralisation as a reason for changes of work routines. Some tasks that were performed locally pre-ERP were performed on a central level afterwards. This change was also experienced in another company where a central organisation manages basic data, new accounts, new articles and changes processes. This was performed on a local level pre-ERP.

6.2 Measurement
In order to question the credibility of the realized and not realized effects, the respondents were asked whether the effects have been measured or not.

6.2.1 Measurement of Effects

Effects have:	Number of Companies
Not been Measured	5
Partly been Measured	2

Table 6.7: Measurement of Effects

Reasons for not Measuring	Number of Companies
Too Difficult to Measure	3
The Company/Environment has Changed	2

Table 6.8: Reasons for not Measuring

Effects have not been Measured
Five of the companies have not measured the effects of R/3, i.e. measures have not been made before the implementation and then compared with measures taken after the implementation. Three of the companies stated that measuring would be too difficult. Two of the companies stated that measuring would be pointless because the company and/or the environment had changed considerably since the implementation. One of these

companies argued, that measuring in itself is not complicated, since the processes that are measured are very simple. This respondent also indicated that the investment primarily rested on information technology rationalisations, therefore measuring other rationalisations was not interesting. Another company argued that the R/3 implementation was a strategic investment, they were becoming too large to have a system built in-house and needed an integrated system, no matter the consequences.

One of the companies argued that it would be very difficult to make an evaluation because it would probably be opinions rather than facts. They also stated that a comparison between old and new measures would not have been possible, since they could not rely on the data in the legacy system. Another company indicated that it is very difficult to isolate effects and say that this change is due to R/3 and nothing else. Moreover, the question of measuring was not raised at the time of the implementation. However, if the implementation had been made today, the respondent states that they would probably consider questions such as: what is it we want to do? Which parameters should we measure? How do customers feel they are served? How long does it take to handle an order? Another company argued that besides from measuring being difficult, companies do not measure effects because the effects may not be what they anticipated. Moreover, there is no turning back or lessons to learn, software systems are only changed every ten to fifteen years. They also believed that effects are not generally evaluated.

Effects have Partly been Measured
Two of the companies had partly evaluated the system. One of these companies had only evaluated R/3 regarding logistics. This company had a logistics project that coincided with the R/3 implementation, and were therefore focused on logistics. Other aspects were not measured and they felt no need to measure anything else either. The R/3 project was mainly focused on creating a platform on which the company could develop. The other company stated that: "In these chairs there have been consultants from [different consulting firms] and they have all been given the same question: Can you help me calculate the effects of an R/3 project? No, no one can!" According to this respondent, all companies make calculations before an ERP project, but there is no tool that actually works when it comes to evaluating the effects after the implementation. This company takes the value added of the company as the starting point of the evaluation and makes the assumption that 20% of the value added is due to streamlining related to the R/3 implementation. In order to confirm their assumptions they take random samples. However, they do not measure the effects of R/3 on each aspect within the identified categories, only the monetary savings due to R/3 is measured. It is considered to be too much work to measure the individual effects on each aspect.

6.3 Summary of Effects

The effects in the seven companies are summarized in table 17 below. This is done in order to make it easier for the reader to get an overview of the answers of the respondents.

Effects	No Expectations	Planned	Planned/ Realized	Planned/ Not Realized	Not Planned/ Realized
Accounting					
Closing the Books	1	6	6		1
Forecasts	5	2		2	2
Financial Reports	5	2		2	1
Costs					
IT Costs	5	2	1	1	1(1)
Administrative Costs	3	4	3	1	1(1)
Personnel Costs	2	5	2	3	1(1)
Sales Costs	6	1		1	1(1)
Production Costs*	4	1		1	
Manufacturing and Logistics					
Purchase Management**	2	5	3	4	(1)
Warehouse Management	2	5	5		2
Production Planning* ***	1	4	3	2	2
Product Quality*	5				
Production Flexibility*		5	5		
Order Management	1	6	4	2	
Customer and Supplier Relations					
Delivery Precision	4	3	1	2	
Customer Relations****	6	1	1		3
Customer Service	6	1	1		2
Supplier Relations	7				1
Information Management					
Information Flow	7				
Availability of Information	6	1	1		(3)
Content of Information	5	2	2		1(2)
Data for Decision Making	6	1	1		2
Organisation and Culture					
Centralisation	5	2	1	1	3
Responsibility	5	2	2		2
Work Routines	5	2	2		1

*The survey includes two distributing companies with little or no production. Therefore, they cannot comment on possible effects regarding production.

**Two of the companies both experienced planned/realized and planned/not realized effects.

***One of the companies both experienced planned/realized and planned/not realized effects.

**** One company both stated planned/realized effects and not planned/realized effects.

() Within these areas one or more company/ies experienced negative effects, which is indicated by the parenthesis.

Table 6.9: Summary of Effects

7. Analysis

In this chapter the empirical findings are analyzed, i.e. how the categories most frequently pointed out in theory regarding ERP effects actually are affected in practice. First, we discuss the congruence of theory and practice. Moreover, the effects that were planned by a majority of the companies are determined. After this, these planned effects are discussed on the basis of whether or not they are realized in practice. Furthermore, ERP effects that have emerged but were not planned are also commented. The chapter is terminated with a discussion of negative effects and measurement of effects.

7.1 Categories and Aspects in Theory and Practice

In this section we will compare how well theory and practice agree when it comes to ERP effects on the categories and aspects identified in the literature. This comparison is made on the basis of the expectations and planned effects of the responding companies.

Our study shows that the categories pointed out in theory as being affected by an ERP System, *Accounting, Costs, Manufacturing and Logistics, Customer and Supplier Relations, Information Management and Organisation and Culture,* are also the areas where the companies have expectations on the system. However, the expectations vary both between and within the categories. The category on which the greatest number of companies had planned effects is *Manufacturing and Logistics*, which is also pointed out in theory as being important. The study shows that this is an important category for the responding companies and it seems to be the area were the companies intended to achieve most improvements.

As presented in the study, each category includes a number of aspects. The investigation shows that the importance of each aspect within a category differs between theory and practice. In theory, the aspects are given equal importance, which is not the case at the participating companies. In the category *Accounting,* the empirical data shows that Closing the Books is the aspect on which a majority of the responding companies had expectations. Our data indicates that this is due to the integrated nature of an ERP System and the fact that information is automatically updated and based on real time data. Moreover, closing the accounts may have a high priority in the companies. When it comes to Forecasts and Financial Reports, only a minority of the companies expected effects.

In the category *Costs*, a majority of the companies expected effects on Administrative Costs and Personnel Costs. This was primarily due to the assumption that administrative work would be more effective and streamlined using an ERP System. This results in lower administrative costs. The companies also saw the opportunity to reduce personnel costs based on the assumption that administrative work would be made more efficient. These effects can also be connected to improvements of the aspect Closing the Books, and to be able to close the accounts using less personnel. Only a minority of the com-

panies expected effects on IT Costs, Sales Costs and Production Costs. It is interesting to note that effects on IT costs were hardly expected, since decreased IT costs due to integration and less need of maintenance, are clearly pointed out in the ERP literature. Moreover, only one of the companies expected effects on Production Costs, which is also clearly stated in theory as being affected by ERP. We find the low expectations on Production Costs remarkable since all aspects within the category Manufacturing and Logistics related to production, except for Product Quality, were planned to be affected. Since most of the aspects related to production were expected to be affected, Production Costs ought to be affected as well.

In the category *Manufacturing and Logistics*, a majority of the companies expected effects on five out of six aspects; Purchase Management, Warehouse Management, Production Planning, Production Flexibility and Order Management. As noted above, this was the category on which the companies had greatest expectations. The companies saw the possibility to make processes more efficient within this category, because of the integrated nature of an ERP System, which may result in improved visibility and increased automatization. However, as mentioned above, none of the companies expected effects on Product Quality.

The categories where the companies in general had least expectations are *Customer and Supplier Relations, Information Management and Organisation and Culture*. Within the category *Customer and Supplier Relations*, only a minority of the companies expected effects on Delivery Precision, Customer Relations and Customer Service, while none of the companies expected effects on Supplier Relations.

In the category *Information Management*, a minority of the companies had expectations on Availability of Information, Content of Information and Data for Decision Making, while none of the companies had expectations regarding the aspect Information Flow. We believe this is surprising, since ERP Systems after all are Information Technology Systems. However, the study does not provide any explanation for these findings.

Within the category *Organisation and Culture*, only a minority of the companies had expectations on the aspects pointed out in theory, Centralisation, Responsibility and Work Routines.

Regarding those aspects where the companies had none or few expectations, we believe that this may be due to several reasons that have not come to light during the interviews. One possible explanation may be the fact that the companies have not given priority to these aspects in the use of the ERP System or that they are not important for the companies at all. The use of parallel systems may also be a reason for not prioritizing aspects. Furthermore, the companies have to focus on some chosen areas in the beginning, and the other aspects may be considered as less important at that time. The study shows that the companies focus on core business, i.e. tangible aspects that are more easily noticeable than intangible aspects. Moreover, Manufacturing and Logistics is the category that is most related to profitability. An ERP System may also not be considered to be a traditional IT System, but a more production related system.

To summarise, the following aspects were the aspects on which a majority of the responding companies had expectations. Thereby, theory and practice agree in these cases:

- Closing the Books
- Administrative Costs
- Personnel Costs
- Purchase Management
- Warehouse Management
- Production Planning
- Production flexibility
- Order Management

7.2 Planned Effects that were Realized

In this section, we will discuss to what extent the effects that were planned by a majority of the companies were realized in practice. Table 18 shows the aspects that were planned to be affected and how many companies that achieved planned effects. Planned effects that were not realized are discussed in section 7.3.

Effects	Planned	Planned/ Realized
Accounting		
Closing the Books	6	6
Costs		
Administrative Costs	4	3
Personnel Costs	5	2
Manufacturing and Logistics		
Purchase Management	5	3
Warehouse Management	5	5
Production Planning*	4	3
Production Flexibility*	5	5
Order Management	6	4

*The survey includes two distributing companies with little or no manu-
facturing. Therefore, they cannot comment on possible effects regarding
manufacturing.
Table 7.1: Planned Effects that were Realized

A majority of the responding companies planned effects on aspects within the categories Accounting, Costs and Manufacturing and Logistics. In general, the companies have succeeded to realize planned effects to a great extent. The only aspect that was not realized by a majority of the companies that planned effects on the aspect is Personnel Costs, which is discussed in the following section. The two companies that realized planned effects of Personnel Costs stated that fewer people were needed to perform the same tasks so when an employee retired no one was hired to do his or her job.

The aspects where all of the companies that planned effects realized these effects are: Closing the Books, Warehouse Management and Production Flexibility. When it comes to Closing the Books the companies have experienced a simplified process as well as time and costs reductions. Regarding Warehouse Management, the companies succeeded to consolidate the amount of warehouses, increase inventory turnover velocity, simplify routines and increase inventory quality inspections. When it comes to Production Flexibility the companies experienced streamlined manufacturing, which resulted in shorter lead times and the ability to quickly adjust the production to changed demand.

The ERP System has brought better co-ordination between order, warehouse and delivery, which resulted in decreased Administrative Costs for three companies. When it comes to Purchase Management, three out of five companies experienced increased efficiency due to the automatization derived from an ERP System. Three out of four companies realized planned effects regarding Production Planning. The companies that realized effects stated that it is now easier to forecast purchase, production and inventory levels. The system also improved visibility of the production plan. Regarding Order Management, the companies that realized planned effects experienced a simplified order process due to integration between sales offices, online order confirmation and the benefits of working in only one system.

The fact that the companies have succeeded to realize planned effects indicates that the companies have focused on these aspects and worked hard to achieve them. The work with process redesign may have been more focused within these aspects in comparison to remaining aspects.

7.3 Planned Effects that were not Realized

In this section we will discuss the effects that were planned by a majority of the companies but were not realized in practice for those expecting it.

Effects	Planned	Planned/ Not Realized
Accounting		
Closing the Books	6	0
Costs		
Administrative Costs	4	1
Personnel Costs	5	3
Manufacturing and Logistics		
Purchase Management	5	2
Warehouse Management	5	0
Production Planning*	4	1
Production Flexibility*	5	0
Order Management	6	2

*This survey includes two distributing companies with little or no manufacturing. Therefore, they cannot comment on possible effects regarding manufacturing.

Table 7.2: Planned Effects that were not Realized

Table 19 shows that Personnel Costs was the only one of the planned aspects that was not realized by a majority of the responding companies. One of the companies experienced increased personnel costs due to the need of hiring additional personnel to handle the system. Two of the companies that did not realize the planned effects regarding Personnel Costs stated that this was due to different market conditions. One of them experienced rapid growth, and was forced to hire personnel. The other company experienced a decline in the industry, and was forced to fire personnel. Therefore, none of these companies can connect any reduction of personnel costs to the ERP System. One of the companies increased Administrative Costs due to the need of hiring additional administrative personnel.

Two out of five companies that planned effects on Purchase Management stated that the R/3 system made the purchasing process more complicated than expected. The company that did not realize planned effects within Production Planning expected to decrease the number of employees working with production planning by the automization of the flow. This turned out not to be possible due to employee resistance. The two companies that did not realize effects regarding Order Management stated that the R/3 system made it more complicated to register an order and more different steps had to be taken than in previous systems.

In the study, it has been shown that lack of system knowledge and not sufficient resources devoted to user training are the most commonly stated reasons for not achieving planned effects. The companies stated that problems with the system essentially are due to poorly managed implementation projects or that they have underestimated what is necessary when conducting an implementation of this kind. There may be a number of additional explanations for not achieving planned effects, for example difficulties using the system, too complex system and resistance to change. Other reasons for not achieving expected effects are external factors such as company growth or industry crisis.

7.4 Not Planned Effects that were Realized

It is interesting to note that companies also have experienced effects from the ERP System that were not planned. The unexpected effects were for example less independence for business units derived from increased centralisation and control due to the system, as well as improved customer relations. The companies may have been aware of the fact that these aspects can be affected by an ERP System, but the companies did not plan effects regarding these aspects. Another reason for the fact that the responding companies overlooked effects may be the difficulty to predict all possible effects due to an ERP System since these systems may potentially affect all processes and all information flowing through a company. What is also important to mention is the fact that the companies did not know the system and did not know beforehand the possibilities the system may bring.

In general, the study shows that the integrated nature of an ERP System, the automatic updating of information and the real time data are the main reasons for unexpected effects. This is what the companies stated regarding the aspects in the categories

Accounting, Costs, Manufacturing and Logistics, Customer and Supplier Relations and Information Management, shown in table 20. Regarding the category Organisation and Culture, some of the respondents stated that organisational and cultural effects due to ERP Systems are often overlooked.

Effects	Not Planned/ Realized
Accounting	
Closing the Books	1
Forecasts	2
Financial Reports	1
Costs	
IT Costs	1(1)
Administrative Costs	1(1)
Personnel Costs	1(1)
Sales Costs	1(1)
Manufacturing and Logistics	
Purchase Management	(1)
Warehouse Management	2
Production Planning	2
Customer and Supplier Relations	
Customer Relations	3
Customer Service	2
Supplier Relations	1
Information Management	
Content of Information	1(2)
Data for Decision Making	2
Organisation and Culture	
Centralisation	3
Responsibility	2
Work Routines	1

( )Within these areas one or more company/ies experienced negative effects, which is indicated by the parenthesis.
Table 7.3: Not Planned Effects that were Realized

7.5 Negative Effects

The negative effects experienced by some of the companies are the effects that have earlier been presented within parentheses in the tables.

Effects	Negative Effects
Costs	
IT Costs	1
Administrative Costs	1
Personnel Costs	1
Sales Costs	1
Manufacturing and Logistics	
Purchase Management	1
Information Management	
Availability of Information	3
Content of Information	2

Table 7.4: Negative Effects

One company experienced negative effects regarding IT Costs, Administrative Costs, Personnel Costs and Sales Costs. The respondent/s explains this with problems when implementing and using the system, and stated that the implementation project was poorly managed. This was also the company that made more than 500 customizations of the system, which may explain the increased costs and difficulties since customizations are not recommended by SAP or by the ERP literature. The company's IT Costs rose due to the fact that the total implementation project turned out to be much more expensive than budget, derived from high consultant costs and after the implementation increased maintenance costs and problems when upgrading. Because of the complexity and insufficient user training, there was a need for hiring additional personnel regarding for example administrative work, and costs within this aspect as well as Personnel Costs and Sales Costs thereby increased. The company that experienced negative effects concerning Purchase Management find it easier to make serious mistakes, since errors spread throughout the integrated system.

It is noteworthy that some of the companies have experienced negative effects concerning Information Management, since an ERP System after all is an information system. Three companies saw negative effects regarding the Availability of Information. They all refer to the complexity of the system and find it hard to reach the sought-after information. Moreover, two companies experienced the fact that mistakes spread easily through the system. If wrong figures are entered into the system they will spread and result in misleading data.

In general, the companies view R/3 as a complex system that is difficult to learn. It is also difficult to find the information that the system comprises. The comprehension that we received from the respondents is that some problems occurred at the time of the implementation. This may be due to a number of reasons. Some of the responding com-

panies state that there may not have been sufficient understanding of the need to change systems among the employees. Therefore, there may have been resistance against the implementation of the system. Poor leadership may also result in difficulties, likewise insufficient training in using the system according to the responding companies.

7.6 Measurement

Measuring	Number of Companies
Effects have not been measured	5
Effects have partly been measured	2

Table 7.5: Measurement of Effects

Reasons for not measuring	Number of Companies
Too difficult to measure	3
The company/environment has changed	2

Table 7.6: Reasons for not Measuring

In order to question the credibility of the realized and not realized effects, the respondents were asked whether the effects have been measured or not. As the question regarding measurement of ERP effects reveals, it is rather uncertain whether or not the companies actually have realized any effects since only two companies have attempted to measure effects. Thus, this question shows the uncertainty as to what effects that have been realized and if effects are due to the ERP System or not. However, we believe that the respondents are able to estimate effects of an ERP System to a certain extent without having to measure. Since the respondents have worked within the organisations pre-ERP, during the implementation and after the implementation was completed, the respondents are able to trust their gut feeling and measurement may not be needed. Still, it is important to note that effects of ERP have not been secured in the organisations included in the thesis. However, as the respondents have stated, measuring effects can be very difficult, or even prove to be impossible, if the external environment or the organisation has changed considerably.

8. Conclusions and Reflections

In the final chapter we return to the research question of the thesis. The conclusions drawn from the study are presented. We end this section with suggestions for further research.

8.1 Conclusions

In order to be able to answer the research question: *To what extent do ERP Systems in practice achieve the effects that are most frequently related to such systems in theory*, we have examined theory on the subject, made an empirical study and thereafter compared these two sources of data. This is done in order to determine to what extent these sources of data agree.

The study shows that all of the identified categories from the ERP literature are also the categories taken into consideration within the responding companies. However, within each category, the importance of the aspects varies in practice in comparison to theory where the aspects in general are given equal emphasis. Some effects pointed out in theory are not planned at all and some are planned in almost all of the seven companies. The aspects that were planned to be affected by the ERP implementation by a majority of the companies were: Closing the Books, Administrative Costs, Personnel Costs, Purchase Management, Warehouse Management, Production Planning, Production flexibility and Order Management.

The empirical study shows that the responding companies did not strive for all of the effects that are clearly pointed in theory as being the result of an ERP System. This indicates that all of the aspects pointed out in the literature are not considered equally important in practice. However, the study shows that the differences between theory and practice are not as significant so that the literature can be considered to be exaggerated or misleading.

When it comes to the aspects where a majority of the companies had expectations it was clear that the greatest expectations concerned the category Manufacturing and Logistics. The majority of the companies that expected effects within these areas also achieved to realize expected effects in practice. Moreover, the aspect Closing the Books in the category Accounting as well as the aspect Administrative Costs in the category Costs were affected by the ERP, in a majority of the companies that expected effects in these areas. Therefore, as we see it, implementing a system is not enough, companies also have to work with the system and know how to use it in order to achieve effects.

All ERP effects that were planned by the responding companies were not realized in practice. The one aspect that was planned by a majority of the companies but not realized by a majority of the companies expecting to do so was Personnel Costs. In general, the study shows that lack of system knowledge and not sufficient resources devoted to user

training are the most commonly stated reasons for not achieving planned effects. Regarding the aspects where the companies had not seen effects, we cannot for sure say that theory is wrong and that the ERP System does not affect these areas. Instead, it may be due to the fact that some effects may take much more longer time than others before they are visible.

When it comes to effects that were not planned but realized some companies experienced bonus effects that they did not expect. This may be due to the integrated nature of the system that is integrating all processes and functions within an organisation. Another reason may be that the companies did not know the potential of the system i.e. what effects they might expect. Moreover, the companies may not have planned the effects at first, but have worked with the aspect at a later stage and therefore achieved effects.

Some of the companies experienced negative effects from the system such as increased costs and difficulties finding desired information. The main reason for these negative effects are according to the responding companies the complexity of the system, which makes it difficult both to learn and to use.

8.2 Suggestions for further research

We believe that this survey may increase the awareness of ERP effects. Companies that are in a situation when deciding whether or not going ERP, may benefit from the result of the study. Since there is no survey that has listed the aspects most frequently pointed out in theory, and thereafter investigated these in a number of companies, we believe we have laid the foundation to a new research area within the subject. We believe that this study may function as a starting point in further research.

Our first suggestion to further research is to conduct a case study of one or two companies and make a more thorough investigation of planned/not planned effects, realized/not realized effects, and also examine the implementation project and its effects on the outcome of the ERP investment.

We also consider it would be interesting to broaden the study, investigating a large number of companies, so that statistical generalisations can be made. In this case, we believe that a standardised questionnaire with fixed answers ought to be used. This methodology also makes it possible to take more factors into consideration, such as industry and company size.

Appendix 1: SAP and R/3

Since we have chosen only to include SAP´s R/3 system in this thesis, we will take a closer look at the vendor and the system.

SAP

SAP is headquartered in Walldorf, Germany, and was founded in 1972 by five former IBM systems engineers. Today, SAP employs almost 29 000 people in more than 50 countries. The company is ranked as the world's third largest independent software provider as well as the largest ERP vendor, which makes SAP one of the world's leading providers of collaborative business solutions. The market share for ERP held by SAP is estimated to between 30 to 60%.[81] More than 60,000 installations have been made and SAP also serves 10 million users at 19,300 organisations in 120 countries across the world[82]. SAP´s first solution R/1 was introduced in 1973. R/1 was followed by R/2, the mainframe version, in 1979. In 1992 the client/server-based R/3 was introduced, which was SAP´s first ERP System.[83]

R/3

ERP Systems may include a wide range of functionality. The components of such systems are often referred to as modules. Among the different packages available, there is some variance regarding which modules that are included and how they are named. SAP´s R/3 includes the following modules:[84]

❑ **FI** (Financial Accounting). This module includes general ledger, accounts receivable, accounts payable and legal consolidations.

❑ **CO** (Controlling). This module includes cost center accounting, product cost controlling and activity-based costing.

❑ **AM** (Fixed Asset Management). This module captures information regarding insurance, property value and depreciation of fixed assets.

❑ **PS** (Project System). This module captures information relating to projects, and includes project tracking and project budget management.

❑ **WF** (Work Flow). This module captures information relating to work flows.

❑ **IS** (Industry Solution). This module includes industry specific solutions. SAP offers industry solutions with in-depth functionality for 21 business groups, including for example, aerospace and defence, chemicals and consumer products.[85]

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[81] O´Leary, 2000
[82] www.sap.com, 2003-03-10
[83] Ibid.
[84] O´Leary, 2000
[85] SAP Annual Report 2001

❏ **HR** (Human Resources). This module captures information relating to personnel, and includes personnel administration , planning and development.

❏ **PM** (Plant Maintenance). This module includes maintenance of equipment and technical objects, preventive maintenance, service management and maintenance order management.

❏ **QM** (Quality management). This module includes quality certificates, inspection processing, planning tools and quality notifications.

❏ **PP** (Production Planning). This module includes sales and operations planning, materials requirements planning and capacity requirements planning.

❏ **MM** (Materials Management). This module includes inventory management, invoice verification and warehouse management.

❏ **SD** (Sales and Distribution). This module includes sales and distribution systems.
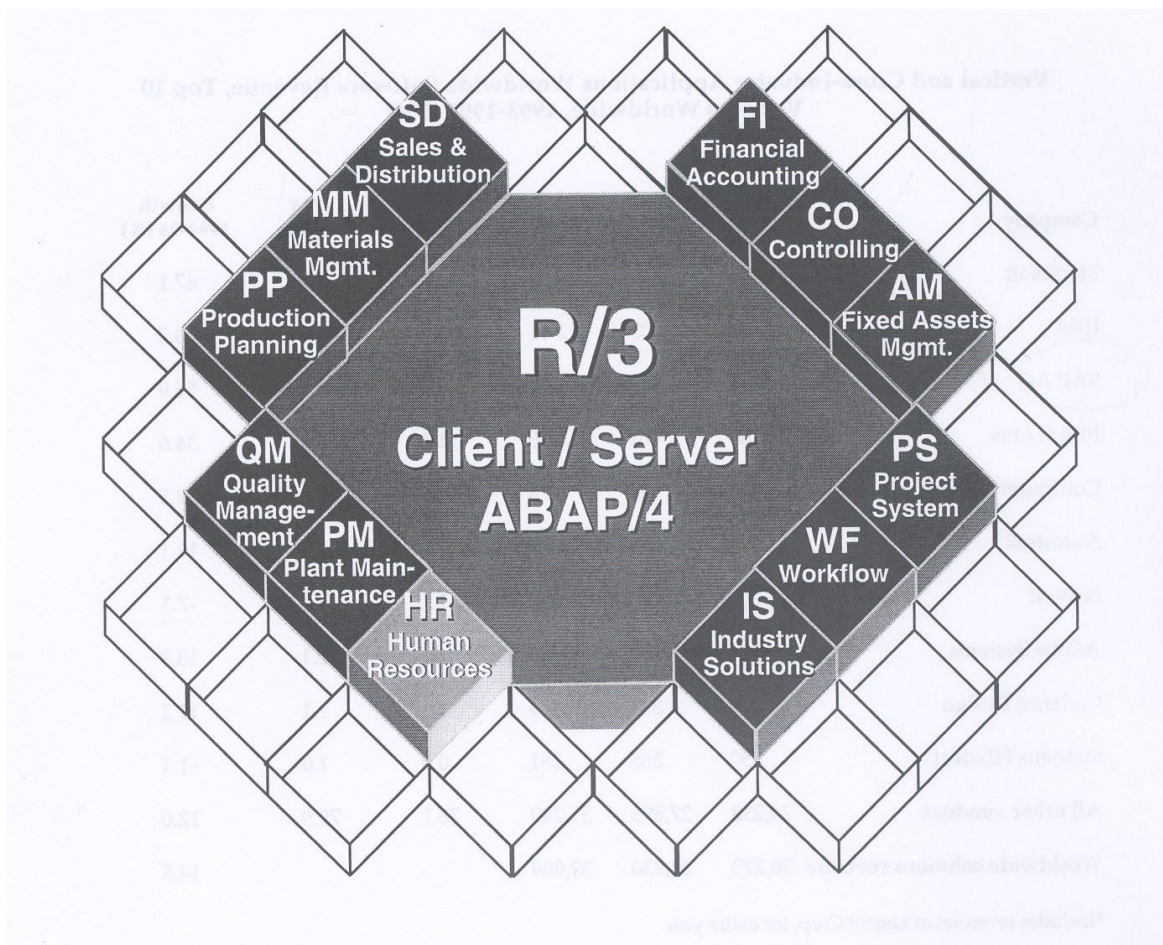

Figure A.1: SAP R/3 Modules

Packages software often comes in different versions, where new versions generally have greater functionality than older versions. This is also the case of SAP R/3. New features and functionality are incorporated into the software as a part of its evolution. This evolution carries both advantages and disadvantages to ERP software customers. The advantages include the elimination of bugs and the incorporation of new features and functionality. The disadvantages include the costs of upgrading and the risk of potential conflicts between different versions of the software. Since the introduction of R/3, there have been a number of versions of the software including 3.0, 3.1, 4.0, 4.5 and 4.6.[86]

The scope of R/3
As stated in previous sections, an ERP System enables an organisation to integrate all data that is used in the entire organisation. Davenport (1998) lists some of the many functions supported by SAP´s R/3 package

Financials	*Operations and Logistics*
Accounts receivable and payable	Inventory management
Asset accounting	Material requirements planning
Cash management and forecasting	Materials management
Asset accounting	Plant maintenance
Cash management and forecasting	Production planning
Cost-element and cost-center accounting	Project management
Executive information system	Purchasing
Financial consolidation	Quality management
General ledger	Routing management
Product-cost accounting	Shipping
Profitability analysis	Vendor evaluation
Profit-center accounting	
Standard and period-related costing	
Human Resources	*Sales and Marketing*
Human-resources time accounting	Order management
Payroll	Pricing
Personnel planning	Sales management
Travel expenses	Sales planning

Figure A.2: The Scope of an ERP System
Adapted from Davenport (1998), p. 122

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[86] O´Leary, 2000

Appendix 2: Glossary

- Customer Relationship Management (CRM)

Customer Relationship Management is a concept that covers every aspect within customer relations[87].

- Data Warehousing

A data warehouse is a single place located across an enterprise's networks where any user can get the latest data, efficiently organized. It functions as a large repository of data and includes several years of transaction data. Data warehousing is the concept of using a data warehouse.[88]

- Supply Chain Management (SCM)

Supply Chain Management is a concept that covers "every aspect of corporate supply chain processes, starting from the production of raw materials to establishing relationships with the customers"[89].

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[87] Yen et al, 2002
[88] O'Leary, 2000
[89] Yen et al, 2002, p. 342

Appendix 3: Questionnaire

The Respondent(s)
- Name
- Title and tasks
- Number of years in the company

1. Background
- When did the ERP implementation start?
- In what phase are you now?
- Which modules have been implemented?

- What were the motives of the ERP investment?
- What were the motives for implementing the chosen modules, i.e. were the modules chosen to support a specific strategy?
- What were the motives for not implementing specific modules?
- Have the modules been customised?
- Have company processes been changed in order to fit the ERP System?
- Have the market position of the company been affected by the ERP implementation?

2. Identified Categories and Aspects
These are the categories and aspects that are generally affected by ERP implementations, and that are most frequently pointed out in theory. Within each aspect we would like the respondent to answer the following questions:

- What were the planned/expected effects?
- Which of the planned effects have been realized?
- Which planned effects have not been realized?
- What non-planned effects have been realized?

Accounting
- Closing the Books.
- Forecasts
- Financial Reports

Costs
- IT Costs
- Administrative Costs
- Personnel Costs
- Sales Costs
- Production Costs

Manufacturing and Logistics
- Purchase Management
- Warehouse Management
- Production Planning
- Product Quality
- Production Flexibility
- Order Management

Customer and Supplier Relations
- Delivery Precision
- Customer Relations
- Supplier Relations
- Customer Service

Information Management
- Information Flow
- Availability of Information
- Content of Information
- Data for Decision Making

Organisation and Culture
- Centralisation
- Responsibility
- Work Routines

3. Measuring
In order to question the credibility of the realized and not realized effects, we want to ask whether the effects have been measured or not.

- If, and in that case how, do you measure/secure the effects on the identified categories?
- If no measurement is made, what is the reason for this?

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