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Enterprise systems: choosing the right IT strategy
A comparison of ERP and EAI

Abstract

With a history of adaptation to market changes, systems environments in organisations have often been updated at separate occasions and for different purposes. As a result companies today may have a wide range of legacy information systems, badly conformed to achieve integration and to make processes more efficient. A way to improve the situation may be to develop a clearer IT strategy.

This thesis concerned the IT strategies of implementing an enterprise system. Two strategies, ERP and EAI, were chosen and evaluated. A real world situation, where an organisation was on the verge of implementing an enterprise system, was described. The real world situation was then analysed on the basis of the evaluation of enterprise systems. A conclusion was reached as to which IT strategy was considered to be better suited in the situation. The thesis concluded that an EAI strategy would be better suited in the particular case even though historical circumstances may promote the implementation of ERP.

Keywords: IT strategy, ERP, EAI, Enterprise systems, Legacy information systems

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Master thesis, 20 credits

Table of contents

Index of figures

Index of tables

Definitions

The following list contains a number of concepts often used in the thesis. There is a need to clearly define concepts to avoid misinterpretations during the reading. Some definitions are more or less generally accepted, while others are derived from specific notions.

Enterprise systems In the thesis, an enterprise system is referred to an enterprise-wide information system that supports the processes of an organisation. According to Davenport the following could be said about the concept: *An enterprise system enables a company to integrate the data used throughout its entire organisation*.[1] Even though Davenport refers to ERP systems in his definition, the concept of enterprise system in this thesis also includes EAI. ERP and EAI are two different IT strategies to implement an enterprise system.

Legacy information system A common opinion of legacy information systems is that they are large, monolithic and difficult to modify.[2] The reasoning in the thesis is mainly in line with Light's definition of legacy information systems. He points out that the word legacy only means 'handed down', and the reason why legacy information systems are kept in the company is because they still may bring benefits.[3]

Enterprise Resource Planning (ERP) A software system designed to support and make the business processes more efficient. This may include manufacturing, distribution, personnel, project management, payroll, and financials.[4] In the thesis the distinction of ERP, as opposed to EAI, is its constitution of modules to support different areas[5], e.g. those previously mentioned. An ERP vendor is a company that provides those modules in a software package.

Enterprise Application Integration (EAI) The use of middleware to integrate the application programs, databases, and legacy information systems involved in an organisation's critical business processes.[6] An EAI vendor is a company that provides the middleware, i.e. the integration technologies.

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[1] Davenport, T.H. (1998). *Putting the enterprise into the enterprise system.*
[2] http://www.webster-dictionary.org, 15:00, 18 August 2004
[3] Light, B. (2003). *An alternative Theory of Legacy Information Systems.*
[4] http://www.webster-dictionary.org, 15:00, 18 August 2004
[5] Davenport, T.H. (1998).
[6] http://www.webster-dictionary.org, 15:00, 18 August 2004

Systems environment[7] The concept of systems environment includes both existing and future information systems as well as their mutual relations and conditions. An information system can exist in form of standard operating procedure, a planning procedure, a quality control method, or in computer based form. Thus, an information system does not need a computer-based solution to satisfy its role.[8]

IT strategy A strategy can be described as an elaborate and systematic plan of action.[9] An IT strategy in this thesis is defined as a similar plan that includes how to make use of information technology. Implementing an enterprise system is a way to make use of the information technology; ERP and EAI are different strategies to implement an enterprise system.

[7] The word "IT infrastructure" is used in Themistocleous' model for EAI adoption in section 5.1.6.
[8] Svärdström, J. (2003). *Holistic System Development; A model for management*.
[9] http://www.webster-dictionary.org, 12:00, 14 September 2004

Abbreviations

The following are abbreviations often used in the thesis.

VBC Volvo Bus Corporation is a business in the Volvo Group.

VTC Volvo Trucks Corporation is a business in the Volvo Group.

ARHK ARendal HuvudKontor, the main office of Volvo Buses in Arendal, Gothenburg.

VBoF Volvo Borås Factory, a production plant of VBC located in Borås

AS/400 The IBM Application System/400 is a family of mid-range business computing systems.

SAP Systems Analysis and Program development. SAP is a German company providing ERP software packages, e.g. SAP R/3. "R" stands for real-time data processing.

1 Introduction

The chapter starts with a presentation of the subject in this thesis, which concludes the relevance of the topic chosen. Further a background presenting the starting-point of the work is given followed by the purpose of the thesis and its delimitations. Finally an outline giving the structure of the thesis completes this chapter.

1.1 Prologue

The business situation of today is generally characterised by fast changes. The external and internal pressures that a company is exposed to increase. As a result the need to be more flexible and make processes run effectively are growing. A situation like this is a common reason why updates in the systems environment are regarded as necessary.
During its lifetime, a company may have been exposed to many situations that have resulted in a restructure of the systems environment. Often improvements to the systems environment to match the competitive situation have been done at different occasions and in different functional areas. While such procedures may solve the current problem, it is generally the basic of an isolated infrastructure where the systems environment consists of disparate stovepipes.[10]
Many disadvantages come with disparate systems environments. Companies may have numerous problems by not being able to fully integrate their operational processes. The problems may refer to data communication to suppliers and customers, but also to the quality and availability of information internally within the organisation.[11]

Companies experience difficulties in knowing how to act in the situation they find themselves in, i.e. knowing how the systems environment could become more integrated. Often the issue concerns whether or not to implement an all-embracing systems environment to support the business processes across the whole organisation. Furthermore it concerns whether or not such an implementation should conform to standardised industry practices or to the business operations specific to the company. The installation of an integrated systems environment would involve the change of business processes and thereby affect the organisational structure to a large extent. The hesitation of management in such cases may be due to the fact that there have been several examples of unsuccessful implementation projects earlier.[12] Moreover managers are often unsure of the benefits a new systems environment might bring, not to

[10] Linthicum, D. (1999). *Enterprise Integration from the Ground Up.*
[11] Evgeniou, T. (2002). *Information Integration and Information Strategies for Adaptive Enterprises.* p. 486
[12] Davenport, T.H. (1998).

mention the costs that will arise from the implementation. The costs of implementing new systems environment are high, as are the costs of maintaining the old disparate information systems. [13]

When considering restructuring the systems environment as a way of integrating and thereby improving business processes, there are in present day two major IT strategic alternatives; enterprise resource planning (ERP) and enterprise application integration (EAI). Both ERP and EAI are enterprise systems developed to solve integration problems internally and externally. They both bring significant changes to the organisation, and they both most commonly involve high costs. ERP is based on the idea that existing systems are replaced with ERP modules. EAI on the contrary allows the preservation of existing systems by using integration technology to bring them together. Regardless of which solution is chosen the objective remains, namely that the non-integrated systems environment must be unified to make the business processes more efficient.[14]

Among research findings today, there are many different views and opinions concerning enterprise systems and their attributes. There are benefits and barriers with both ERP and EAI. In fact many of the attributes of the two strategies are alike. It is clear that these attributes span over different levels, operational and strategic, as well as different aspects, e.g. technical and organisational.

There are several studies about ERP and EAI presented separately, hence extensive material about each enterprise system is easily found. There is however a large gap in research dealing with the comparisons of the two solutions. Many companies today are confronting a choice between enterprise systems but there are few comparisons that can act as guidelines. It is inevitable for companies to make decisions about enterprise systems. To meet competition in the market today, information technology is a strategic resource.[15] Due to the need of improving old information systems, evaluating the advantages and disadvantages of IT strategies becomes critical to organisations.

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[13] Gunasekaran, A.. (2001). *A model for investment justification in information technology projects*. p. 350

[14] Themistocleous, M. (2004). *Justifying the decisions for EAI implementations: a validated proposition of influential factors.*

[15] Davenport, T.H. (1998).

1.2 Background

The wish for deeper studies of enterprise systems and of the strategic implications concerning them was the starting-point of this thesis. The authors came into contact with the Volvo Buses main office, ARHK, where an ERP implementation case was introduced. The case concerned the production plant in Borås, which is the organisation's main bus chassis manufacturer.
After a meeting at the Volvo Bus production plant in Borås, below abbreviated VBoF, various viewpoints came to light concerning the affects an ERP system might have on the organisation. Being of current importance, the topic was considered interesting to explore in further depth. The authors of this thesis chose to map out the systems environment at VBoF by looking at the present information systems, exploring the way they supported the processes and inquiring into the plans for the future and the viewpoints concerning these. The description would then constitute the case study of the master thesis.
Based on the authors' knowledge of IT strategies obtained from previous studies, the decision was made to evaluate two different strategies, namely ERP and EAI. The expectation of the evaluation was to find advantages and disadvantages connected to each strategy. Moreover, the findings from the evaluation were to be compared to the case study. The analytic comparison between the evaluation of ERP and EAI and the results from the case study was expected to yield an optimal solution relative to VBoF.

1.3 Purpose

The purpose of this thesis is to evaluate two alternative IT strategies and to describe the systems environment in an organisation through a case study.

1.3.1 Delimitations

There are different strategies for organisations that wish to improve their systems environment through the implementation of an enterprise system. The evaluation of IT strategies in the thesis was delimited to ERP and EAI.
Since the focus of this thesis was the strategic issues of ERP and EAI, the authors chose not to give any detailed technical descriptions.

1.4 Outline

Chapter 2, **Methodology**, is a description of the way the project has been carried out.

Chapter 3, **Theoretical foundation**, is a presentation derived from literature containing strategic implications of ERP and EAI.

Chapter 4, **Results**, is a presentation of the material derived from the case study at VBoF.

Chapter 5, **Analysis**, is a comparison between the results and the theory, i.e. the theoretical findings compared to the situation at VBoF.

Chapter 6, **Conclusion**, is the authors' opinion why one solution is to prefer over the other. The reasoning is derived from the analysis.

Chapter 7, **Discussion**, treats the justification of the thesis. The chapter considers the course of action, points to possible weaknesses and suggests alternative procedures.

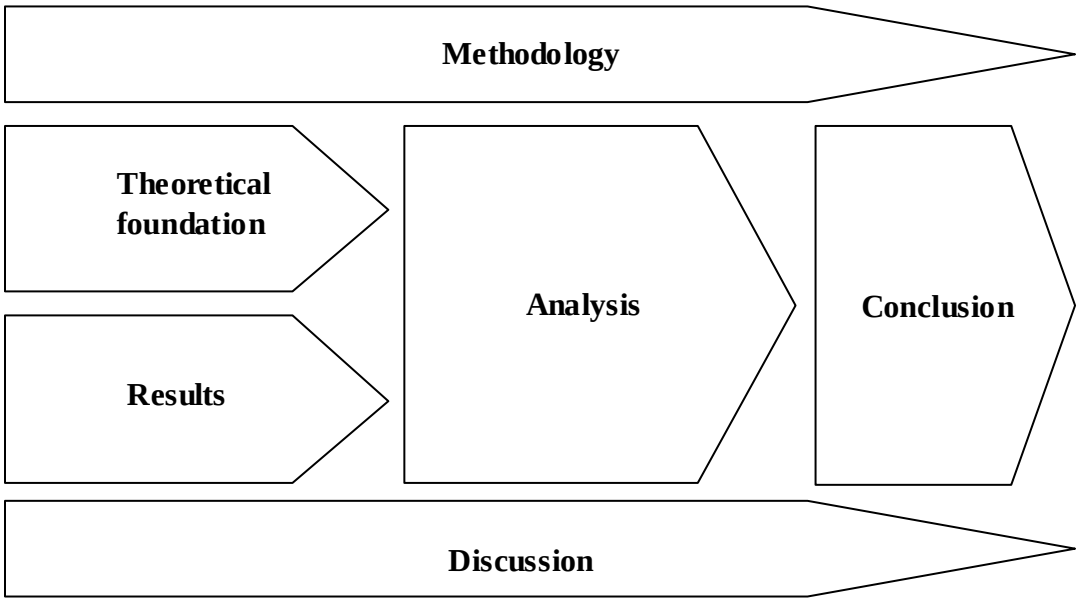

Figure 1.Disposition

2 Methodology

This chapter describes the advancement of the thesis. First the theory of science is outlined. Thereafter follow literature- and empirical studies. The chapter is then concluded with the procedure clarified through literature foundations.

2.1 Theory of science

The theory of science is introduced with philosophical traditions where positivistic and social constructivist philosophical traditions are discussed. Thereafter follow data collection, quantitative or qualitative method. The research design of this thesis is clarified in a comparison between exploratory and conclusive design. The section is concluded with quality of research.

2.1.1 Philosophical traditions

There are two philosophical contrasting traditions within theory of science; Positivism and Social Constructivism. Each view has a list of associated assumptions and methodological implications. It is not common that one view is followed strictly; usually a mix of both worlds is used. The standard lists for each view according to Easterby-Smith[16] are summarised in table 1.

	Positivism	**Social Constructivism**
The observer	Must be independent	Is a part of what is being observed
Human interests	Should be irrelevant	Are the main drivers of science
Explanations	Must demonstrate causality	Aim to increase understanding of the situation
Research progresses through	Hypothesis and deduction	Gathering rich data from which ideas are included
Concepts	Need to be operationalised so that they can be measured	Should incorporate stakeholder perspectives
Units of analysis	Should be reduced to simplest terms	May include the complexity of 'whole' situations
Generalisation through	Statistical probability	Theoretical abstraction
Sampling requires	Large numbers selected randomly	Small numbers of cases for specific reasons

Table 1. Contrasting implications of positivism and social constructivism[17]

It is common that hermeneutics is used but the authors have chosen social constructivism instead. Hermeneutics deals with interpretation as the main research method. [18] The term social constructivism is used in this thesis because, as opposed to positivism, it enables the common understanding of the situation to become the foundation for knowledge.[19] This includes the compromises that must be considered in order to suit as many users as possible. That also supports the system developers' concept of listening, creating and learning.

[16] Ibid.
[17] Ibid.
[18] Wallén, G. (1996). *Vetenskapsteori och forskningsmetodi*k. Lund: Studentlitteratur
[19] Easterby-Smith, M, Thorpe, R, & Lowe, A. (2002). *An introduction to management research.*

Philosophical tradition used in this thesis

This master thesis is mainly in line with the *social constructivist* school.

- As we are conducting semi-structured interviews, we are undoubtedly a part of the situation and affect in the way we are.
- A system that supports the company supports the process and thereby the organisation, which consists of humans, that is the basis for system designs.
- This thesis is covering a large area and cannot be precise. It is a sample from the organisation to let us know a bit more of the situation.
- The purpose of the interviews is to collect rich data and analyse it from a theoretical perspective.
- This thesis is intended to incorporate the whole situation based on qualitative fact from a few interviews.
- Generalisation is done by theoretical abstraction.

The sample size is small and thoroughly selected.

2.1.2 Data Collection

There are different ways of collecting data; quantitative and qualitative methods. There is a difference between positivism and social constructivism that affects the approach chosen. In positivism the research process is divided in three steps; collection of data, analysis of data and writing of the findings. In contrast to the positivistic view of sequential steps, social constructivism methods take the form of a circular process. Data collection can be analysed immediately and the analysis affects future data collection. [20] This is made visible in figure 2.

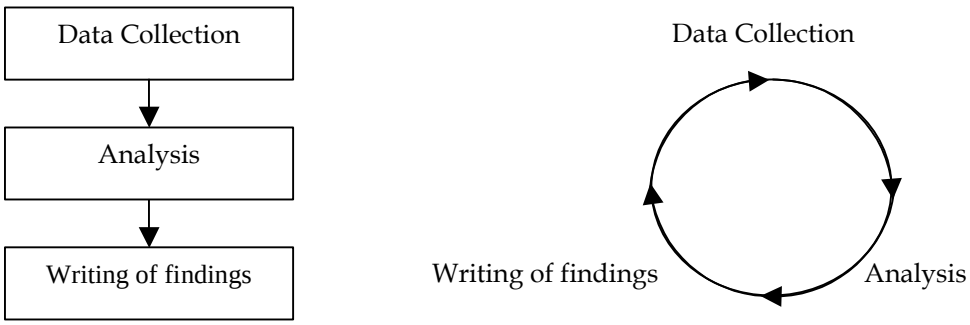

Figure 2.Positivist and Social Constructivist methods of data collection, analysis and writing of the findings.

[20] Ibid.

The most fundamental of all qualitative methods is the interview but there are also other methods like protocol analysis and group interviews. An interview may be structured, unstructured or semi-structured. A structured interview is a fixed interview that often generates simple, short answers. An unstructured interview is more of a conversation. The interview is a quantitative method when referring to structured interview but the most commonly used quantitative method is observation. Other approaches mainly used for quantitative methods are psychological tests and activity sampling. The interview is a qualitative method when referring to unstructured- or semi structured interviews.[21]

Data collection used in this thesis

The interviews were *qualitative* according to social constructivism theories. This reflects the interviewees' thoughts from a holistic perspective, which is in line with system developers' goals.[22] The interviewees may then freely describe each situation from a subjective perspective and that is the point of this thesis' interviews, to get different subjective point of views.[23]

2.1.3 Research design

There are two types of research design available, exploratory and conclusive. Conclusive design can then be divided into descriptive and causal; and performance-monitoring research.[24]

- Exploratory research aims to increase the understanding of problems in a certain topic. It is not common with conclusions from exploratory studies because it is only exploration of the surroundings.
- Conclusive research means evaluation of different alternative actions.
    - Descriptive research is a common research design and differs from exploratory research design. Descriptive research aims to answer specific questions and solve a clearly defined problem with a certain goal.
    - Causal research aims to find the facts and origin of a problem. This is applicable when the researcher is well read in the topic. This is used to verify gathered information
    - Performance monitoring research gives information about possibilities and/or problems.

[21] Ibid.
[22] Magoulas, T & Pessi, K. (1998). *Strategisk IT-management.*
[23] Lantz, A.(2003). *Intevjumetodik*. p.18
[24] Kinnear, T. C. & Taylor, J. R. (1996). *Marketing Research: An Applied Approach. p. 127*

Research design used in this thesis

The research of this thesis is conclusive. That means that it aims to evaluate alternative solutions to a problem. The problem is derived from the empirical studies and theory is used to evaluate different theoretical solutions.

2.1.4 Research goals

There are two kinds of research goals, deductive and inductive.[25]

- Deductive research has its starting point in theory. A hypothesis based on theory is compared with the empirical studies. The goal is to validate the theory studied.
- Inductive research has its starting point in empirical studies opposite to deductive studies. The goal is to find new theories with support from empirical studies.

Research goal in this thesis

The research goal for this thesis is to validate if theory is applicable to practice, if theory matches empirical studies. Therefore the research goal is *deductive*.

2.1.5 Quality of research

Validity means that measurements should be relevant to the topic. Credibility means that the measurement is made in a reliable way.[26]

Authors background

The authors' backgrounds are students in system development and analysis. One of the major challenges within systems development and analysis today is about implementation of enterprise systems. The authors have studied this topic during the last year and followed the development of ERP and EAI in different courses. One of the authors has experience of Volvo Busses from last summer where a project related to e-business was made.

The authors' have no previous experience of interviews but has used the literature available for aid in conducting interviews. The tutor of the thesis is experienced in the field of enterprise systems.

Interviews

The interviews are the primary source of data for the results in this thesis. Eight interviews were conducted. The data collection was made during June. It was necessary to make the interviews two or three at each occasion due to the

[25] http://www.sv.ntnu.no/ped/hans.petter.ulleberg/VITEORI.htm 17:50 12 September 2004
[26] Malterud K. Validitet.(1998). *Kvalitativa metoder i medicinsk forskning.* pp 157-65.

distance to VBoF. The interviewee's answers will the gathering of data in this study. Each interview lasted between 60 and 90 minutes. At the beginning of the interviews we described the structure of the questions. All questions were intended to reflect the plant (VBoF) only and not the whole organisation of VBC. Many of the issues concerning alternative solutions were hot subjects in the organisation and some interviewees wished to be anonymous. Therefore, the decision was made not to record the answers on tape. In that way more honest and true opinions may have been received from each interviewee.

No technical equipment has been used in this thesis except for pen and paper to make notes of the interviews. Having two observers instead of one increased the credibility of the notes from the interviews.

Interviewees

The choice of interviewees was vital for the research process.[27] The choice of interviewees was based on the idea of getting a holistic view of the case at VBoF. It is of necessary value for system developers to receive a general view of the activities and the organisation and not just management level point of views. We wanted interviewees whose contribution reflects the overall understanding and attitude of the organisation. Therefore, interviewees were chosen from different departments and from strategic and operative levels. Our contact at VBoF suggested interviewees and after much consideration eight individuals were chosen. The important matters were that the interviewees had been working for at least a couple of years at the plant and that they represented as many different levels and departments as possible. We interviewed the plant manager, the IT coordinator, the engineering manager, a production manager the production controller, the system administrator, a system developer and a production engineer.

Analysis method

Our thesis is based on the idea of interpreting the interviewees instead of asking direct questions, this for ensuring that the reliability is high.[28] There are several factors that could make direct questions unsuitable. One example is that the interviewee may choose to keep certain things secret due to political climate at the plant. Data may be interpreted from indirect questions instead for a clearer understanding.

[27] Malterud K. Urval. (1998). pp 55-64.
[28] Lantz, A. (2003).

Clarification

The clarification of the result of the interviews has been dialogic. This means that misunderstandings and clarifications are made during interviews rather than afterwards.[29] If interviewees were to review the answers after the interview some spontaneity would probably disappear due to political correctness.

Triangulation

The interviewees represent a broad range of employees at VBoF. However, due to the time limit of this study, it was not possible to interview a large number of employees in the production line. That would be even more ideal to the triangulation of sources. It was not possible to let any additional academic discipline analyse this subject. The only observer triangulation is the fact that we are two students conducting this study. One of the authors conducted the interview while the other made notes. These tasks were then alternated between the authors. Triangulation of theory has not been made in its fully true form. However, one theory is used to collect data and another to analyse it. This is vital to this study, as the data collection should reflect the reality in a holistic way. The analysis should be summarised from interpreted answers, which is the skill of system analyst, in a way that is understood more easily.

2.2 Literature studies

Extensive literature studies concerning the topic chosen must be carried out before writing a master thesis. The literature study was based on the latest research findings in the field of enterprise systems. The material was gathered from research articles found in databases of academic libraries. As mentioned in the introduction, extensive material on ERP and EAI was easily found but it often treated the different enterprise systems separately. It was more problematic to find comparisons between the two enterprise systems. This is a major gap in knowledge about enterprise systems. The simple reason why it is important to compare enterprise systems is that many companies today are in a situation where a choice between enterprise systems plays a decisive role on the company's future.

2.3 Empirical studies

The primary sources of information were the exploration of present systems environment of the organisation; eight semi-structured interviews were carried out. The purpose of the interviews was both to gather information about the present use of the plant's information systems, and to identify general viewpoints and attitudes among employees at VBoF.

[29] Malterud K. (1998). *Att kombinera metoder. Kvalitativa metoder i medicinsk forskning*. pp 166-76.

Secondary sources were pictures of the plant's systems environment and its connection to the business processes. Several screen shots, collected partly from VBoF's own legacy information systems, i.e. the AS400 environment, partly from other purchased or inherited information systems, provided a clearer view of the present systems environment.

No technical measuring instrument was used to aid in our work. However, the choice of questions was elaborated from a model, which can be viewed as a tool in analysing the systems environment of an organisation. The model is further discussed in section 3.2. A document containing the questions used during the interviews is placed in appendix B.

2.4 Procedure

This master thesis was based on the basic procedure of soft system methodology, SSM, provided by Checkland.[30] The procedure of SSM was used as an all-embracing model where some parts were analysed on the basis of Svärdström[31] and Themistocleous.[32] In the following section the procedure is further described through the presentation of SSM.

2.4.1 SSM

Soft System Methodology, or SSM, was developed during the 1970's. The methodology emerged from systems engineering. At the point where problem situations became so complex that systems engineering were no longer a sufficient tool for solving them, the concept of SSM grew stronger.

SSM is intended to handle problem situations where people perceive and interpret the world in their own ways and make judgements that are not always shared by others. A problem where SSM is appropriate is in deciding how a company should make use of information technology.[33]

The nature of human beings is to attribute meaning to observations and experiences. Given an interpreted experience, humans form intentions, i.e. they take purposeful action in response to their experience of the world. The actions, derived from experience-based knowledge, will in turn result in a world that is experienced differently. Hence, a type of knowledge acquisition cycle is created, which visions the concept of learning.

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[30] Checkland, P.B. & Scholes, J. (1999). *Soft System Methodology in action.*
[31] Svärdström, J. (2003). *Holistic System Development; A model for management.*
[32] Themistocleous, M. (2004). pp. 85-104
[33] Checkland, P.B. & Scholes, J. (1999). p. xiii (preface)

This short introduction to the basic idea that underpins the SSM concept can be clarified in figure 3. A real world situation of concern yields choices of relevant systems of purposeful activities. The real world situation of concern and relevant systems of purposeful activities are compared. The comparison leads to action that is needed to improve the situation.[34]

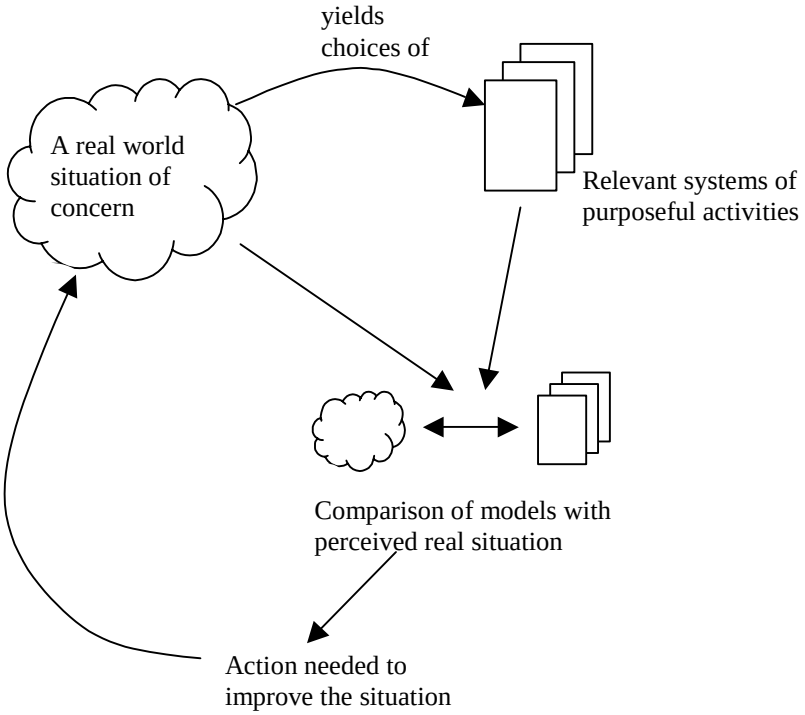

Figure 3. The basic shape of SSM.

SSM is often associated with the seven-stage model that appeared in 1975. This model is an elaborated form of the shape in figure 3. However, since the seven-stage model has been in use for almost 30 years, it may be perceived as out of date. One of the drawbacks of the model is its dividing up in stages. According to Checkland, this structure may encourage a procedure that starts with stage one and ends with stage seven. Preferably the procedure should be seen as a constantly ongoing process.[35]
Checkland presents the procedure in figure 3 as a basic structure of SSM. Further, he describes it in more detail by elaborating each part of it. However, by showing the structure of SSM as a basic shape, the vision of an ongoing cycle is made clearer.

[34] Checkland, P.B. & Scholes, J. (1999). p. 3
[35] Checkland , P.B. & Scholes, J. (1999). p. 27-28

2.4.2 The procedure used in the thesis

The authors chose to use the basic shape presented by Checkland to clarify the course of actions in the thesis. The purpose of the thesis was to describe a real-world situation, i.e. the systems environment at the production plant of VBoF. Further it would present alternative IT strategies, which would then be analysed and compared. In the end the comparison would result in a conclusion as to which IT strategy was best suited to support the plant. The procedure conducted in the thesis was similar to the process of system thinking, hence the reason why the structure of SSM was considered to be an appropriate all-embracing model.
Given the basic shape of SSM, the structure of the thesis was divided up according to figure 4. To clarify further, the different parts of the model were numbered from one to four. Each part was then connected to the section in the thesis where it was treated.

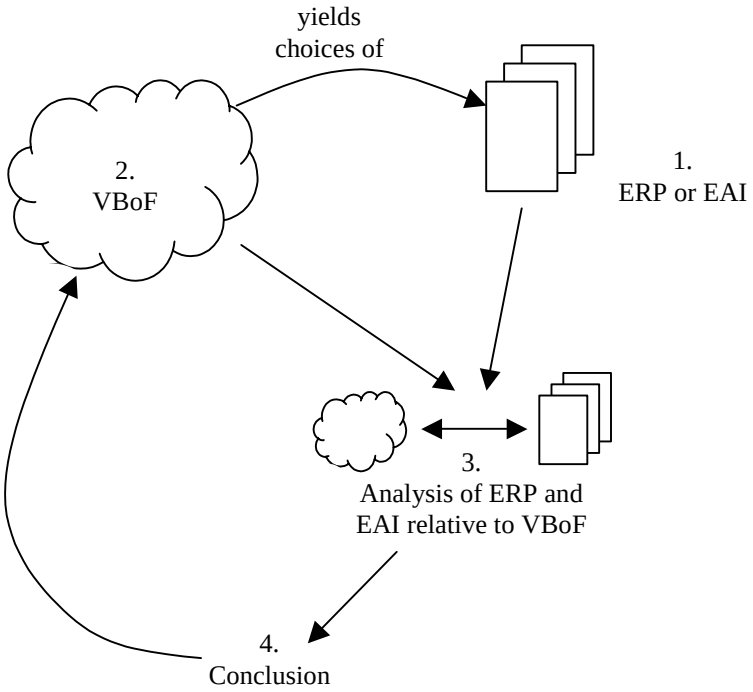

Figure 4. How the basic shape of SSM is used in this master thesis.

Part 1 concerned the relevant systems of purposeful activities. The relevant systems in the thesis were ERP and EAI; hence this part was constituted by the theoretical description of those two alternative enterprise systems. The theoretical section is presented in chapter 3, Theoretical foundation.

Part 2 described the real world situation of concern. In the thesis the model for holistic and coordinated development proposed by Svärdström[36] supported this part. The model constituted the base of the interview questions, i.e. the empirical study of the thesis. The result from the empirical study is presented in chapter 4, Results.

Part 3 was constituted by the comparison of models with the perceived situation, i.e. the relevant systems of part 1 were compared to the real world situation of part 2. In the thesis this part is presented in chapter 5, Analysis.

Part 4 of Checkland's model presents the action needed to improve the situation. In the thesis the contents of part 4 reached the conclusion of what those actions were. However, since the scope of this thesis was to evaluate two alternatives and not to design a new system, the SSM cycle in this case ended here. In another words, instead of leading to action this part resulted in the conclusion as to what actions were appropriate in the particular situation. The conclusion is presented in chapter 6, Conclusions.

[36] Svärdström, J. (2003).

3 Theoretical Foundation

The beginning of the chapter is a presentation of two models used to give structure to two parts of SSM. Then follow the theories of ERP and EAI; constituting ***relevant systems of purposeful activities*** *in the basic model of SSM.*

The two models used are the model for EAI adoption[37] and the model for holistic and co-ordinated development.[38]

- The model for EAI adoption gives structure to *relevant systems of purposeful activities*.
- The model for holistic and co-ordinated development is used to give structure *to a real world situation of concern*. Figure 5 below shows the two models used to give structure in two parts of SSM.

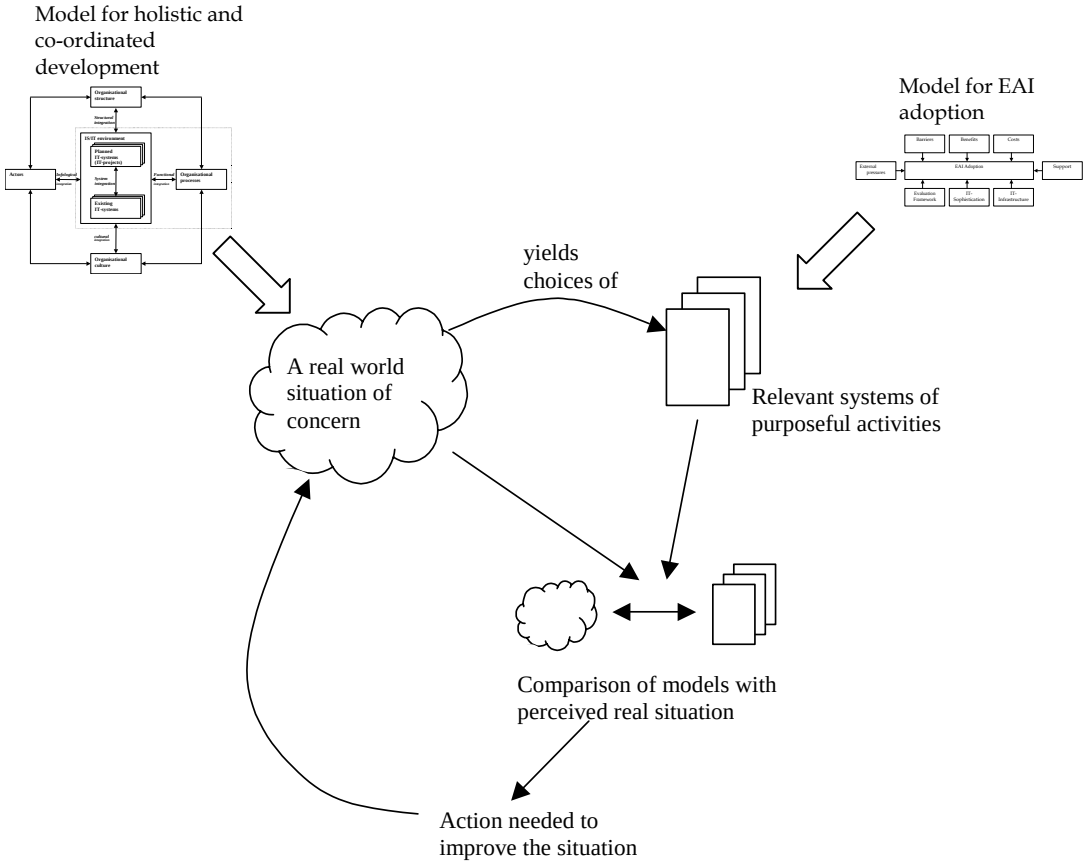

Figure 5. Two models are used to give structure in two parts of SSM.

[37] Themistocleous, M. (2004). p. 85-104
[38] Swärdström, J. (2003).

3.1 Model for EAI adoption

The purpose of this thesis is to compare two IT strategies, namely ERP and EAI. Therefore the use of a model elaborated as a tool for EAI adoption only, may be regarded as a drawback with the risk of not giving a satisfactory analysis of ERP. However, the authors of this thesis consider the model to be a useful tool for analysing the suitability of ERP adoption as well. The proposition is well supported in Themistocleous' article in the section describing each key factor. At several occasions the author points out the possibility of applying the factors to the evaluation of ERP adoption. Examples of this are presented further down in the text, where the key factors are described in more detail.
In his article Themistocleous also presents a revised form[39] of the model by adding categories to some of the key factors. The revised model may give a clearer picture of the structure. Nevertheless, as this thesis uses the model in the area of ERP as well as EAI, the authors have chosen the non-revised version, which is thought of as being more general. The intention of the use of the model is to rationalise the structure of the theory of ERP and EAI.

When considering the adoption of EAI, organisations may use the model mentioned above as a tool for decision-making. The model is a decision support model for eight key factors that lead to EAI adoption. [40] The model is presented in figure 6, and each key factor is further described in section 3.3, which treats the relevant systems of purposeful activities.

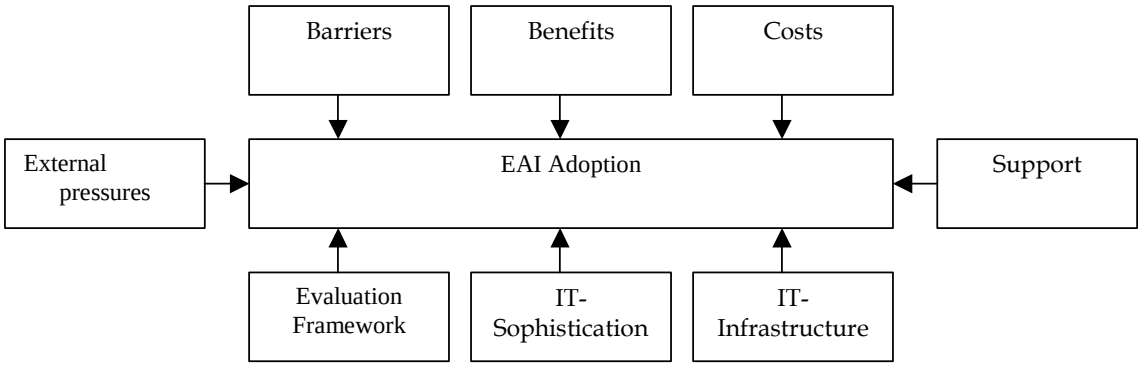

Figure 6. Model for EAI adoption.

[39] Themistocleous, M. (2004). p. 102
[40] Themistocleous, M. (2004). p. 85

Benefits

Organisations need to evaluate all benefits that the new technology offers before adopting it. The benefit evaluation should cover the following categories:

- **Operational**
  What will be the affect on planning, productivity, flexibility, costs etc.?
- **Managerial**
  How will the adoption affect performance, decision-making and the organising of business processes?
- **Technical**
  How will the adoption affect the IT infrastructure?
- **Strategic**
  What will be the affect on customer satisfaction, competitive advantages, ability to respond to external pressures etc.?
- **Organisational**
  Will the adoption affect the efficiency of doing business?

According to Themistocleous the above-mentioned categories were originally intended for the evaluation of ERP benefits.[41]

Barriers

The barriers to the adoption of EAI are similar to the ones of ERP.[42] When evaluating the barriers, the same categories are applicable as the ones listed in the previous paragraph. The following barriers are thought of as influencing the adoption:

- Promise to integrate IT infrastructures
- Changes to the organisation
- Changes to the employees' tasks and inter-organisational relationships
- High costs
- Likeliness of being adopted by large organisations

Costs

When the expected costs are bigger than the benefits it might lead to a rejection of the new technology. To provide a better understanding of the costs, they are classified into direct and indirect cost factors. Themistocleous goes even further by separating indirect human costs and indirect organisational costs.[43]

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[41] Themistocleous, M. (2004) p.88
[42] Ibid.
[43] Themistocleous, M. (2004) p.97-98

External pressures

There are two ways in which the external pressure affects the adoption of EAI, increased competition and the need for trading partners. Organisations may achieve a competitive advantage by differentiating their IT infrastructure. A different IT solution may also improve the collaboration between companies. [44]

Evaluation framework

Due to the diversity of EAI technologies and products on the market, a framework to support decision-making is needed. Themistocleous has proposed such a framework that highlights combinations of technologies to be used for integration. He believes that such a framework positively influences the adoption of EAI.[45]

IT infrastructure

The IT infrastructure may be seen as a factor influencing the adoption since numerous problems in companies result from the non-integrated nature of the IT. In those cases there is a need for a structure that is more flexible, maintainable and manageable.[46]

IT sophistication

This factor is related to the understanding of technical problems in the organisation. IT sophistication influences the adoption if there are limitations to the expertise or existing information systems in the company.[47]

Support

Vendor and consultants support is a factor that influences the adoption. In this case the conditions are similar to both EAI and ERP. Organisations have limited knowledge of the IT solution and therefore support from other sources is important in making decisions.[48]

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[44] Themistocleous, M. (2004) p.88
[45] Ibid.
[46] Ibid.
[47] Themistocleous, M. (2004) p.89
[48] Ibid.

3.2 Model for holistic and co-ordinated development

The model for holistic and co-ordinated development is used in the thesis to formulate questions in five important areas: structural-, infological-, cultural-, functional- and system-integration. This is supportive to deliver a holistic view of a company's existing and future systems environment. The model is presented in figure 7, and a detailed description follows below.

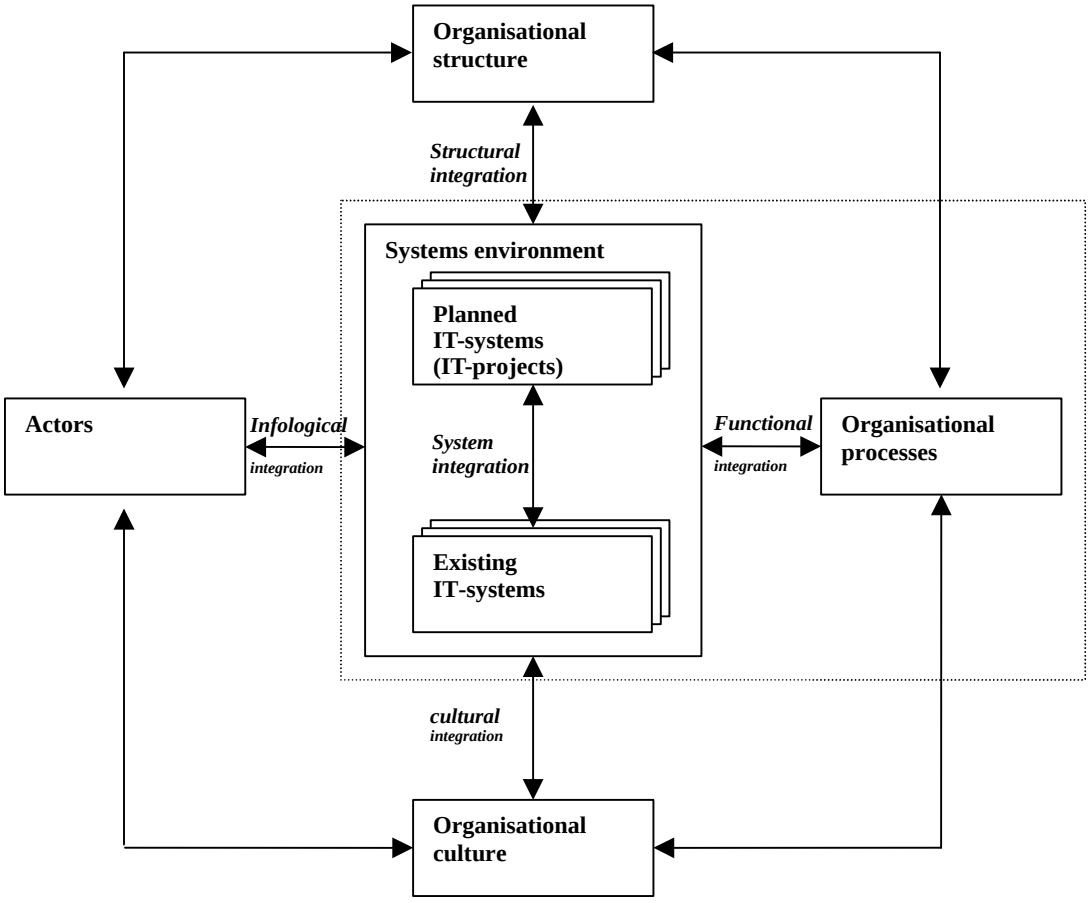

Figure 7. Model for holistic and coordinated Development

Development of new systems in an organisation requires that the organisation will be able to integrate the new systems. Many factors affect a successful implementation. Typically the function of the new system is in focus, but that is not enough. If structural-, infological- and cultural- integration is accomplished; the system integration will be even more successful.

In the centre of the model the classical development of systems is visible. The systems are supposed to support the organisational processes. But the model also shows the importance of other factors than organisational processes that the

development must take care of. The rectangle to the right shows the classical view of system development. The four rectangles surrounding the system development are the affected areas in the organisation. The double arrows refer to integration factors that affect a successful integration and that is the core of the model.[49]

Structural Integration

The organisational structure is close to the organisational goals and exists to fulfil these goals. The organisational structure is division of labour, decision authority, rules and routines to coordinate work to fulfil the organisational goal. The purpose of this is to accomplish regularity and predictability in the behaviour of individuals in the organisation. Through rules, routines and formal structure the individuals act more as a group and the organisation will be seen as one as it also is a symbol of the organisational goals to the public. [50] With a new system the organisational structure may be affected in numerous ways, e.g. balance of power and communication. Therefore structural integration is important to consider when implementing enterprise systems.

Infological Integration

The actors of the IT system is:[51]

- Stock owners
- Management
- Users
- System maintenance operators
- Members of the organisation that are dependent of the system to perform its tasks
- Members of the organisation that are affected of the system, directly or indirectly

There can also be external actors:

- Customers
- Suppliers
- Public authorities
- Trade unions

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[49] Svärdström, J. (2003).
[50] Jacobsen, D. I. & Thorsvik J. (1999). *Hur moderna organisationer fungerar*, Lund: Studentlitteratur.
[51] Checkland, P. (1981). *Systems Thinking*, *Systems Practice*, John Wiley & Sons.

The actors have different interests that may affect the system design. The different actors also have knowledge that may be vital to the system design. The different demands are to be negotiated with the actors until a good solution is accomplished.[52] Therefore infological integration is important to consider when implementing enterprise systems.

Cultural integration

The organisational culture is common assumptions about how to understand, feel, think and act to solve problems. It is also normative standards and values of the organisation. The way that individuals interpret information, events and activities is affected by cultural factors.

The goal of the organisational culture is to regulate the behaviour in the organisation. An organisational behaviour encompasses:
How members of the organisation understands and interprets goals for work
How they prioritise between tasks
How they acts to solve problems.

The organisational culture can change due to implementation of a new system. e.g. goals and informal structures of power. It is therefore of great importance to consider cultural factors. Therefore cultural integration is important to consider when implementing enterprise systems.

Functional integration

A process exists to refine a product in an organisation. A process may consist of manual and mechanical actions. Other processes, e.g. administration, can support the core process.

IT is used to support, maintain or control processes in an organisation. IT systems shall "be a copy" of the organisation[53]. Sometimes organisations must reorganize itself before implementation of IT systems. Otherwise the new system can support old and ineffective processes. Processes can be changed due to optimisation of them or external factors[54]. Therefore functional integration is important to consider when implementing enterprise systems.

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[52] Hedberg, B. (1980). *Using Computerized Information Systems to Design Better Organisation and Jobs.*
[53] Hugoson, M.-Å. (1989). *A System for Systems: A Theory of Information Systems Architecture and Interaction.*
[54] Mackenzie, K. D. (1984). *A strategy and desiderata for organisational design.*

3.3 Relevant systems of purposeful activities

Following SSM, this section is devoted to the theoretical presentation of enterprise systems. Relevant systems of purposeful activity as a part of SSM can be seen in figure 8. Themistocleous' model for EAI adoption is used to give structure to relevant systems of purposeful activities. The beginning of the section gives a short introduction to the enterprise systems investigated, ERP and EAI. Thereafter follows a detailed description of the enterprise systems analysed on the basis of eight key factors derived from the model presented in section 3.1. The factors are benefits, barriers, costs, external pressure, evaluation framework, IT infrastructure, IT sophistication and support.

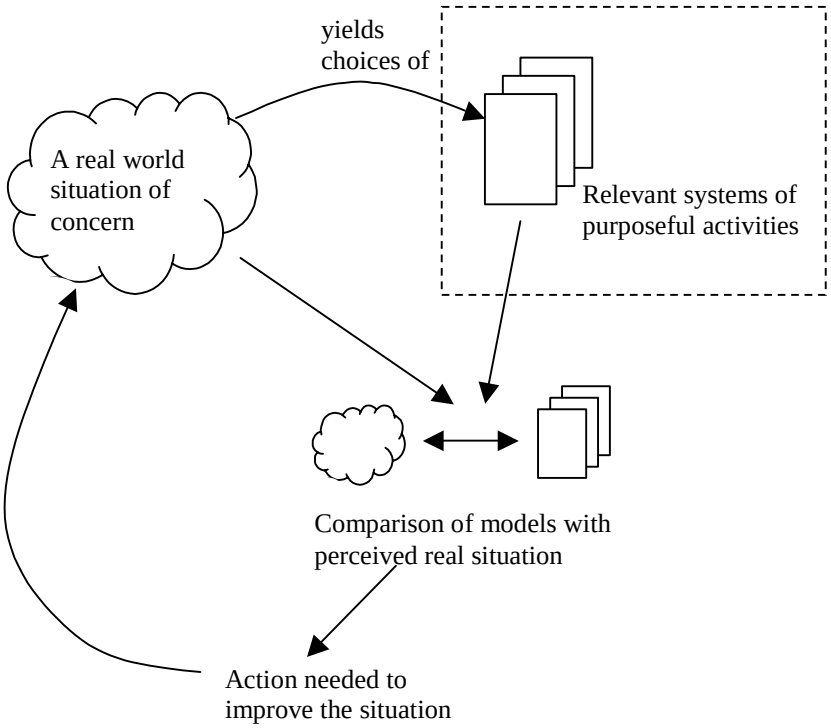

Figure 8. The relevant systems of purposeful activities

3.3.1 Enterprise systems

This short introduction is a quick summary of enterprise systems. The two enterprise systems studied, namely ERP and EAI will be detailed in the eight sections following this introduction. This introduction is some basic information about enterprise systems to make the following sections easier to understand.

ERP

Enterprise resource planning, or ERP, is an enterprise system that supports the business processes in the organisation. The support of the processes refers to the development of the system to work above the functional entities to enable emphasis of the business processes.[55] The link between ERP and business process re-engineering (BPR) is strong; in principle an ERP implementation requires the restructure of processes.[56] An ERP implementation will drive the organisation towards a process-oriented business.[57]

The ERP vendors supply a standardised software package developed to support different branches of industry. The design of the system aligns with the specific best practices assumed to apply to the type of industry in question. Best practices are a combination of vendor marketing of what they think is best and educational institutions that contribute to industry by developing professional models and theories.[58] Hence, it is the vendors, not the buyers, who decide in what way the organisations processes are to be supported. When a company decides on implementing ERP, it will benefit the most from the advantages principally by adjusting to the standardisation of processes embedded in the system.[59] Despite the package solution an installation results in, there is within certain limits ways of conforming the system to better suit the organisation by configuring the system.[60] An ERP also consists of modules. Given the needs and demands identified, the company may customise the system by deciding which modules to implement.[61] The concept of combining modules may create an alternative solution to organisations. BoB is short for best of breed and signifies, as the name implies, that only the best parts available are chosen. The principle is the same as with one single ERP, but in this case several different vendors provide the modules. The main reasons for choosing BoB are reducing of the risk

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[55] Al-Mashari, M. (2001). *Process Orientation through Enterprise Resource Planning (ERP): A Review of Critical Issues*. p. 175-176

[56] Koch, C. (2001). *BPR and ERP: realising a vision of process with IT*. p. 260-261

[57] Beretta, S. (2002). *Unleashing the integration potential of ERP systems – the role of process-based performance measurement systems.* p. 259.

[58] Swan, J., Newell, S. & Robertson, M. (1999). *The illusion of "best practice" in information systems for operations management.* p. 284

[59] Chen, I.J. (2001) *Planning for ERP systems: analysis and future trend.* p. 379.

[60] Davenport, T.H. (1998). p. 125

[61] Davenport, T.H. (1998). p. 125

that comes with the dependency on one single vendor and preventing decreased flexibility.[62] However, BoB may result in poor compatibility between the modules.[63]

EAI

Enterprise Application Integration, or EAI, offers a way of improving the systems environment in the organisation. EAI is based on keeping the existing legacy information systems and integrate them internally and externally. Basically, the systems may that are adapted to the organisation may be kept, but the communication between systems is improved.
EAI resembles ERP in the way that it focuses on the company's business processes instead of supporting separate functions. Nevertheless, in contrast to ERP, the installation of EAI may not need such an extensive restructure of the organisation. EAI enables integration between already existing systems and by that it may be appropriate for companies whose information systems are well built to support the processes.[64] To render integration possible without replacing old systems, integration tools and technologies must be brought to the business. These integration tools are called middleware and can be seen as functions that pass information between organisational applications. Middleware hides the structure of the underlying operating system and network and hence makes integration easier.[65] Companies on the verge of implementing EAI need to take time to find out which technologies will constitute their integration package.
EAI theory suggests, as the name implies, that existing systems may be integrated. This is based on the same principle as with legacy information systems, i.e. that the organisation shall constitute the foundation for the system design. As companies integrate systems, the existing systems are kept in use, and alongside all usability and knowledge stay with them[66].

3.3.2 Benefits

There are many benefits of both ERP and EAI. The benefits are divided into five categories, namely, operational, managerial, technical, strategic and organisational.

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[62] Light, B., Holland, C.P. & Wills, K. (2001). *ERP and best of breed: a comparative analysis*.
[63] Irani, Z., Themistocleous, M. & Love, P.E.D. (2003). *The impact of enterprise application integration on information system lifecycles*. p. 182.
[64] Johannesson, P., & Perjons, P. (2001). *Design principles for process modeling in enterprise application integration*.
[65] Linthicum, D. (1999).
[66] Light, B. (2003).

Operational

The most important benefit of ERP is that all modules of the system easily communicate with each other. As an affect, the flow of information through the organisation will become very efficient. However to make use of this benefit a complete implementation is required, i.e. all business units' old information systems need to be replaced by the new system modules.[67] Integration of business units will be discussed in more detail in section 3.3.7. There are several ways in which ERP enhances the performance. Although the most significant improvements are supposed to occur some time after the implementation, instant benefits are inventory reduction, improved productivity and reduced financial close cycle.[68]

Through integration of applications (EAI), external and internal value chain planning is improved. The IT infrastructure is flexible since minimum changes to systems code are needed.[69] The improvement of business processes and organisational restructuring reduces operational costs and increases productivity. Managing and maintaining the IT infrastructure also becomes less costly.

Managerial

Due to the integrated nature of business units, an ERP system provides a clearer overview of the organisation. The ability of looking at the business from a broader perspective, with suppliers, alliances and customers as a whole, makes it easier to manage an extended company.[70] ERP enhances decision-making by providing accurate and timely information across the whole organisation.[71]

As a consequence to the structuring of more organised processes, an implementation of EAI provides more understanding of processes. The data quality is enhanced, which among other things improve the decision-making process.[72] Overall, EAI incorporates functionality from several different systems and thus achieves a flexible and more manageable IT infrastructure.[73]

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[67] Pearlson, K.E. (2001). *Managing and using information systems-a strategic approach*. p. 98-99
[68] Chen, I.J. (2001). p. 384
[69] Themistocleous, M. (2004) pp. 95-97
[70] Chen, I.J. (2001). p.374
[71] Poston, R. & Grabski, S. (2001). *Financial impacts of enterprise resource planning implementations*. p. 271
[72] Themistocleous, M. (2004). p. 95
[73] Themistocleous, M. & Irani, Z. (2003). *Towards a Novel Framework for the Assessment of Enterprise Application Integration Packages.*

Technical

Through single vendor ERP all applications and platforms are common and therefore the organisation will be able to obtain multiple synergies. In addition the vendor provides system upgrades, which results in lower demands on internal IT capacity.[74]

In most cases EAI integration is based on non-invasive technologies, i.e. the changes to existing applications are minor.[75] In principle EAI brings much the same technical benefits to the organisation as do ERP. Both solutions are provided by vendors, which provide upgrades and support as well. However, unlike ERP, application integration allows the reuse of systems.[76]

Strategic

Enhancing the company's competitiveness is the primary reason for implementing an ERP. The strategic benefits include improved response to customer demands, efficient communication through information sharing and universal access to real-time data. [77]

EAI automates and simplifies electronic transactions, and may therefore be a suitable tool in conducting e-business. Several advantages are related to e-business and e-commerce. Increased access to markets, more sales channels and automated transactions, which in turn result in improved performance and customer satisfaction, are some of the benefits.[78] Due to the constant refinements in supporting the functions, legacy information systems may be valuable as a competitive tool. Tailor-made legacy information systems are often connected to the critical business processes in organisations.[79]

Organisational

Installing an ERP system is often driven by the need of standardising business processes. Managers that want to clean up the untamed structure of the organisation may do so by conforming the processes to a software package.[80] The concept of process change is further discussed in section 3.3.7.

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[74] Light, B. (2001). p. 221
[75] Themistocleous, M. & Irani, Z. (2003).
[76] Themistocleous, M. (2004) p. 97
[77] Chen, I.J. (2001). p.378-381
[78] Themistocleous, M. & Irani, Z. (2002). *Novel taxonomy for application integration,* pp. 154-165.
[79] Light, B. (2003).
[80] Pearlson, K.E. (2001). p. 99

The ERP system allows the streamlining of management structures. By making them flatter and more flexible, the implementation may result in more democratic organisations.[81]

Recent studies show increased activity of mergers and acquisitions. The applications in different companies tend to be incompatible and integration is a necessity.[82] The benefits created by e-business come when companies integrate their applications across the whole value chain.[83]

3.3.3 Barriers

There are many barriers of both ERP and EAI. The barriers are divided into the same five categories as in the previous section, namely operational, managerial, technical, strategic and organisational.

Operational

The vendor of the ERP package determines the system's functionality. If the vendor for some reason is unable to provide a product or an upgrade, the organisation's core functional area may suffer.[84] The company's existing information systems are specialised and their functionality is hard to replace.[85]

Even though the keeping of existing information systems may involve a preservation of the competitive strategy, there is a risk that the organisational IT sophistication disappears when employees involved in their development leave the company.[86]

Managerial

Just as the standardisation and uniformity of ERP systems creates flatter organisations and breaks down hierarchical structures, they are also factors that support the centralisation of control over information.[87]
ERP systems are not designed to access information outside their own technology. This is prohibitive to the organisational flow between any legacy information system and the ERP. Even though ERP vendors have started to solve this problem by offering integration points to their systems, the market still

[81] Davenport, T.H. (1998). p. 127
[82] Ersala, N., Yen, D.C. & Rajkumar, T.M. (2003). *Enterprise Application Integration in the electronic commerce world*. p. 71
[83] Themistocleous, M. & Irani, Z. (2002) .
[84] Light, B. (2001). p. 221-222
[85] Themistocleous, M. & Irani, Z. (2003). *Towards a Novel Framework for the Assessment of Enterprise Application Integration Packages*.
[86] Light, B. (2003)
[87] Davenport, T.H. (1998). p. 127

needs maturity.[88] To avoid the problem and benefit the most from ERP, a replacement of legacy information systems is required.

Confusing terminology in the EAI area has created a debate regarding its capabilities. With the novelty of EAI comes the need for categorisation of application integration technologies.[89] The redesign of processes and integration of information systems require high complexity of understanding. Integration will not become successful if the handling of business in the organisation cannot be clarified.[90]

Technical

Although ERP vendor support and the maintenance of system upgrades is a technical benefit, the advantage may only be fully used of in the case where organisations do not modify the ERP modules during implementation. The extensive work of customising the system to better fit the organisation is a technical challenge. Companies should keep their systems the way they are to reduce costs connected to future maintenance and upgrades.[91] In cases where ERP are being rolled in incrementally or in the case of BoB, ERP systems need to be integrated with either legacy information systems or other ERP systems.[92]

There is no single EAI product that solves all integration problems. Managers need to take time and evaluate what kind of technology is needed and what tools are available on the market. There is lack of employees with EAI skills.[93] The complexity of integration technologies has resulted in confusion about the capabilities of each technology. Many technologies are overlapping in functionality.[94]

Strategic

Using a standardised ERP modules to support the business may result in the loss of competitive advantage An ERP system is publicly available and something the organisation as well as its competitors may buy and use. For companies whose competitive advantage is their business processes, ERP may not be an appropriate solution.[95]

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[88] Linthicum, D. (1999). *Enterprise Application Integration from the Ground Up*.
[89] Themistocleous, M. & Irani, Z. (2002).
[90] Themistocleous, M. (2004). p. 97
[91] Bingi, P., Sharma, M.K., & Godla, J.K. (1999). *Critical issues affecting an ERP implementation*.
[92] Ersala, N., Yen, D.C., & Rajkumar, T.M. (2003) . p. 71
[93] Themistocleous, M. (2004). p. 96
[94] Themistocleous, M. & Irani, Z. (2003).
[95] Pearlson, K.E. (2001). p. 100-101

As mentioned in the previous section, the company may gain strategic benefits from preserving existing information systems. However, this may be valid only if those systems are well built and bring strategic advantages in the first place. [96]
EAI implementation may involve political issues, e.g. concerning who controls the processes. There may also be security concerns and hesitations to let partners and customers access applications through e-business.[97]

Organisational

To carry out a satisfactory ERP implementation and benefit the most from expected advantages, the company must undergo an extensive organisational change. Business processes must conform to the ERP package and making this alignment requires time, careful planning and a lot of money. [98]

To fully benefit from the EAI technologies, there is a need to re-engineer the business processes. Therefore EAI implementation may result in resistance to change. Operating units may be sceptical about the change because of the fear of losing autonomy as their data and processes are to be shared with the rest of the organisation. One example that Themistocleous points to is when the company loses its dependence on the internal IT department. The unit providing technical support will become less important if the organisation decides to let an EAI vendor take care of the IT. Cultural issues are also a factor that can involve organisational barriers. Multinational organisations may have subsidiaries in other countries where the way of doing business does not correspond to the rest of the organisation.[99]

3.3.4 Costs

Valuating the benefits from IT, and above all justifying its investments, has been and still is a difficult matter. Traditional performance metrics, such as net present value (NPV), measure the average improvement on performance to compare it to the investment costs. However, individuals have several ways of using technology, which consequently leads to different kinds of performance improvements. Therefore several authors in the field point to the importance of relating the investments to business processes, instead of individual entities.[100]
The difficulty in evaluating IT investments lies in lack of calculations showing the expected financial value. Pearlson makes a comparison by looking at the way manager analyses the investment of building a new plant. The costs and benefits being tangible, makes it relatively easy to calculate the expected return.

[96] Light, B. (2003).
[97] Themistocleous, M. (2004). p. 97-98
[98] Bingi, P., Sharma, M.K., & Godla, J.K. (1999)
[99] Themistocleous, M. (2004). p. 96-98
[100] Peacock, E. & Tanniru, M. (2003) *Activity-based justification of IT investments.* p.2-3

However, regarding IT investments, the benefits might be increased process efficiency, improved service to customers, more accurate data and so on. Those intangibles are difficult to estimate.[101] According to Gunasekaran et al. qualitative benefits such as customer support and greater product flexibility may be impossible to assess and quantify. Therefore, many companies have to accept short-term losses in order to receive long-term benefits and prioritise the organisational strategy.[102]
The difficulty in estimating the costs and benefits concerns IT investments in general, thus it applies to both ERP and EAI. However, the literature presents factors regarding investment issues that might differ the two enterprise systems, therefore investment issues concerning both enterprise systems are presented below.

During the 1990's, when companies replaced their systems environment, numerous reports showed the failures and fiascos of ERP implementations. Reduced costs and financial improvement is what managers strive for from the adoption of ERP. Nevertheless, what organisations experience during implementation is something quite different. Replacing Systems environment and changing the business processes is a complex procedure. Projects are usually late or over budget, and in either case result in huge costs.[103]
Figures show that the investment of an ERP system can reach more than $1 milliard for a large company. Compared to the benefits, costs are easier to quantify. An ERP installation at Cisco Systems, Inc. reports the proportions of costs as follows; software 16 per cent, hardware 32 per cent, system integration 38 per cent and head count 14 per cent.[104]

Direct costs

Apart from the investments in hardware and software an ERP implementation also requires extensive consultancy costs. The cost of hiring ERP consultants is a major concern. According to Bingi et al., the lack of more than a few years of experience *has sent the compensation for skilled SAP consultants through the roof*. An average implementation can take as much as 150 consultants.[105]
Organisations that choose to modify the system to better fit the business processes experience higher costs. Customisation of the software involves development costs but it also leads to longer implementation time and requires more resources from consultants and from inside the organisation. The ERP

[101] Pearlson, K.E. (2001). p. 117-118, 182-183
[102] Gunasekaran, A., Love, P.E.D., Rahimi, F. & Miele, R. (2001). *A model for investment justification in information technology projects*. p. 351
[103] Poston, R. & Grabski, S. (2001). p. 273
[104] Chen, I.J. (2001). p. 380-381
[105] Bingi, P., Sharma, M.K., & Godla, J.K. (1999)

system should be kept "as is" as far as possible to avoid additional cost and future maintenance and upgrade expenses.[106]
The alternative solution of changing the organisation according to the system's best practices will result in different kinds of costs. Some estimates show that change management makes up 5-10 per cent of an initial ERP implementation.[107]

Despite the fact that EAI allows the reuse of existing information systems, the implementation will result in extensive software and development costs. However, those costs may be lowered due to the reduction of integration time and maintenance costs that is offered by EAI in contrast to ERP.[108] According to a case study[109], the highest costs of EAI derive from consultancy and process re-engineering. As in the case of ERP, the restructuring requires time and careful planning in order to fit the future IT strategy.

Indirect human costs

The implementation of ERP will result in costs derived from the need to design new business processes, configure software and test the system. Additional costs come with the requirement for high participation of internal staff that can transfer data from the old systems to the new ERP.[110]
Management effort causes costs since top management must be involved in every step of the implementation in order for it to proceed satisfactory. This kind of intervention helps bring all the organisation's staff to the same thinking, which is important in several aspects. People are a hidden cost. ERP implementation requires both time and money in training employees and improving their morale before the installation. In addition to learning the new technology, employees also have new responsibilities to adapt to. If the people are not ready for the consequence of ERP implementation, the costs will increase even further.[111]

The case study mentioned in the previous section[112], showed that the remaining costs, i.e. others than the direct costs of consultancy and process change, was reported to be of medium importance. Those costs include employee's training, changing of employee's culture and management effort. However, even though some costs are given less focus, they still affect the adoption. As mentioned when discussing the barriers of EAI, the resistance among people when fearing the loss of organisational responsibilities may cause additional hidden costs. If the

[106] Bingi, P., Sharma, M.K., & Godla, J.K. (1999)
[107] Al-Mashari, M. (2001). p.180
[108] Themistocleous, M. & Irani, Z. (2002).
[109] Themistocleous, M. (2004).
[110] Holland, C.P. & Light, B. (1999). *Global Enterprise Resource Planning Implementation*.
[111] Bingi, P., Sharma, M.K., & Godla, J.K. (1999)
[112] Themistocleous, M. (2004)

benefits of the new structure are unclear, employees are less willing to support the new Systems environment.[113]

Indirect organisational costs

Apart from the human costs derived from the process of change management of an ERP implementation, the business restructuring also brings indirect organisational costs. Gattiker et al. distinguish between design costs, which are the money spent developing common understandings, and compromise costs. In principle it could be said that the lack of the former increases the latter, i.e. compromise costs derive from the mismatch of operational tasks and system design. *Greater functional variety creates greater variety in information needs across sub-units and thus greater compromise costs if a single, standard system is broadly deployed.*[114]

Process re-engineering is the most important cost factor of EAI. Apart from the extensive work of planning, educating and understanding the processes, all of which may be tied to the direct costs, organisations experience additional indirect costs. When changing the processes, companies are forced to redesign their business strategy.[115] EAI does not only concern the inside of the organisation. The sharing of information and processes in inter-organisational networks affects strategy, control, human and organisational parameters, some of which may lead to conflicts. Issues like those mentioned need to be analysed and understood in order to accomplish a satisfactory integration.[116]

3.3.5 External pressures

Pressures from the outside push the organisation to move in certain directions. The search for competitive advantages and the influence from trading partners are the two major external pressures.[117]

Competitive strategy

Enterprise integration is considered to be of great strategic value as a competitive advantage. Both ERP and EAI are strategies to overcome integration problems in organisations, which is a topic that will be further discussed in section 3.3.7. However, the two enterprise systems differ concerning the strategy of obtaining a competitive advantage.

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[113] Themistocleous, M. (2004). p. 97-98
[114] Gattiker, T.F. & Goodhue, D. L. (2003). *Understanding the local-level costs and benefits of ERP through organisational information processing theory.* p. 433
[115] Themistocleous, M. (2004). p. 98
[116] Themistocleous, M., Irani, Z. & Love, P.E.D. (2003). *Evaluating the integration of supply chain information systems: A case study.* p. 2-3
[117] Themistocleous, M. (2004). p. 88

In the past companies would develop information systems according to the way business were done. However, with ERP the strategy is reversed; the business processes must often be modified to fit the system.[118] Nevertheless, companies should not make decisions about a system based only on technical criteria. According to Davenport organisations benefit the most from ERP by viewing the system in strategic and organisational terms; *those companies that stressed the enterprise, not the system, gained the greatest benefits*.[119]
Whether or not organisations will be able to gain a competitive advantage from a publicly available information system is a question often being discussed. While ERP vendors target an increasing number of midsize and small companies, the competitive benefit seems to depend on who can achieve a better fit between the business processes and the ERP system.[120]

Due to the problems with legacy information systems, ERP was developed to solve many issues. ERP are developed in accordance with best practice of processes in the industry. That is, what the ERP developer thinks is best. Researchers at educational or professional institutes also contribute to the notion of what best practices are for the moment[121].
Few companies succeed to implement ERP systems without modification. The views about what constitutes best practice often differ between vendors and users. Best practices may be *best* practices but organisations have a cultural behaviour that might be less than *best* and requires a thorough BPR to get aligned with best practices bundled in an ERP system. Findings show that there is little support for the notion of a fixed best practice. What is considered to be best is rather depends upon the current situation.[122]

Due to the possibility of making fine adjustments over time, legacy information systems may prove valuable in supporting the competitive strategies. In fact, legacy information systems are often connected to the critical business processes in organisations.[123] According to Linthicum the business value of EAI is obvious. He argues that the continuous development of software in the organisations has created business-critical systems that serve one specific purpose and one specific set of users. The systems have become custom-built stovepipes in the way that their utilisation is limited to individual functions. EAI enables the sharing of the

[118] Davenport, T.H. (1998). p. 125
[119] Davenport, T.H. (1998). p. 128
[120] Chen, I.J. (2001). p. 379
[121] Abrahamson, E. (1991). *Management Fads and Fashions: the diffusion and rejection of innovations*. p. 586
[122] Swan, J., Newell, S. & Robertson, M. (1999). p.292
[123] Light, B. (2003).

data among these stovepipes *without making sweeping changes to the applications or data structures*. Hence the specialised legacy information systems, which may support distinctive competitive strategies, are given the opportunity to survive through EAI.[124]

Trading partners ERP

Among organisations there is a need for improvements in supply chain management. Business process re-engineering and just-in-time techniques have been, and still are, measures in the area. However, the trend today leans towards increased collaboration and multi-enterprise supply chain optimisation.[125]

While some business processes are well supported by ERP modules, others are not. Areas that are less data intensive, e.g. supply chain planning and customer management are not as well provided for. However, developers have started to elaborate tools to link front office, i.e. sales, marketing and customer service, with back office, e.g. logistics and financials. These tools are supply chain optimisation (SCO) and customer relationship management (CRM). Figure 9 shows the future development of ERP according to Chen.[126]

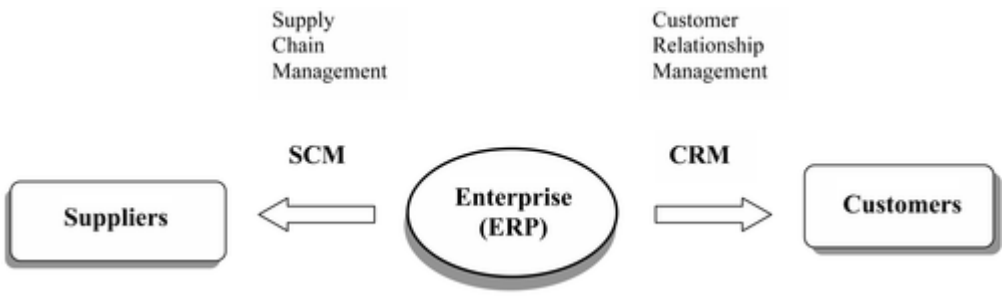

Figure 9. Future trend of ERP systems.

Advanced planning systems (APS), also referred to as SCO, work as an aid in providing optimal solutions to the management of supply chains. Since APS do not generate their own data, they may use the data provided by ERP through integrating with the system. In this way organisations having implemented an ERP may further benefit from the system by adopting APS. It is worth mentioning however, that the integration of APS or SCO with ERP requires

[124] Linthicum, D. (1999).
[125] Themistocleous, M., Irani, Z. & Love, P.E.D. (2003). p. 2
[126] Chen, I.J. (2001). p. 381-382

additional changes to business processes and higher level of mutual trust among trading partners.[127]
Having realised the need for customer service, ERP vendors have started to taking over and forming alliances with companies in the CRM market. Hence, organisations are offered the possibility to implement CRM systems either as bolt-ons or through the procurement of an ERP/CRM package. As in the case of APS, the installation of CRM requires significant changes due to the extensive impact on business processes.[128]

As mentioned in the beginning of this part, the trend today leans towards increased collaboration and multi-enterprise supply chain optimisation. In this respect, EAI may involve an advantage by making the integration across organisational borders more efficient.[129]

Due to the variety of definitions among authors concerning e-commerce and e-business, a clarification needs to be made. In this master thesis, e-commerce refers to electronic business-to-consumer applications, whereas e-business refers to the business-to-business applications. Thus, the term e-business is a part of inter-organisational relations, e.g. supply chain management (SCM). The definitions mentioned above, agree with terms discussed by both Linthicum and Themistocleous et al.[130]

The development of e-commerce and e-business has strongly affected the role of EAI. Inter-organisational application integration is a prerequisite for the possibility of conducting business over the Internet. The value of e-business comes when integration of applications that support the whole value chain is put into practice.[131] EAI supports integration at an organisational as well as an inter-organisational level. Through integration the members of a supply chain can build a common IT infrastructure that unifies all information systems and enables process automation. Figure 10 gives a vision of how this might be done.[132]

[127] Chen, I.J. (2001). p. 382
[128] Chen, I.J. (2001). p. 383
[129] Themistocleous, M.., Irani, Z. & Love, P.E.D. (2003). p.2
[130] Themistocleous, M., & Irani, Z. (2002).
[131] Themistocleous, M., & Irani, Z. (2002). p. 155-161
[132] Themistocleous, M., Irani, Z. & Love, P.E.D. (2003). p. 4

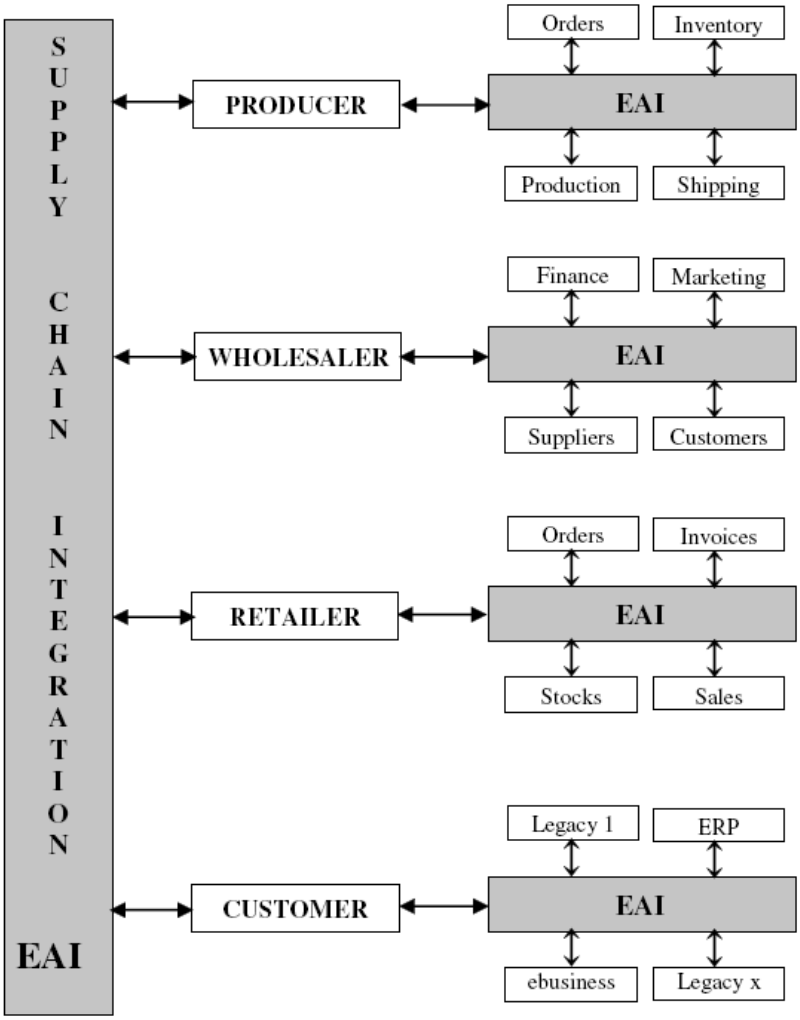

Figure 10. Supply chain integration through EAI technology.

When considering inter-organisation integration companies need to decide whether they want loose or tight type of integration. This is a matter that will be further described in section 3.3.6.

3.3.6 Evaluation framework

Analysing the need of the company and from that choosing the proper IT solution requires suitable tools to work with. Themistocleous stresses the importance of an evaluation framework as an aid in matching the business with different alternatives in the market.[133] As Themistocleous in his article refers to

[133] Themistocleous, M. (2004). p. 88

the adoption of EAI alone, the authors of this thesis have chosen an alternative to serve as a framework for ERP adoption.

The results from a survey conducted by *Information Week* show that the top three reasons for the failure of IT projects are poor planning or poor management, change in business goals and lack of business management support.[134] Apart from the extensive technical issues, companies need to take time and think through what their business needs are.[135]
Various criteria for selecting an ERP have been identified among companies. There are differences between large and midsize organisation not only in the way they choose their ERP, but also in the composition of the selection group. Several authors[136] in the field point to the significance of the selection group. They stress the participation of people who know the business processes and will be affected by the system.
According to an exploration made by Bernroider and Koch, smaller organisations put less emphasis on the selection process than did large organisations. Still the former stressed the costs and adaptability of the system. The importance of different criteria varied among companies depending on their size. [137] Below follows a list of criteria that may be considered to be relevant in the selection process of an ERP system.

- Market position of vendor
- Customer and supplier needs
- Internationality of software
- Organisational flexibility
- Customer satisfaction
- Possibility to customise the software
- Innovation capabilities
- Implementation time
- Support

The list of criteria is gathered mainly from the discussion of Bernroider et al.
In realising what system is needed, organisations need to develop a vision of life after implementation to clarify the goal. Such a procedure will help selecting the appropriate modules and functions.[138]

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[134] Umble, E. J., Haft, R.R. & Umble, M.M. (2003). *Enterprise resource planning: Implementation procedures and critical success factors.* pp. 241-257, 250
[135] Parr, A. & Shanks, G. (2000). *A model of ERP project implementation.* p. 289
[136] Bernroider et al. (2001), Davenport (1998), Umble et al. (2003), Chen (2001)
[137] Bernroider, E. & Koch, S. (2001). *ERP selection process in midsize and large organisations*. p. 253
[138] Chen (2001)

According to Themistocleous an evaluation framework is a factor that affects decision-making and positively influences the adoption of EAI.[139] Themistocleous and Irani have proposed such a framework that may be used during the selection of integration technologies and tools.[140]

The framework consists of criteria collected from previous findings[141] along with additional findings made by Themistocleous et al. Together they result in a list of twelve evaluation criteria:

- Connectivity layer
- Transportation layer
- Translation layer
- Process automation layer
- Integrated product
- Toolkit product
- Loosely type of integration
- Tightly type of integration
- Custom systems integration
- Packaged systems integration
- Intra-organisational integration
- Inter-organisational integration

The four different layers refers to the levels of integration proposed by Themistocleous, see the following section for a further description. Evaluating integration layers aids in the process of assessing EAI packages. The remaining eight criteria are gathered from the evaluation of opposite EAI packages.

Companies may choose an integrated or a toolkit product. A toolkit criterion refers to the out-of-box EAI package. In such cases the company does not need detailed technical knowledge, since the essentials are in knowing what the package does. However, there is no such total EAI solution available on the market today. An integrated product is a solution built up from different tools the organisation can use to upgrade and enhance the system. [142]

Loosely or tightly type of integration refers to the connectivity mechanism that EAI supports. The choice of one type does not need to eliminate the choice of the

[139] Themistocleous (2004). p. 85-88
[140] Themistocleous, M. & Irani, Z. (2003). *Towards a Novel Framework for the Assessment of Enterprise Application Integration Packages*.
[141] Ring & Ward-Dutton (1999), Puschmann & Alt (2001).
[142] Themistocleous, M. & Irani, Z. (2003).

other; in fact companies often need both types. Loose and tight connectivity assists in asynchronous and synchronous integration respectively. Synchronous integration involves a higher degree of process dependency and hence suits the co-ordinated communication between companies conducting e-business.[143]

Custom systems integration refers to the unifying of customised information systems, while packaged ditto refers to integration of packaged or standard applications.

Intra-organisational and inter-organisational integration refer to the integration at enterprise and cross-enterprise levels. As in the case of loosely or tightly types, both intra- or inter-organisational integration are needed by organisations.[144]

3.3.7 IT infrastructure

There are a considerable number of organisations that need to unify their information systems and automate their business processes. Companies may straighten their systems environment through the integration of the IT infrastructure, but in doing so the need for changing the structure of the organisational processes increases.[145] The following section is divided into two parts, integration and change of business process.

Integration

Several companies having invested in ERP claim that the improvement of organisational integration is below expectations. According to Themistocleous et al., ERP systems are facing problems concerning integration issues. A web based survey questionnaire distributed to ERP specialists in different countries, show that 38 per cent of organisations implementing ERP, do not replace their legacy information systems. The results from the survey stresses integration with existing systems as the major difficulty.[146] However, as a response to the dissatisfaction among organisations, Beretta[147] argues that ERP does bring substantial organisational integration, but only if the focus on business processes is present during implementation.
To obtain satisfactory effectiveness, integration has to be leveraged through three dimensions:

[143] Themistocleous, M. & Irani, Z. (2002).
[144] Themistocleous, M. & Irani, Z. (2003)
[145] Themistocleous, M. (2004). p. 88
[146] Themistocleous, M., Irani, Z., & O'Keefe, R.M. (2001). *ERP and application integration Exploratory survey*. p. 199-202
[147] Beretta, S. (2002).

- **Information integration**. The capability of transferring data efficiently throughout the whole organisation.
- **Cognitive integration**. The capability of understanding the perspectives of other professionals and functional units.
- **Managerial integration**. The capability of commitment from each manager.

ERP systems support information integration by the use of one common database. Cognitive integration is obtained through standardised practices. Finally ERP provides the balancing of unit performance with process performance, which results in dual focus to management attention, i.e. managerial integration. The structural components of business processes in ERP implementation bring the realisation of the three dimensions of integration to organisations.[148]

EAI helps integrating the disparate processes of an organisation. As a result companies may eliminate redundant processes and improve coordination. Results from studies show that an integrated technology environment is one of the important considerations on business improvement initiatives. The need for communication networks, i.e. links between the company, customers and suppliers, increases emphasise on integration even further.[149] In the area of inter-organisational integration distinction is made between loose or tight integration forms. In a tight type of integration, companies in the value chain attempt to function as one organisation, i.e. a virtual organisation. In this case enterprises share common data and processes. In a more loose type of integration, there is a lower dependency of processes and members of the value chain focus on exchanging data.[150]

There is no single EAI technology that solves all integration problems; as a consequence companies will have to use a set of technologies. Choosing the right mixture becomes an important factor for the success of EAI implementation. Careful consideration has to be taken to understand the needs of the company and to be able to purchase the technologies that fully support the processes. Themistocleous et al. propose an elaborated framework that correlates the integration technologies to the organisation's existing information systems.[151]

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[148] Beretta, S. (2002). p. 256-260
[149] Bhatt, G.D. (2000). *An empirical examination of the effects of information systems integration on business process improvement*. p. 1353
[150] Themistocleous, M., Irani, Z. & Love, P.E.D. (2003). *Evaluating the integration of supply chain information systems*. p. 4-5
[151] Themistocleous, M., Irani, Z. & Love, P.E.D. (2003). p. 10

Like Beretta talks about leveraging ERP integration through three dimensions, Themistocleous proposes that EAI achieves integration through four different layers. An explanation of the integration layers follows below.

- **Connectivity.** This is the layer through which data and objects are drawn from the source system, i.e. the already existing system in the organisation.
- **Transportation.** This is where the data and objects are transferred to the central integrated infrastructure.
- **Translation.** The infrastructure adapts the data and elements to conform to the target application.
- **Process automation.** This layer automates business processes. It directs the translated data to the target system and produces new events.

Since an EAI package is based mostly on non-invasive technologies, few changes need to be carried out to the existing information systems.[152]

Change of business processes

When designing new systems for an organisation it is not uncommon that requirements of system developers are hard to fulfil. That is, in the way of describing the activities in the company. Many companies have low degree of understanding of the processes involved. That often leads to some sort of re-organisation connected to the design-phase of new systems. However, ideally, the system development process only is about understanding the company's needs and then realising the support for the needs in a system.

Business Process Re-engineering is a concept where the business is ready to do what is necessary to significantly improve performance. Small adjustments and improvements are not equivalent with BPR, which is about radical changes. Many companies are still function-oriented and experience problems when dealing with customers across the whole value chain. By re-engineering the processes to work across the functions, organisation may create a more efficient flow of business.[153] Quoting Gunasekaran (1997): *The basic aim of BPR is to deliver quantity goods at competitive prices in a timely fashion*. Information technology is often used as a driver or structure for the organisational and structural change. Reorganisation is supported by information systems to achieve a better process delivery system.

[152] Themistocleous, M. & Irani, Z. (2003).
[153] Gunasekaran, A., & Nath, B. (1997). *The role of information technology in business process reengingeering*. pp. 92-93

Around three quarters of organisations fail to improve the organisational and process structure. The main reasons for this are that companies are:[154]

- Making minor changes instead of major changes
- Bringing the BPR to an end before it is complete
- Not assigning enough or suitable resources, including leadership, to carry out the BPR

The major elements of BPR are shown in figure 11.

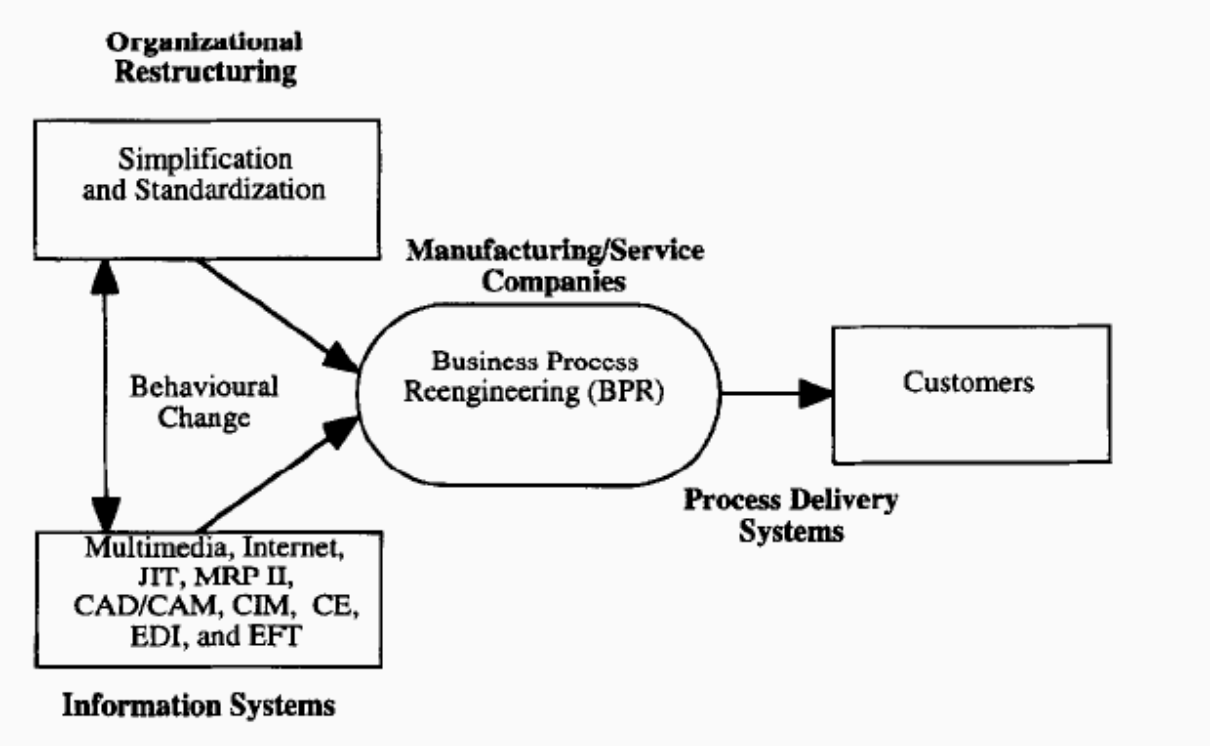

Figure 11. Major elements of business process reengineering[155]

The problems associated with implementation of ERP packages are in particular the adaptation of the organisational processes to match the best practices of an ERP system. The reason for this is that packaged software are unsuccessful of meeting the organisational information needs and possibility to match business processes.[156] Implementations of ERP systems frequently require organisations to adapt to the package through business process reengineering. To unleash the full potential of ERP it is suggested that complementary BPR increases ROI (return

[154] Waters, D. (2002). *Operations Management Producing Goods and Services*. pp. 262-265
[155] Gunasekaran, A. & Nath, B. (1997).
[156] Lucas, H.C., Walton, E.J., & Ginzberg, M.J. (1998). *Implementing package software.*

on investment, a calculation used in business to measure the value of an investment) but at the same time increases the level of complexity.[157]
As mentioned earlier, the non-invasive nature of EAI technology makes integration of existing information systems possible without making extensive changes to applications. However, to enable the unifying of information systems and automation of processes both at intra-organisational and inter-organisational levels, a common IT infrastructure is needed.[158] The way to achieve this is through the re-engineering of business processes. As this is an issue that likewise concerns ERP implementation, much of the reasoning in section 3.3.7 may be applied here as well. However, EAI may bring additional concerns as it deals with inter-organisational partnerships to a larger extent than do ERP.
To accomplish efficient sharing of data and processes across the value chain all its members need to conform to the same structure. The organisation's former functional entities, most commonly separated from each other, should be torn down to facilitate the conduct of the process. At an inter-organisational level, some partners may be forced to change as their transactions may depend on the transactions of another value chain member. In such situations resistance to change may emerge.[159]

3.3.8 IT sophistication

IT sophistication is a factor that refers to the understanding and handling of technical problems in the organisation. If there are limitations in the way employees use existing information systems, the company may want to consider an alternative IT strategy.[160] The following section concerns the organisation's sophistication of ERP and EAI respectively.

Considering the implementation of ERP systems, authors[161] in the field point to the importance of critical success factors, CSF. The use of a list containing CSF, may serve as an aiding tool in improving the organisation's sophistication of ERP. A selection containing some of the factors most frequently occurring is listed below.

- **Top management commitment**
  An ERP implementation affects the competitive advantage of the business. Handing over the responsibility to the IT department, may risk the survival of the company. The commitment of top management throughout

[157] Somers, T.M., & Nelson, K.G. (2003). *The impact of strategy and integrations mechanisms on enterprise system value: Empirical evidence from manufacturing firms.* p. 322
[158] Themistocleous, M., Irani, Z. & Love, P.E.D. (2003). p. 4-5
[159] Themistocleous, M. (2004). p.98
[160] Themistocleous, M. (2004) p.89
[161] Bingi, Sharma & Godla (1999), Hong & Kim (2002), Umble, Haft & Umble (2003)

the project brings the whole organisation to the same thinking, and facilitates the transforming of business practices.[162]

- **Understanding of strategic goals**
  There is a need for a common view among employees to help understanding why ERP is being implemented. One way to acquire this is to use key people that create a clear vision of how the company should operate.[163]
- **Extensive education and training**
  Understanding how the user's interference with the ERP system affects the company is critical, since the lack of sufficient employee training may become a major cost. Not only do employees have to deal with new technology, but also new responsibilities that often come with the change of business processes have to be taught.
- **Focused performance measures**
  As a consequence to the extensive costs often associated with ERP implementation, top managers often feel the need to measure the financial return and with that justifying the investment. Still, as mentioned above, traditional measures may limit the overall view. By focusing on the business process level, and take various dimensions like quality, timeliness and efficiency into account, the company may achieve a satisfactory measurement.[164]
- **Data accuracy**
  In ERP systems all the business' data are gathered in a common database. Since everyone in the company shares the same information, it is critical that all users are in agreement with the importance of correct data entry.[165]
- **Implementation time**
  The cost of implementation, e.g. through hiring consultants, increases with time. By deciding not to customise the ERP module, i.e. *go plain vanilla*, companies may reduce implementation time. Yet, a solution with no modification may be a bad match to the business requirements.[166]
- **Organisational fit**
  Before the implementation of ERP, an organisation needs to identify the gap between the system and the business requirements and then come to a conclusion on how to bridge the gap. For successful implementation, there is a need for fit between the organisation and the ERP system before the

[162] Bingi et al. (1999).
[163] Umble et al. (2003). p. 244
[164] Beretta, S. (2002). p. 255
[165] Umble et al. (2003). p. 246
[166] Bingi et al. (1999).

adoption.[167] The concepts of organisational change and business process re-engineering were discussed in a previous section.

Classical system development theory suggests that the organisation should constitute the foundation for the design of the system. That is what is supposed to be the case for the legacy information systems that companies have developed over the years. Legacy information systems are used by the employees and their knowledge may be the only IT support that the organisation has today. There is an ambiguous view of the older systems in organisations. Some may think that the old and well-tested systems are the best systems the organisations can get.[168] Others may think that the old systems are difficult to learn and not supportive to the processes.

According to Light, the value of legacy information systems increases when taking social and organisational as well as technical considerations into account. Legacy information systems can be an asset since through the years all the debugging efforts make them reflect the essential tacit knowledge of the organisation. During the lifetime of an information system, the organisation that uses it changes. Allowing constant adjustments, legacy information systems have the ability of changing accordingly and to fulfil the needs and demands of the users.
However, the possibility of building the IS according to people's usage, might just as well be a disadvantage. The issue becomes a problem if the skills of the people that constructed the system are no longer available to the organisation. When legacy information systems grow old, there is a risk that employees get less familiar with them and the time designated to system maintenance increases. The group of employees that have knowledge of the old systems may be rather small, and if they leave the company there are no one who has the knowledge to handle the systems properly. [169] In addition, the documentation of legacy information systems is often inadequate, which makes the understanding of the IT harder.[170]

A project manager involved in an EAI implementation case study made by Themistocleous and Irani reported that there is a shortage of employees with EAI skills and knowledge. The company had to spend both time and money to obtain

[167] Hong, K-K. & Kim, Y-G. (2002). *The critical success factors for ERP implementation: an organisational fit perspective.* p. 25-27
[168] Light, B. (2003).
[169] Light, B. (2003).
[170] Themistocleous, M. & Irani, Z. (2001). p. 319

this knowledge. According to the manager, enterprises that have the knowledge are in a position to adopt EAI. *The sooner you adopt this knowledge the better.* [171]

3.3.9 Support

Support is an important factor since it concerns not only what the vendor provides but also how many vendors the organisation should be dependent on.

Regardless the choice, both ERP and EAI implementation require the support from vendors and consultants. In organisations there is often lack of knowledge and skills concerning the implementation of these kinds of package solutions.

The common big problem with a growing number of systems in companies led to development of standard systems. These were developed by vendors that sold the standard systems to companies. Today there are many rivalling ERP vendors. Companies are confronted with a choice of action to leave their old systems and pass to a new system. This puts a stamp on the relations with the ERP vendor.

First, it is of great importance that the company chooses the right ERP vendor. Some ERP vendors are specialised to certain branches and their standard systems might have functions that suit the certain branch better, e.g. companies selling services may not need systems for selling gods. Second, the ERP vendor may be focused on a certain market; small, middle or large companies. Third, the ERP vendor may have sold their system to the company's competitor and the company might want to take that into consideration. Fourth, if the company is to implement the system internationally it is vital that the system is adapted to handle country specific differences. If it is a question of remote countries, it is important that there is knowledge of implementation to be obtained, i.e. if there are ERP consultants.
In the cases where ERP vendors are unable to deliver what is desired, there are the best of breed alternative, which provide an ERP package built up by modules from different vendors.

Regardless the strategy a company chooses it will be dependent of one or more vendors internally or externally. There are advantages and disadvantages to have one vendor only.[172] One vendor has full responsibility of the company and several vendors do not have to communicate and coordinate all activities. This implies also that the company is dependent on a sole vendor. If that single vendor disappears the company is without vendor and think of all companies that are completely dependent on IT. It is a more stable state in the long run to

[171] Themistocleous, M. & Irani, Z. (2003).
[172] Light, B. (2001). p. 221-222

stake on a number of vendors. Thereby the risk is distributed but it puts higher demands on coordination.

Traditional outsourcing often causes a debate in what effect the handing over of operational control of the data centre might have on the organisation's core competitiveness. There have been shifting trends through the years concerning outsourcing. Ekanayaka et al. argue that the following years will bring more ASP offerings. ASP is a shortening for application service provider, which is a third-party service firm that provides applications across a network through renting. The service of ASP is a type of IT outsourcing, i.e. a way for the organisation to let the vendor provide the IT in return of a fee. Traditionally, outsourcing was affordable mainly by large companies with large IT budgets. However through ASP, where core business applications are accessible through renting, e.g. over the Internet, even small to mid-size enterprises that lack the core IT competencies may afford the investment. Even though the delivering of ERP through ASP is considered a part of an immature market, the model may offer an alternative to complex ERP systems.[173] There may be several benefits from outsourcing the IT and adopting a rental model.

- Companies with small IT budgets and scarce IT capacities can afford ERP tools and be on the cutting edge of technology.
- The letting off of hardware, training and installation expenses companies reduce the capital spending.
- The IT investment is being spread out into manageable payments over time.
- The company maintains a flexible IT infrastructure through the option of switching applications in the future.
- Through the saving of time and resources, the company may focus on its core business.[174]

Succeeding in installing an ERP system requires finding the right people to guide through the implementation phase. The hiring of consultants becomes an important issue, since the project demands functional and technical as well as interpersonal skills. Furthermore, the ERP market being relatively young, there is a lack of consultants with years of experience. [175]

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[173] Ekanayaka, Y., Currie, W.L. & Seltsikas, Phil. (2002). *Delivering enterprise resource planning through application service providers*. p. 192-193
[174] Singh, C., Shelor, R, Jiang, J. & Klein, G. (2003). *Rental software valuation in IT investment decisions*.p. 2-3
[175] Bingi et al. (1999).

Due to the lack of knowledge and skills in organisations, there is a need for good EAI support as well. Both vendors and consultants may provide this kind of support.[176]

During the last decades companies have developed different systems to support different functions in the company. It has led to a large number of systems.[177] Some of these systems may have been developed by external vendors, whilst others have been developed internally. The external vendors may still exist but might as well have gone bankrupted or by other means they might no longer be able to support or update the systems. In some cases the external vendors have regular communication with the company. In the cases where the external vendors do not take part of it anymore, the internal IT-department may have taken over the support and update of the system.[178]

An EAI package consists of a set of technologies to solve integration problems. This is due to the fact that there is no single technology that may fulfil all the needs of an organisation. Each EAI vendor configures their products by putting together technologies to support a specific market. As a consequence, companies need to evaluate the available packages to see which one provides optimal support to their business processes. While some EAI vendors develop tools that focus on legacy integration, others put together software from third parties to build an EAI package.[179]

[176] Themistocleous, M. (2004). p. 89
[177] Ersala,N., Yen, D.C. & Rajkumar, T.M. (2003). *Enterprise Application Integration in the electronic commerce world*. p. 70
[178] Light, B. (2003)
[179] Themistocleous, M. & Irani, Z. (2003)

4 Results

Referring to the basics of SSM provided by Checkland (see section 2.4) people perceive and interpret the world in their own way. The purpose of this part containing the results of the thesis is to present VBoF's ***real world situation of concern****. This can be seen in figure 12.*

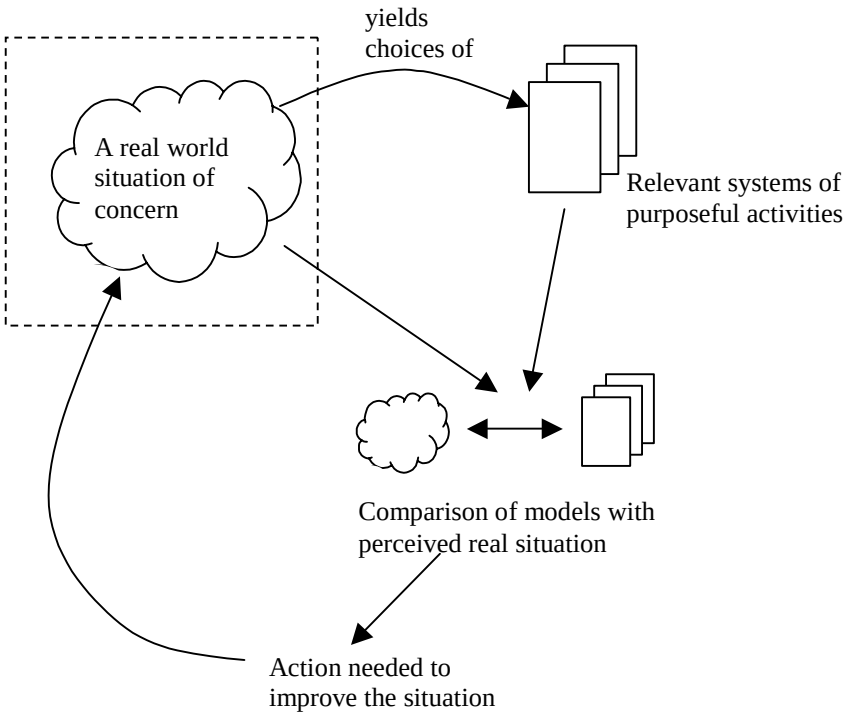

Figure 12. Presentation of a real world situation of concern.

4.1 A real world situation of concern

As employees at VBoF vision their organisation a certain way, there is a need for an appropriate structure in analysing this vision. In this thesis a model proposed by Svärdström was chosen to support this task. This model was described in detail in section 3.2. The model for holistic and co-ordinated development is divided into five different areas, functional-, cultural-, infological-, and structural integration.

4.1.1 Functional integration

The main process at VBoF is OTD, Order to Delivery. It is divided into several sub processes, which are presented in figure 13. Basically it is about material supply and assembly of the parts into chassis and finally a test of the finished product. Alongside the four assembly flows is the packing process of CKDs (Completely Knocked Down chassis). The main process is supported by Finances, Human resources, Engineering and Quality departments. Then there is the plant manager to lead VBoF.

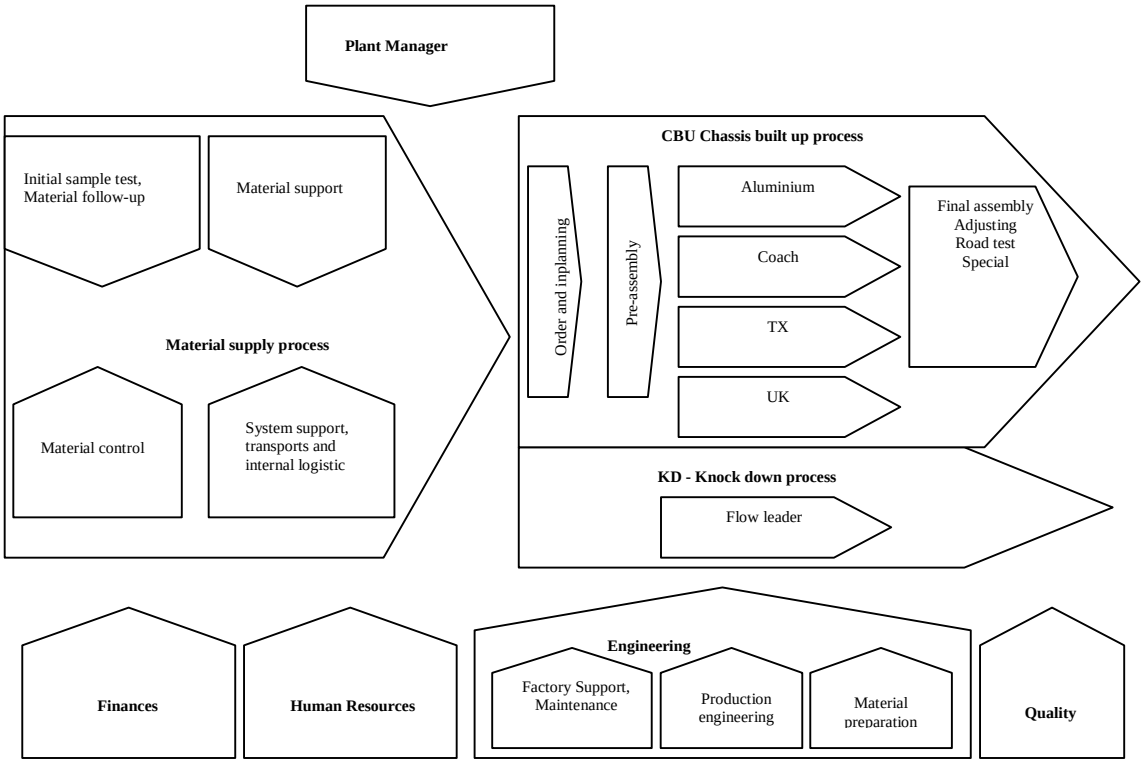

Figure 13. Processes at VBoF.[180]

IT is vital to the activities at VBoF, the business cannot work without it, e.g. routines for annual reports. As the production controller puts it:

> *If it is not working I have a problem. I am very dependent on IT. I have no backup for manual work. I have neither the knowledge for doing it manually.*

New systems are not always designed to fit the processes. As the IT-coordinator puts it:

[180] Provided by Benny Mild.

> *You want the processes, not the IT techniques, to initiate IT development but in practice it is not so. Often IT personal drives on: "They do like this at Volvo Trucks, shouldn't we do that too?" Projects are too much driven by IT, the processes are somewhat neglected.*

The information systems available at VBoF are described in detail in section 4.1.5 and include SAP R/3, AS/400 and Trucks' systems. Apart from the above mentioned information systems, the plant's employees also use Microsoft Office and in particular Excel for planning issues, and Outlook for communication. The style sheets are made manually and distributed by mail. When given the question "What tools do you need in order to do your work?" one employee answered:

> *Outlook!*

The systems available leave much of the usability of the information base to the user. The user must be aware of how to use the system, e.g. use of correct terms.

There used to be one computer at production and then they produced 15 chassis per day. Now there are a lot of computers but there are still only 15 chassis per day. The purpose of the systems is to contribute to control but it is the users responsibility. As the production controller puts it:

> *Although the systems might not have contributed to the number of chassis produced it is needed to support the heavy information flow that has been built up by e.g. an increased number of versions of chassis.*

IT has rationalised the processes. It is not possible to work as we did 20 years ago, IT is a prerequisite to handle the number of versions. IT has given a tremendous possibility to generate reports and follow ups, but is it useful?

Every second month there is a system meeting where system issues are discussed in order to integrate the use of systems in different departments, e.g. KOLA[181] adaptation to EDI technology and the Y2K adaptation. Every system has a system owner, a system responsible and a system administrator. The regular meetings are an initiative of the former IT coordinator. For the moment there is problem to get a good overview of the systems in use. The engineering manager:

> *Many systems work with separate databases, it is difficult to overview but it depends if you are used to it.*

[181] KOLA is one of the systems inherited from VTC.

The most important question that is discussed is the future development of IT in the organisation. The IT-coordinator:

> *If we would replace all IT technology with personnel we could use the IT finances to employ 70 persons. It is an intriguing thought.*

4.1.2 Structural integration

As an introduction to the organisational structure three organisational charts will be presented. This will introduce the reader to where in the organisation VBoF belongs.

On the highest level the organisational structure is divided by markets; Europe, North America, Asia Pacific and International. There are also has corporate functions like IT, product planning, Corporate Communication and Commercial Development centralized.

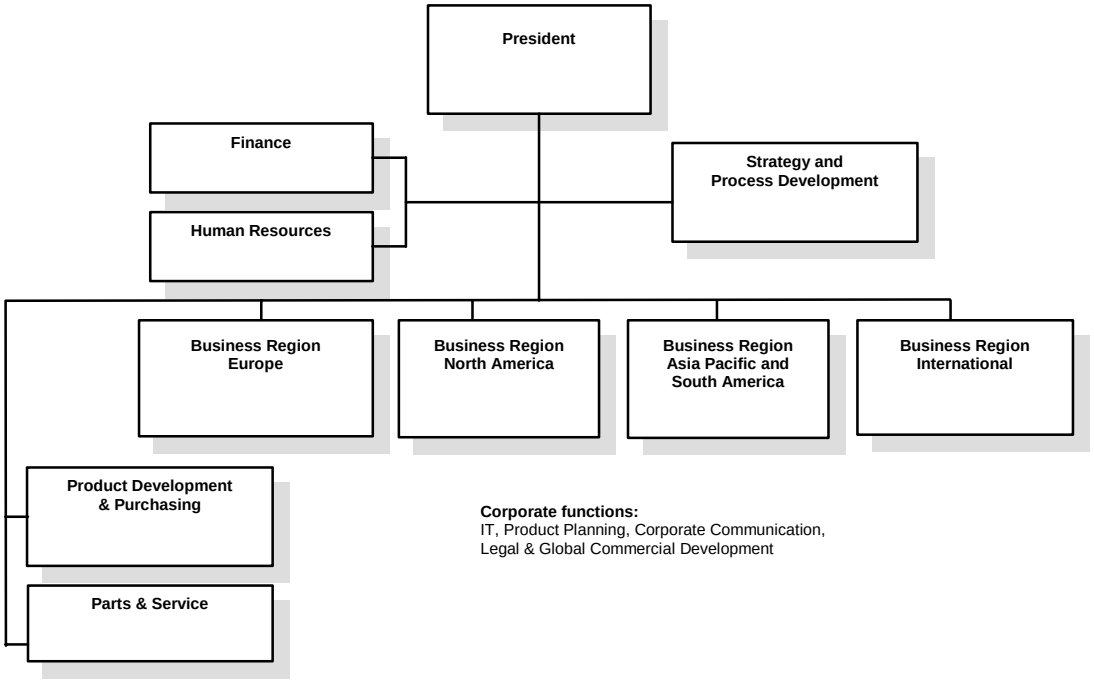

Figure 14. Organisational chart of Volvo Bus Company.

On the next level, under business region Europe, the organisation is still divided by markets; Europe North, West, Central and South. There are also staff functions like Global Commercial Development.[182]

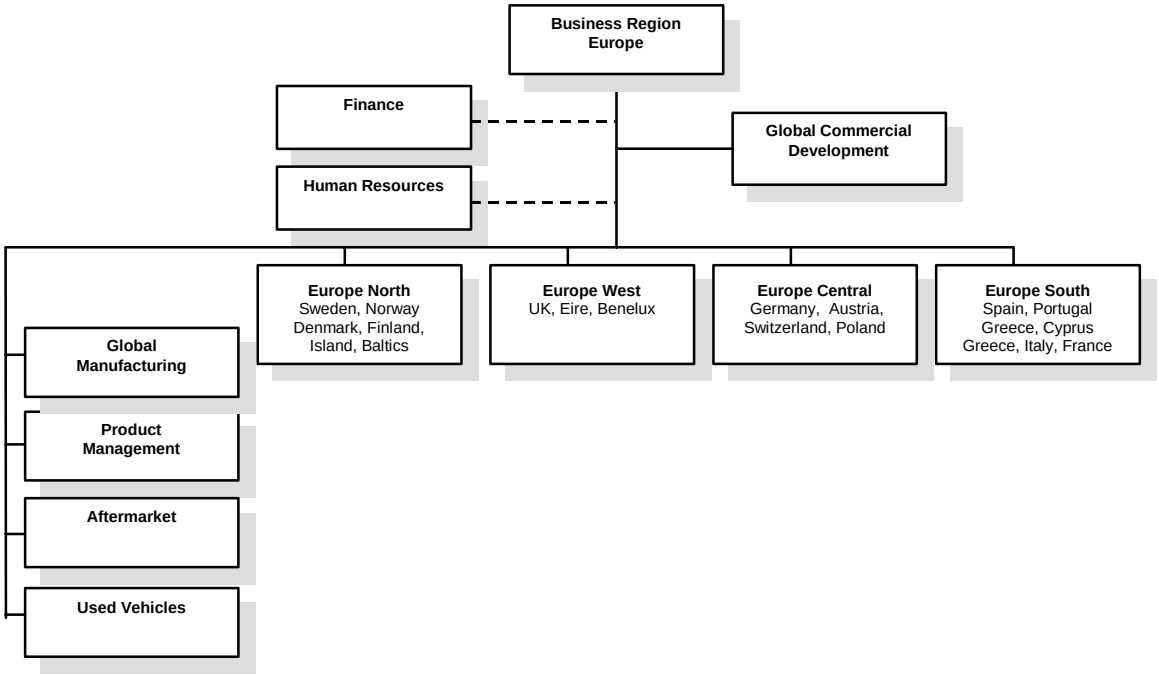

Figure 15. Organisational chart of Business Region Europe.

[182] This s the department at Volvo that accepted our study, see 1.3.

Global Manufacturing is divided geographically. Under Global Manufacturing, VBoF will be found as one of the production sites. Most production sites are body-builders. VBoF is the largest manufactures of chassis. The chassis are transported in two different ways; CBU, Completely Built Up, and CKD, Completely Knocked Down chassis. Wroclaw is the largest facility for complete buses, which is made with chassis (CKD) from VBoF.

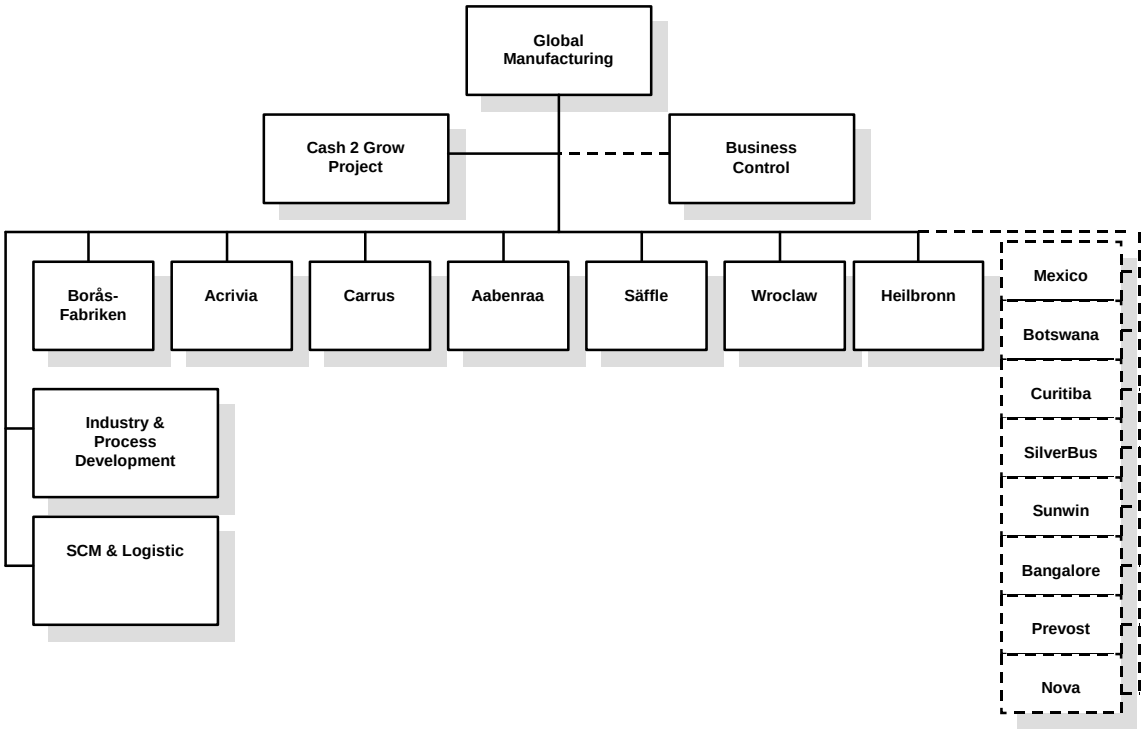

Figure 16. Organisational chart of Global Manufacturing.

VBoF delivers chassis in time with right quality and with the right price to internal and external customers; bodybuilders. The organisational goal demands that Volvos three corporate values, quality, safety and environmental care. In order to accomplish this the business is process oriented. The plant manager:

> *We want to make sure the organisation is process-oriented in the highest degree*

The organisation of the factory is flat. It is necessary to have a good relation between hierarchical levels and thereby do a good job. There are problems to produce the chassis in time and it is vital for the business that this is not neglected. This is assured by having few hierarchical levels. On the contrary the relation with main office is more hierarchical. As the plant manager puts it:

> *VBoF strives for decentralisation and ARHK strives for centralisation. It may depend on different views of leadership, need for control in contrast to trust. When decisions are delegated it is not necessary that they are the best decisions, it is enough with the second best. The important thing is that it is delegated.*

Communication between departments is important in order to ensure that departments are working towards a common goal. Communication through informal channels is mostly the case, but there are also formal channels. The production controller:

> *We have different forums to create synergy effects on communication between departments. We have a CBU-meeting where everyone meet and discuss. It is very good with forums with many aspects.*

But there is also room for improvements. The fact that communication works well may be because of the small size of the organisation. The IT-coordinator:

> *The communication works quite well. The bad things are that it can become isolated islands. It is hard to get an overview, you don't see all aspects due to lack of knowledge. One example is economists, who are very few, compared to logistics; few count the economy department in. Increased exchange between departments would be great.*

Between close departments the communication is better but this is due to the nature of the work. As the production manager puts it:

> *We have good contact within CBU[183] assembly. We are responsible for approximately 230 persons so we have a position of power. There is worse communication between HR, Economy etc. We are working with our group very much so there is no co-incidence that we have good communication. We spend a lot of time to lead and co-operate.*

Some departments have good communication and the communication increases with time. The production controller:

> *The more often we change bosses the more communication between departments. It's getting better and better.*

[183] In this case CBU refers to four of the flows, Aluminum, Coach, TX and U.K.

Although communication is not at its peak the business runs and the corporation between departments are most useful in certain situations. The plant manager:

> *When problems occur, communication between departments must work.*

The quality of the information is considered to be good by the sender, but the receiver must always edit the information for the receivers needs. The plant manager:

> *We must shorten the information routes. Everyone is responsible for not altering information or adding irrelevant information. We must have few levels. It is so easy to distribute information with the use of IT, one problem is that it is too information.*

The responsibility of quality of information is connected to area of responsibility and system responsibility. The production controller:

> *Every department is responsible for its quality of information and therefore every boss. It is totally clear who is responsible.*

IT has been vital for the organisation and it's needed in the future but a system cannot be perfect. As the IT coordinator puts it:

> *IT is a prerequisite to exist, so referring to that IT has delivered all quality, but there are lacks. There is always someone that starts to dig and check if something is wrong. The perfect system does not exist. Many people find the systems insufficient and think that they should solve everything, but the systems are the way we make them.*
>
> *One example of how IT has changed the organisation: We send a prognosis to vendors one year ahead. Two decades ago this was a complicated process (even though the degree of customisation was low then) with only four updates per year. Today we update that list with the use of IT automatically two times a week.*

Development of IT has improved the organisation in many ways and this affects the organisation and its employees. As the system administrator puts it:

> *The quality today is much better. Large projects like Y2K resulted in great improvements. My systems are nearly 100% reliable.*

The development of the AS/400 systems, i.e. BUMMS[184], changed the agility of the organisation. The production engineer:

> *Before BUMMS we were governed by construction. Some processes, for example errors, it is easier to correct. BUMMS is good because it is customised*

The implementation of the financial master of SAP R/3 has improved the work for economists. As the production manager puts it:

> *R/3 was an improvement for economy systems. It is easier to get an overview. There is better information about deliveries, proceeding, time-schedules etc.*

Development of IT requires resources and everyone does not realise this. As the production engineer puts it*:*

> *Development runs slowly, due to lack of resources. It is necessary to run the new and old in parallel. You cannot be in a coma during implementation.*

4.1.3 Cultural integration

To respond to changes in production volume, the organisation must be agile. VBoF strives to maintain the flexible and free organisation. But there is also a pressure to become more centralised. Some think that the organisation is too loose and require more authority in order to be effective. The IT-coordinator:

> *The key word is freedom and it has advantages and disadvantages. The advantage is that you are seldom stopped. Sometimes the organisation is badly managed.*

A common view of the ways of solving problems is that the organisation is "fixing things" instead of doing jobs by standardized methods. This is very flexible but at the same time time-consuming when doing routine work. The engineer manager:

> *We have a fixing-mentality, a prestige loose organisation. You may speak to whom you want in the hierarchy and that feels good, it can be a disadvantage sometime.*

The organisation consists of different generations, which think very differently. In general the older group of employees see advantages with old systems while

[184] BUMMS. Swedish: BUssars Material och MonteringsSystem. Translation: VBC's Material and Assembly system.

new employees favour standardised solutions. The most straightforward view perhaps is to think of the customer and their needs and adapt the organisation to that.

4.1.4 Infological integration

The personal communication is essential to the organisation. Speaking tête-à-tête is not replaceable with mail or phone. The informal communication is the driving force in at VBoF. As the technical manager puts it:

> *Absolutely most important! The rest is just formal communication. It is the informal communication that drives the company forward.*

Informal communication is in particular necessary when frameworks are missing. Then structures can be formalised and put in practice. Yet there are disadvantages with informal structures. Some people are excluded from discussions and there is a possibility that made decisions can be contradicted. As the IT coordinator puts it:

> *Informal communication is more important than meets the eye. Some reasons are that interpretation problems can arise and return questions are not instant.*

The most important formal communication is mail. It has almost completely replaced telephone, postal letters and fax. There are off course disadvantages with mail. It is very easy to use and to reach many people with little effort. But this can be expensive. As the IT-coordinator puts it:

> *One example is a hospital where someone lost a scooter. Around 1000 e-mails were sent to find out if someone had seen it. The cost of the work hours to read the e-mails probably paid for the scooter many times*

Many tasks are described in detail but this information is not always trusted and informal communication is used to verify. The reason for this may be of cultural differences as the production manager outs it:

> *Many of us are farmers' sons; we neglect systems and have a tendency to take shortcuts, which often become detours.*

If it is not obvious enough yet how important the informal communication is, let the plant manager's comment reinforce the viewpoint:

> *The informal communication is very important. IT has not replaced face-to-face communication. We have a 15 minutes meeting with all employees in the factory every month, it would be hard to replace it with writing.*

The existing systems, AS/400, SAP R/3 and the heritage from VTC, have different usability attributes. The AS/400 and Trucks systems require knowledge of the processes and buses in general. As the system administrator puts it:

> *A beginner needs to understand how system works, understand the [value] chain and different departments.*

Education is required to use SAP R/3 and as the technical manager puts it:

> *More education on SAP would be great.*

Common computer skills are required for all systems. Some employees have never used a computer and need education and often help with computer related work when applicable. New employees are supposed to be educated in the systems but this is not always enough. As the production controller puts it:

> *SAP R/3 education do not have the right focus, it should be user-oriented.*

Employees that have been in the company for a long time find the AS/400 systems easy to use if you know the processes and buses. SAP/3 on the other hand is harder to use and some old employees find SAP/3 troubling and complicated. But as the production manager puts it:

> *We should not have old systems like AS/400.*

Younger employees see SAP/3 as a challenge and as a resource. What is important to remember is that all system users must be active with their systems otherwise their knowledge is lost. As the production controller puts it:

> *You must work actively with all systems or you will lose knowledge*

4.1.5 Systems environment

The IT-environment is divided into two parts, existing and planned IT-systems.

Existing IT systems

The systems currently in use at VBoF are numerous. Ranging from the older IBM AS/400 to SAP R/3 the systems constitute a challenge for each employee. The production engineer:

BUMMS[185] has many applications, I have no idea how many. The systems are built for the factory and are not always adapted to it.

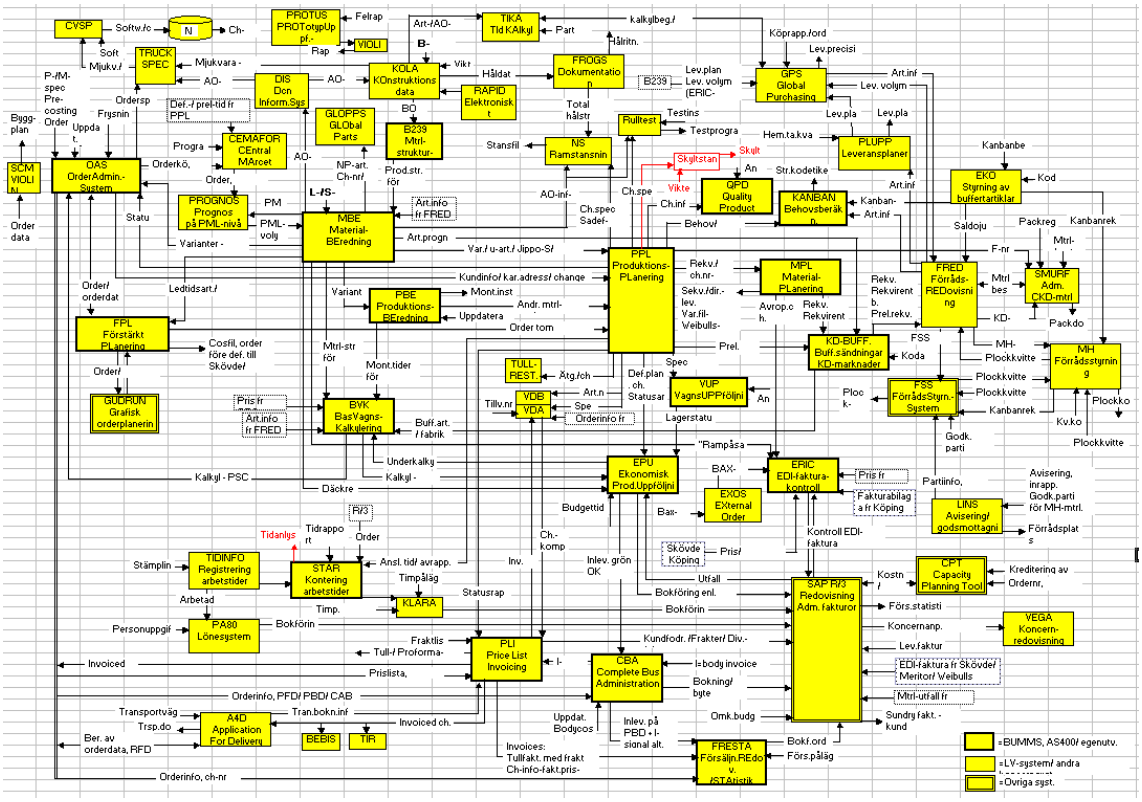

Figure 17. System map of VBoF.

The IT coordinator at VBoF provides the system map.[186] It is the only documented picture of the systems available at VBoF. Figure 17 is placed here to visualise the complexity of the IT environment. To get a clearer view the reader is referred to the enlarged picture in appendix A. Many of the systems are inherited from VBC' concern neighbour, VTC that is a larger company than VBC. On the system map, the systems with one thin frame are Volvo Truck inherited systems. There are also systems that are developed by Volvo buses with one thick frame; those are in AS/400 environment. Apart from these there are also a few other systems, developed by smaller IT-firms seen with two thin frames.

Inherited VTC systems

The systems inherited from VTC are developed for VTC's production plant in Tuve, Sweden. The Tuve plant produces frames and assembles trucks. The production procedure is similar to the production of bus chassis, which is why

[185] BUMMS is the name of the first collection of systems developed specifically for VBoF.
[186] IT coordinator Benny Mild.

some of VBoF's systems were inherited from VTC. These systems are separate from VBoF's other systems and hence constitute "system islands".

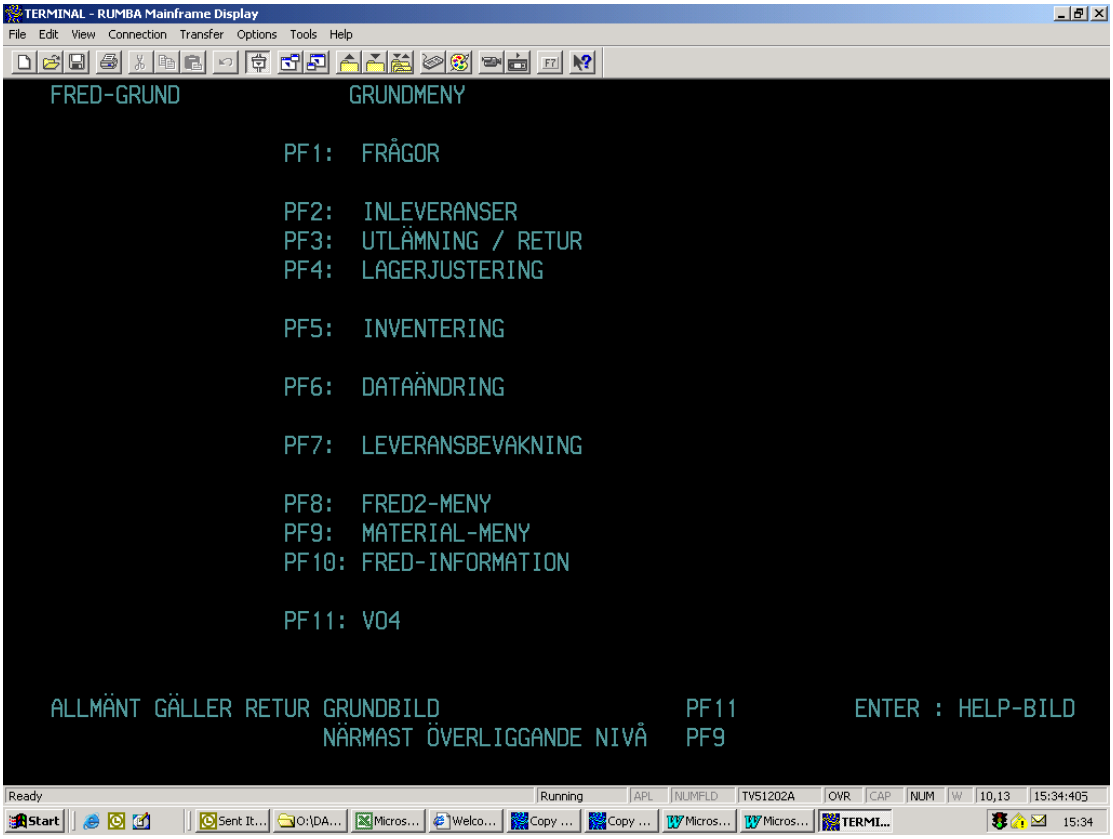

Figure 18. Main menu of FRED[187], a system inherited from VTC.[188]

The use of systems developed for Volvo Trucks are still in practice, an example of this is a recent development of KOLA.[189]

[187] FRED. Swedish: FörrådsREDovisning. Translation: Store Accounting.
[188] Provided by Benny Mild.
[189] Swedish: KOnstruktionsdata Lastvagnar, Translation: Konstruction Data for Trucks

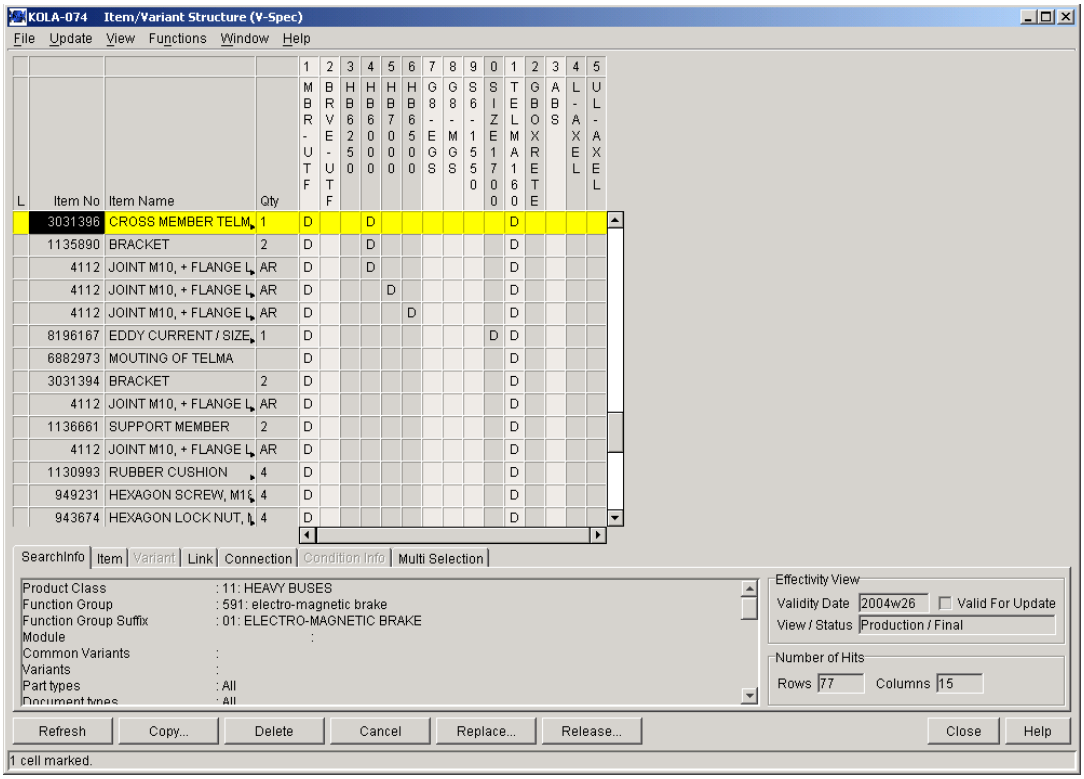

Figure 19. Screenshot of the new version of KOLA, developed by VTC.[190]

This means that Volvo Buses are in the hands of Volvo Trucks in some ways. This is due to the fact that buses historically are customised trucks made for passengers. Even though the first Volvo bus was built in 1928, VTC still influence VBC. As the plant manager puts it:

> *We have a high degree of Volvo trucks' systems of historical reasons, since chassis of trucks is similar to chassis of buses*

Self developed systems

The first systems developed for VBC alone were developed in the late eighties. This was after VBC was created as an independent division within the Volvo Group in 1968. The spirit of the company at that time was that each division should take care of itself. These were the BUMMS systems created on IBM's AS/400 platform introduced in 1988. The AS/400 was at that time fairly new product with features like the tool called Synon, which allowed the programmer to create applications easier. The plant manager:

[190] Provided by the IT coordinator.

We have many systems that are 25 years old. Old systems have been patched and added. They are not always optimal.

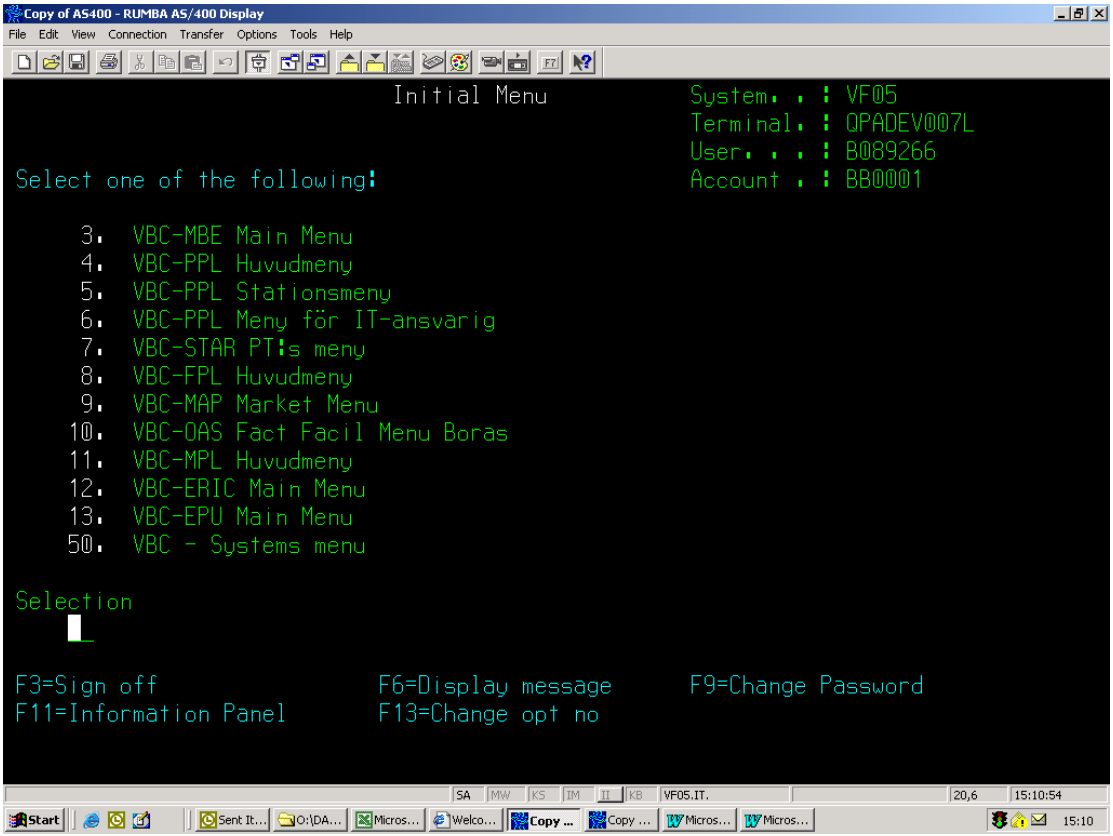

Figure 20. Screenshot of main menu of AS/400.

SAP R/3

In order to enhance the IT support for the economy departments FI/CO modules of SAP R/3 were implemented in 1997. SAP R/3 improves coordination between the members in the value chain. The plant manager:

The economy is connected to Gothenburg via SAP.

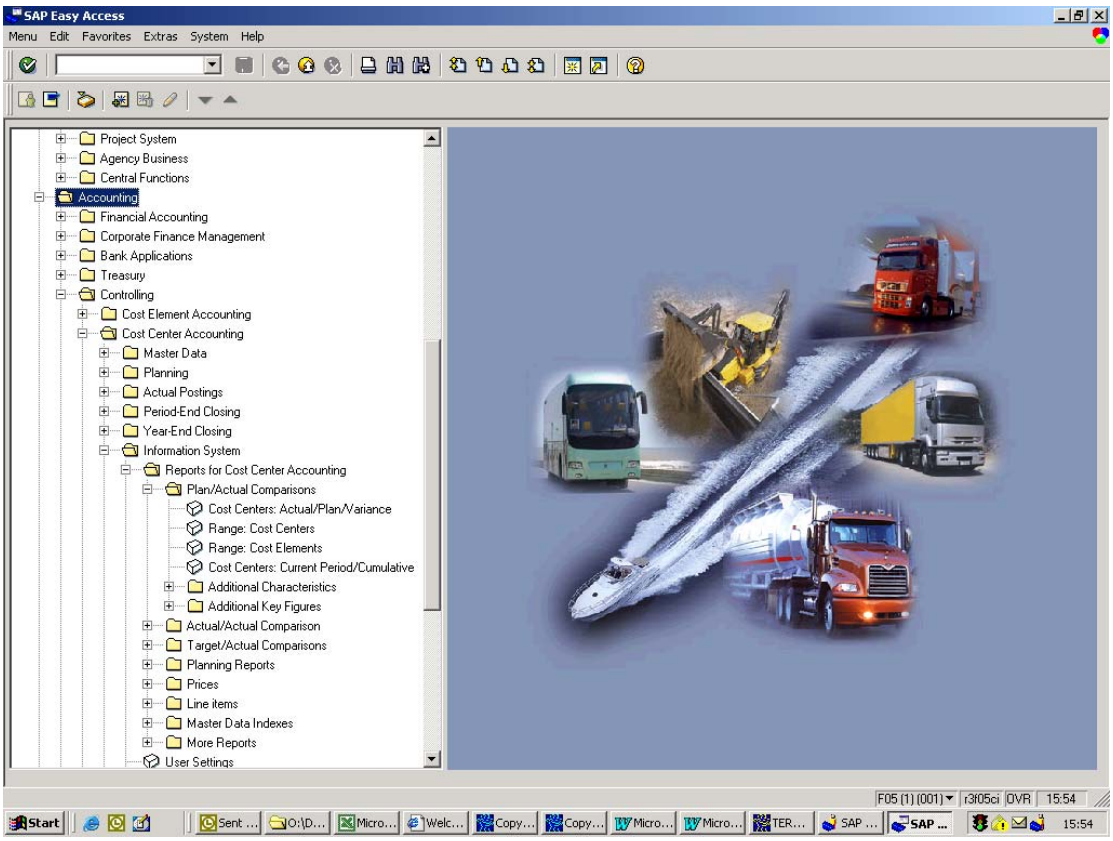

Figure 21. Screenshot of SAP R/3 FI/CO.[191]

Other systems

A few systems are developed by external firms. An example of this is FSS[192]
It is developed by MA systems in Lund, Sweden. The following is a description of MA-systems collected from their main page on the Internet: *MA-system in Lund is a knowledge-based company within logistics, with high competence in system solutions, consulting and training*.[193]

Planned IT systems

As a step towards co-ordination between body-builders the VBC' main office has planned the implementation of an ERP system at VBoF. The final decision to install has not yet been taken, but according to the IT strategy at VBC the intention is to implement ERP across all the fully owned production plants. The Volvo Buses ERP system has been named the Bus Master, and it is a modified SAP R/3 system. According to the plans a possible implementation will take place during 2006 to 2007.

[191] Provided by IT coordinator. FI/CO is the financial module of SAP R/3
[192] FSS. Svenska: Förrådstyrningssystemet. Translation: Warehouse Management System
[193] http://www.masystem.com/

The Bus Master is expected to bring advantages such as improvements in logistics, reduced IT costs due to integration and automatic updates, concentration of skills and competence, access to local interfaces from other plants and common organisational structure. To benefit the most from the ERP system, a strong connection between processes, the organisation and its systems environment is desirable. SAP R/3 is meant to provide a state of the art systems environment, which will make business processes more effective through a higher degree of automation and communication between process activities.[194]

The Finance Master, which is a part of the SAP R/3 finance module, is already in use at VBoF. The Finance Master has a strong interface to the Bus Master, however the existing module is not a prerequisite for a Bus Master implementation.

The Bus Master has already been rolled out at other Volvo plants, which is one of the reasons why an implementation is considered necessary at VBoF. Since the creation of the Bus Master there have been changes made to the system at the different implementation sites. VBoF is the largest manufacturer of chassis and has a rich variety of products; hence the Bus Master is expected to need additional modifications to conform to the plant. The IT-coordinator expressed the following:

> *I see a risk in that VBoF is larger than people generally think. Perhaps this may lead to the Bus Master implementation only applying to certain parts of the organisation.*

There are different expectations and opinions towards the Bus Master among employees at VBoF. Some refer to the implementation in Säffle body-builder plant, which turned out to be problematic. There are concerns that an implementation of the Bus Master would require a lot of resources. The IT-coordinator:

> *The complexity of standardised systems requires time. Everything becomes very much ruled by IT, what happens to the business?*
>
> *Suppose all plants will implement the Bus Master. A common organisational development is good, but it is a long journey. It will be problematic to set aside resources from the daily business operations.*

The interviews showed that several think an ERP would be a good way to straighten the systems environment at VBoF. The systems administrator:

[194] VBC (PowerPoint) presentation of Bus Master (2002.06.12, Rolf Nordberg)

> *We do not really have any alternatives. The way I see it we are stuck in a corner and are unable to carry on like this if we want to meet the demands of the future. The Body-builders will probably become more involved through R/3.*

The system developer made a metaphor of the systems environment at VBoF as *an old car with a good engine*. In order to bring order and improve people's conceptual view of the information systems it may be worthwhile to *put the engine in the package of a Porsche*.

> *SAP may be a good way to bring order in an old car with a good engine.*

However the opinions at VBoF differ, one relatively common view is that the organisational IT strategy must be supported across all levels. A strong organisational engagement from the top is lacking. The production engineer:

> *The main office, ARHK, in Gothenburg delays the decision and is unable to get going. It is a complex organisation; every little change in the systems causes consequences here and there. ARHK claims we are heading in a certain direction, but how much and in what way?*

5 Analysis

*Following SSM, this section is devoted to the **comparison of models with perceived real situation**. This as a part of SSM can be seen in figure 22.*

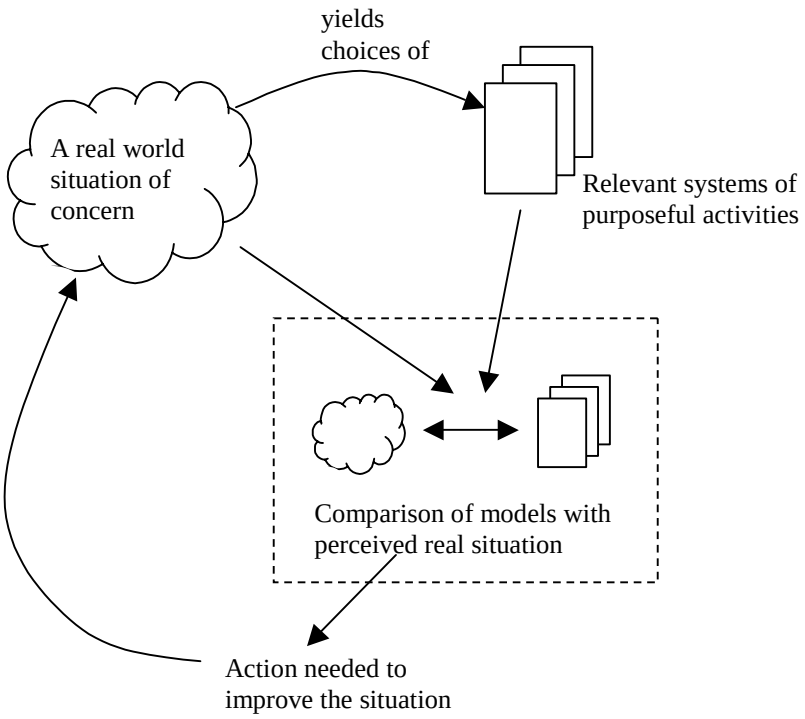

Figure 22. Comparison of the models with perceived real situation.

5.1 Comparison of models with perceived real situation

Themistocleous' model for EAI adoption is used to give structure to comparison of models with perceived real situation as in section 3.3, relevant systems of purposeful activities. Thus, a detailed analysis of the theory and results follows, on the basis of eight key factors derived from the model for EAI adoption, presented in section 3.1. The factors are benefits, barriers, costs, external pressure, evaluation framework, IT infrastructure, IT sophistication and support. The chapter is finalised with a summary of the analysis.

5.1.1 Benefits

Operational

The ERP implementation at VBoF today consists only of the Finance Master. According to the SAP section in 4.1.5 the Bus Master will possibly be implemented in 2006-2007. But both the Finance Master and the Bus Master together do not replace all old systems, therefore VBoF may not fully benefit operationally from its ERP implementation.[195] The systems that are not replaced by SAP will be kept in use if they are still considered needed. That means that the implementation of SAP at VBoF will become a mixture of ERP and EAI solutions, as it seems today. This is normally the case in real-world situations. The (reduced) benefits of ERP may not be recognised yet because the implementation of Finance Master is quite new. The system structure at VBoF will continue to be complicated even though additional parts of SAP will be implemented. The major benefit of EAI will remain even though ERP modules coexist with other systems, i.e. flexibility of integration.[196]

Managerial

The system map of the production plant shows a complicated situation. VBoF would benefit from a simpler structure of systems in order to have a better overview in order to manage the factory easier.[197] The necessity of informal communication to drive the company forward has disadvantages, e.g. some decisions may be contradicted. If more communication could flow through formal channels maybe this problem would be reduced. The use of EAI or ERP would improve the quality of data and thereby contribute to fewer errors and reduce the need of informal communication when something goes wrong.[198] In

[195] Chen, I.J. (2001). *Planning for ERP systems: analysis and future trend.* p. 384
[196] Themistocleous, M. (2004) p. 95-97
[197] Chen, I.J. (2001). p.374
[198] Themistocleous, M. & Irani, Z. (2003)

the case of EAI when legacy information systems are kept, there may be advantages when something must be changed that the system normally not allows.

Technical

VBoF would draw much use of common platforms and the technical synergies following an ERP implementation. VBoF's systems today consist of multiple databases, vendors and interfaces. The technical problems are many and there have been problems managing the wide area of different systems. The use of EAI would look easier with the reuse of legacy information systems.[199] However, the use of EAI requires a thorough development of existing systems in order to suit the standards of today's measures due to the fact that many systems are too old.

Strategic

The bus business is not making huge progress and has never done historically; there is a need for increased competitiveness.[200] ERP could contribute to that by improving the means of communication which today mostly consist of informal information sharing but some things still require tête-à-tête communication to reach its audience. However, the use of ERP may remove the systems that are tailor-made connected to critical business processes.[201] In order to be competitive these systems may be of great use. It is good when systems are customized as the production engineer put it.

Organisational

The organisation is in need of standardisation of processes due to the diversity of its systems and thereby also processes. The plant manager realises this and is working towards a flatter and more flexible organisation. This can be well supported by the implementation of an ERP system. The organisation must also make sure the process is streamlined across the whole value chain. This can be achieved by the use of e-business in the EAI case[202] but also with support from ERP. In the case of ERP though, suppliers and vendors are limited to the same ERP system in order to make benefits from the ERP choice.

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[199] Light, B. (2001). p.221
[200] Chen, I.J. (2001). p.378-381
[201] Light, B.(2003).
[202] Ersala, N., Yen, D.C. & Rajkumar, T.M. (2003). *Enterprise Application Integration in the electronic commerce world*. p. 71

5.1.2 Barriers

Operational

VBoF's experience with SAP has been characterised by difficulties of adaptations to users needs, both, educational and user-interfaces. This may be an expression of unaccustomedness to the new system. SAP has only replaced some systems at VBoF and the most system supported critical processes still use customised systems. The knowledge if existing IT systems are limited to a few persons so there is a growing risk that the IT sophistication will decline if existing systems are kept. On the other hand SAP is a large company and updates will probably be available for a long time but that is also hard to predict.

Managerial

The central issue to maintain at managerial level is the clarity of processes.[203] If processes are clear it is easier to implement and use either EAI or ERP. The existing system with Financial Master and Bus Master architecture requires the integration of legacy information system or replacement of ditto. The choice of ERP supports the plant manager's vision of a flatter organisation and at the same time centralised control over information. That can let main office have more control and simplify issues for responsibility of information quality.[204] One disadvantage with ERP is that a standardised solution does not allow necessary changes (outside system defaults) when something goes wrong. One disadvantage with EAI is that a collection of tools for integration needs to be found and used over to whole organisation. [205]

Technical

The implementation of SAP R/3 at VBoF is meant to be made incrementally. The customisation of SAP has been according to a strategy of keeping SAP 80% as it is and modifying 20%. The Bus Master has been modified to a certain degree, even though it is a sound idea not to modify ERP implementation too much. [206] As mentioned in the previous section the ERP modules have to be integrated with legacy information systems. This is a major technical challenge, both difficult and expensive. However, if VBoF had chosen EAI techniques to integrate legacy information systems the problem had still existed, but integration had been the normal case for all systems.[207] The IT knowledge needed for integration is expensive in either case.

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[203] Themistocleous, M. (2004) p.97
[204] Davenport, T.H. (1998). p. 127
[205] Linthicum, D. (1999). *Enterprise Application Integration from the Ground Up.*
[206] Bingi, P., Sharma, M.K., & Godla, J.K. (1999). *Critical issues affecting an ERP implementation.*
[207] Ersala, N., Yen, D.C., & Rajkumar, T.M. (2003) . p. 71

Strategic

The processes at VBoF are fully dependent on IT and therefore it is of strategic importance. The legacy information systems at VBoF are customised to suit the processes but the legacy information systems are not perfect and do not fully suit the processes. Furthermore, the results indicate that standardised software would be even more deviant for the processes than existing legacy information systems. This means that the legacy information systems better can support IT as strategic advantage but this can be limited to certain processes. IT systems are a political issue at VBoF and it could benefit from ERP promises of easier control of responsibilities.[208]

Organisational

The organisational structure is old and rigid and change is slow in the organisation. This means that both strategic choices of implementation will be difficult. Fear of loosing control and power is a political issue that also affects the implementation. The main point is that weather it is ERP or EAI that is chosen, a change must probably occur and it will be difficult anyhow. The company must take this change and develop its organisation; in the case of EAI to be more efficient and in the case of ERP to suit ERP practices.[209] The 20% customisation of SAP implementation is a modification made to suit differences between plants. The processes in other factories can differ from VBoF.[210]

5.1.3 Costs

Because many of the benefits are intangibles, it is difficult to properly calculate the expected return of IT investments. Thereby it is often hard to justify an enterprise system implementation, which may result in benefits like increased process efficiency, improved customer service and real time data.[211]
In order to support the high product variety at VBoF an extensive configuration of ERP would be needed. Such a customisation brings additional design costs in the implementation phase. On the other side, by not customising the system, the organisation risks future compromise costs as a result of the mismatch between business processes and its IT. [212] It is a difficult option that VBoF needs to deal with. The complicated issue of not knowing the correct financial figures of each alternative brings a lot of uncertainty.

In contrast, by choosing EAI VBoF does not have to consider the options of design costs versus compromise costs. Since EAI lets the organisation keep its

[208] Themistocleous, M. (2004). p. 97-98
[209] Bingi et al. (1999).
[210] Themistocleous, M. (2004). p. 96-98
[211] Pearlson, K.E. (2001). p. 117-118, 182-183
[212] Gattiker, T.F. & Goodhue, D. L. (2003). p. 433

customised legacy information systems, the problem is not as critical. However, the EAI buyer needs to find out which integration package is the most appropriate. Even though EAI allows integration regardless of the system type, a lot of time and efforts, hence money, are needed to create the optimal software solution. [213]

One major cost factor is the fee of hiring consultants.[214] Both ERP and EAI require new routines to be learned, and resources are needed to educate the staff and teach them how to handle new tasks.

One may conclude that no matter the choice, both ERP and EAI would bring extensive costs and there is a lot of uncertainty as to how extensive these costs would be.

5.1.4 External pressures

Increased competition and need for trading partners are factors that intensify the external pressure. The means to match this pressure may be to rebuild the systems environment.[215]
There may be a competitive risk of letting an external vendor build up the systems environment. In the case of ERP systems the competitive benefit will come to those who may achieve a better fit between their processes and the best practices of the system.[216] In principle processes have to be modified to fit the ERP system. This is the opposite procedure to what generally has been the case of legacy information systems, which were developed according to the way business was done.[217] Legacy information systems may be a strong competitive tool since they during their lifetime have been adjusted to suit business processes.[218]

Employees at VBoF have different opinions of the value the existing systems environment may bring. On one hand the self-developed improvements done to the systems have made them well suited to support operations, on the other hand the system islands is thought of as preventing an efficient flow of information. VBoF has a high product variety as a response to external demands. Processes that match this kind of complex production are vital to the organisation.

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[213] Themistocleous, M. & Irani, Z. (2002).
[214] Bingi et al. (1999).
[215] Themistocleous, M. (2004) p.88
[216] Chen, I.J. (2001). p. 379
[217] Davenport, T.H. (1998). p. 125
[218] Light, B. (2003).

Even though ERP systems have been criticised of not being able to support the relation to trading partners, attempts has recently been made to provide additional tools to link the ERP with SCM techniques.[219]
Through EAI, members of a supply chain can build a common systems environment that unifies all information systems. Hence EAI already supports integration at an inter-organisational level.[220]

The planned implementation of the Bus Master at VBoF is a way to improve the inter-organisational activities. The improvement comes through achieving organisational structure across all the plants of VBC.

5.1.5 Evaluation framework

The experience of VBoF from the authors' views is that no accepted evaluation framework is used to aid matching the business with different alternatives in the market. [221] Neither does any other framework for EAI selection appear. And this study constitutes one of few (or none) documents of comparison between ERP and EAI at VBoF. It can be a major disadvantage not to have evaluated different alternatives and just rush into one because of e.g. informal contacts. This applies to comparison between ERP and EAI and ERP vendor selection and EAI vendor selection.

The results point to lack of clarity from top management and lack of well-substantiated support from employees. These are two reasons that is a common for failure of enterprise system implementation.[222]

The system map is very complicated and few know the true structure of it. The processes are supported by this complicated structure. That can mean that business processes are complicated and needs refinement too. This may be worth considering but it is important to note that the interviews only point to a complicated system structure, not for certain a complicated business process.

5.1.6 IT infrastructure

Unifying the IT of the organisation and make its processes efficient are both ways to reduce operational costs and improving efficiency. As pointed out in the area of ERP as well as EAI, companies may achieve this firstly by implementing the re-engineering of processes to make them work above the organisational functions. Secondly by integrating the information systems, to fully support the

[219] Chen, I.J. (2001). p. 381-382
[220] Themistocleous, M., Irani, Z. & Love, P.E.D. (2003). p. 4
[221] Themistocleous, M. (2004). p. 88
[222] Umble et al. (2003). p. 250

processes.[223] When implementing an ERP system, organisations bring about integration through replacing the old information systems in favour of ERP modules. This is in contrast to EAI, where the organisation's systems are kept as they are with additional integration tools to enable integration between them.

The IT infrastructure at VBoF consists of a mixture of systems that are either self-developed, inherited from VTC or implemented from external vendors. The number of information systems is extensive and each one of them handles separate parts of the organisational processes. The plant manager at VBoF wants to make sure the organisation is process oriented to the highest degree. Others comment that the operational processes should initiate the IT, not the other way around. Even though information systems preferably are being developed with respect to operational processes, such procedures do not always seem to be the case at VBoF. Instead the IT is often seen as the driving factor when new projects are carried out.
System modifications have been carried out in order to make the business more efficient, e.g. adaptation to EDI technology and adjustments to the construction data system, KOLA. Those changes have brought business improvements.
The information systems developed in-house, i.e. BUMMS, have made the organisation more agile. Earlier the organisation was controlled by the construction systems inherited from VTC. The BUMMS systems environment is by some considered to be well adapted to support the processes, however old-fashioned the interfaces are.
The financial department uses the financial master, i.e. modules of SAP R/3 to support the economic activities. The financial master implementation has resulted in improved overview and handling of information.

To achieve improved efficiency, the emphasis on business processes is required.[224] Irrespective of the choice of either fully replacing old systems or just using technologies to integrate them, there is a need to tear down the walls surrounding functional entities. In order to support a process orientation, the IT infrastructure should conform to the flow of business processes.

At the production plant VBoF it is stated that IT has rationalised the processes. Due to the variety of chassis produced at the factory, IT is a necessity to manage the growing flow of information. However, there is a concern caused by the handling of information at VBoF. Separate systems use their own databases and it is hard to get a good overview. People see the systems environment at VBoF as a sea of system islands, separated from each other. When meetings take place to

[223] Themistocleous, M. (2004). p. 88
[224] Gunasekaran, A. & Nath, B. (1997). pp. 92-93

discuss future IT development, the focus of interest is on integrating the use of information systems in different departments.

Implementing an enterprise system brings efficient organisational integration. ERP enables the sharing of common data. It provides synergetic modules, adapted and standardised according to a specific industry. Due to the conformation to best practices, the modules provide improvements to the business processes. Therefore, an organisation that chooses to implement an ERP, will have to change according to those best practices.[225] In an ERP implementation former systems are replaced with the modules and an efficient flow of information is enabled.[226] The synergetic effect of the modules puts the emphasis on the processes.
EAI enables common data to be shared across the organisation just like ERP does. However it does not provide best practice modules, instead it assumes that the best practices are already inside the organisation. EAI gives superiority to business processes; hence the company implementing it needs to reengineer its processes accordingly. Other than that, EAI permits the keeping of legacy information systems providing that additional technology packages are implemented to enable satisfactory integration and efficient flow of information. [227]

5.1.7 IT sophistication

The production plant VBoF strives for decentralisation, while its main office seems to be heading towards centralisation. The structure of few hierarchical levels promotes the communication and the openness of informal information sharing at VBoF. The organisational culture is considered to be free and there is room for autonomy. Still, some would like to see a more centralised management and a higher degree of authority in order to be more effective.
Several interviewees stated that the informal communication is a necessity, since the IT environment does not solve effective information sharing.

An ERP system supports the decentralisation of an organisation, since the emphasis on business processes flattens the hierarchical structure. [228] As pointed out earlier, when it comes to implementation costs a company benefits the most from an ERP by not customising it. However, employees are facing major changes brought to them by the new IT solution. Employees are well practiced in handling the present organisation, but an ERP brings changes as well in the area of operational tasks and staff positions as in the use of software. There is a need

[225] Pearlson, K.E. (2001) p. 99
[226] Chen, I.J. (2001). p.378-381
[227] Themistocleous, M. (2004) p. 97
[228] Davenport, T.H. (1998). p. 127

of extensive training and education to enhance the understanding of the enterprise system and its consequences.[229]
In the case of EAI, the keeping of legacy information systems affects IT sophistication in a positive as well as in a negative way. Positive because the fine adjustments during its lifetime have created a customised system, well tuned to suit the operational processes. Negative because the skills to manage the systems are often tied to the tacit knowledge of employees who have been there from the start. There is a risk that the ability to efficiently benefit from legacy information systems disappears when those employees leave the organisation.[230]
Both enterprise solutions discussed in this thesis promote the integration of the organisational systems environment. Integration means that common data are shared between employees. It is therefore important that all users understand that their handling of information affects the whole organisation.

VBoF has not fully gained approval for the Bus Master. The lack of a clear vision of the future IT strategy is clearly indicated. The general understanding at VBoF seems to be divided in two parts; one that perceives the Bus Master as too standardised to be able to support the processes and one that thinks it would help to structure the organisation.

5.1.8 Support

Due to the relatively small IT department at VBoF the organisation is in need of consultants to lead the implementation of enterprise systems. There are many ungrounded opinions that do not support either ERP or EAI or existing legacy information systems. This creates confusion in the organisation that makes issues concerning systems a dangerous subject in discussions.

The choice of SAP in an organisation like VBoF is a good choice based on the fact that SAP targets the automotive industry and that VBoF is part of the Volvo Group, which also implements SAP. The purpose for the Bus Master is to increase the communication with bodybuilders. These are distributed across the world and the SAP modules have been modified differently in each location, with 80% kept as it is and 20% customised. The reason for this has been to modify according to each locations needs and specialities.

With one ERP and several legacy information system vendors, the business has spread its risks for future absence of updates and support. If a solution towards full implementation of SAP were chosen, then there would be only one sole vendor. This can be an advantage as the same firm makes updates and support.

[229] Umble et al. (2003). p. 246
[230] Light, B. (2003).

This simplifies the process of updating. However, it can also be a disadvantage if SAP does not meet VBoF's requirements of timing for updates. VBoF can end up in the hands of SAP. This can be a strategy disadvantage that can lead to inflexibility and diminished power. When implementing EAI the dependency on vendors decrease, since the risks may be spread. If legacy information systems are kept, as in the case of EAI, it is important that support and future updates are secured, either through the vendor or the internal IT-department.

5.2 Summary of analysis

Table 2 is a summary of the analysis of theory and results. Some features of IT strategies apply to both EAI and ERP while most features differ the two strategies.

	EAI	**ERP**
Benefits	• Better communication • Better quality of data • Flexibility • Systems tailor-made to critical processes	• Better communication • Better quality of data • Common platform • Standardisation of processes
Barriers	• Systems knowledge may disappear from organisation • Clarification of processes needed • Centralisation • Integration with ERP system (if applicable) • System not adapted to processes • Organisational change	• Vendor has system knowledge • Clarification of processes comes with system • Decentralisation • Integration with legacy systems • Legacy information systems not well-developed • Organisational change
Costs	• Difficult to justify financially • Consultants costs • BPR costs • Integration costs	• Difficult to justify financially • Consultants costs • BPR costs • Design costs vs. Compromise costs
External pressures	• Systems adapted to operational processes • External demands requires efficient processes • Promotes e-business	• Processes adapted to systems • External demands requires efficient processes • Requires additional tools or same ERP to achieve e-business
Evaluation framework	• Evaluation framework exists but has not been used in the case of VBoF • Lack of clarity from top management • Lack of substantiated support from employees	
IT infrastructure	• Achieves integration • Mature market for inter organisational integration	• Achieves integration • Immature market for inter organisational integration
IT sophistication	• Employees have knowledge of systems	• Knowledge of systems must taught
Support	• Multiple vendor	• Single vendor

Table 2. Summary of analysis.

6 Conclusion

Traditionally IT in itself has been the initiator of system development at VBoF. This is a conduct that is not in accordance with the ideal implementation theories of enterprise systems. In fact, to let the IT alone be the pushing factor is not even in accordance with the general understanding at VBoF. The systems environment today resembles a sea with isolated islands. There is a less customised heritage from VTC; a group of well conformed but old-fashioned core systems and in order to make the economic area more efficient there has been an implementation of a financial ERP module. The systems environment at VBoF is sprawling at different directions.

Staff at VBoF appreciates the freedom and openness derived from the decentralised and informal organisational culture. However, there is still a need for structure, a clear view and future strategy. Those are factors that should be provided for by top management, i.e. the organisation's main office executives.
The vague structure of the IT strategy is mirrored in VBoF's collection of information systems.

Despite the general view that communication among employees is very good, the flow of information is to a large extent hindered by the functional boundaries. People have knowledge concerning their operational tasks and the handling of information systems supporting those tasks, but few know what is going on inside the neighbouring information system even though they take part of the same process. It seems like integration of information systems at VBoF is very much desirable.

The implementation of SAP's FI/CO module in the Finance Master was a small step towards an ERP strategy as since it was only implemented in one part of the organisation. A future implementation of SAP Bus Master would result in additional modifications of modules and vendor updates would therefore be complicated. Furthermore, the Bus Master would only be implemented in some parts of the organisation. The Finance Master and Bus Master would not constitute a complete ERP enterprise system and would not unleash the full potential of ERP.

Employees at VBoF pointed to the rich product variation at the plant, and some of them stated that only customised information systems could match the production demands.

The conclusion from above mentioned is as follows. VBoF needs a more structured systems environment, a clearer IT strategy and integration of information systems. All this may be provided for by ERP as well as EAI.

However, there are concerns that the Bus Master is too modified. Some of the ERP advantages an organisation may benefit from, e.g. updates from the vendor, would to a certain degree be lost in the Bus Master. The implementation would not include all parts of the plant, which brings additional drawbacks, such as unsatisfactory integration. Furthermore, the VBoF production may be constrained by an information system that is not developed to meet specific operational demands. Thus the authors would recommend an EAI implementation in favour of ERP in the case of VBoF.

It should be mentioned though that with the Finance Master in use and with Bus Master implementation within reach, it could be beneficial to continue towards a full implementation of ERP. The ERP advantages would appear in a wider organisational perspective, where multiple sites use the same system. However that would not be in the scope of this thesis.

7 Discussion

The purpose of this thesis was to describe the systems environment in an organisation and to evaluate two alternative IT strategies. With that in mind it may be stated that the purpose has been fulfilled. The thesis presents a description of the systems environment at VBoF and it gives a theoretical evaluation of the two IT strategies ERP and EAI. It also reaches the conclusion as to which of the two enterprise systems is best suited to be used at VBoF.

However, in this case the interesting question might not be if, but rather how the purpose was fulfilled. Are there things that should have been done differently? Could things have been made clearer?

To begin with the interviews might have given a better result if they were conducted at a later stage in the process. Due to the adjustment of employees' summer vacation, the interviews were carried out before the procedural structure of the thesis was fully elaborated. By performing the interviews in a later stage it would have been easier to straighten some of the question marks that came up during the gathering of material.

As a consequence of the above mentioned it was difficult to prepare the theory of science in detail. Preferably the theory of science should have been given more emphasis. However, it was clear that it would be conclusive research and that the data collection would be qualitative.

Themistocleous model for EAI adoption is, as the name implies, originally developed for EAI evaluation only. The use of this model required thorough motivation for use as ERP evaluation. A model for ERP and EAI evaluation would have made this study clearer.

7.1 Suggestions for future research

There are many areas that could benefit from further research.

- Development of a model to evaluate different IT strategies to achieve an enterprise system.
- Detailed studies of evaluation frameworks in organisations.
- Further studies regarding justification of enterprise system investments.

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17:50 12 September 2004

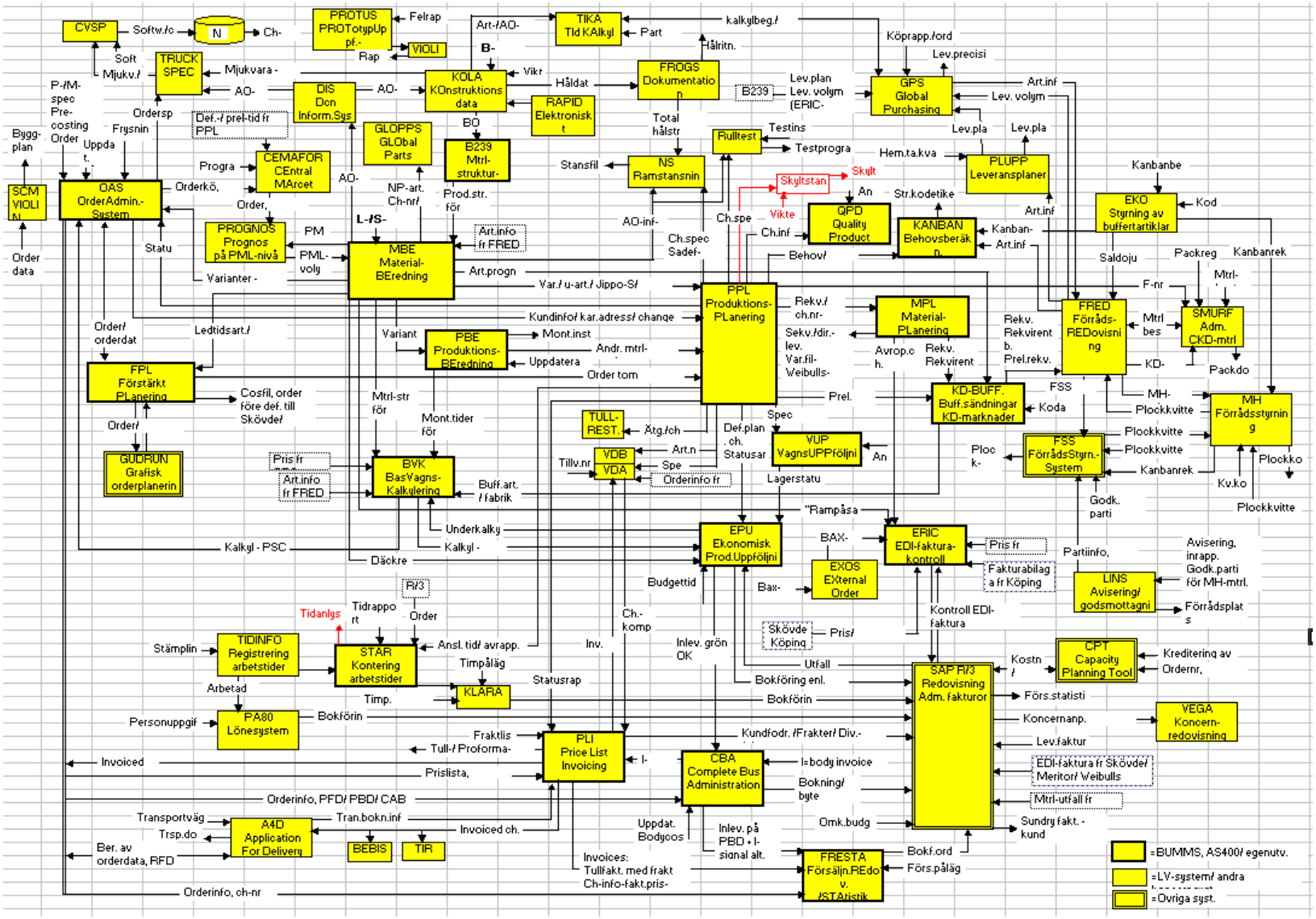
http://www.webster-dictionary.org
15:00, 18 august 2004
22:00, 26 august 2004

http://www.masystem.com/
12 September 17:50

9 Appendices

9.1 Appendix A

System map provided by the IT coordinator of VBoF.


CVSP
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Mjukv./
TRUCK SPEC
Mjukvara -
AO-
P-/M-spec
Pre-costing
Order
Ordersp
Frysnin
Uppda t.-
Bygg-plan
SCM VIOLI N
Order data
OAS OrderAdmin.-System
Orderkö,
Order,
Statu
Varianter -
Def.-/ prel-tid fr PPL
CEMAFOR CEntral MArcet
Progra
PROGNOS Prognos på PML-nivå
PM
PML-voly
PROTUS PROTotypUppf.-
Felrap
Rap
VIOLI
DIS Don Inform.Sys
GLOPPS GLObal Parts
B-
KOLA KOnstruktions data
Vikt
RAPID Elektronisk t
B239 Mtrl-struktur-
BO
Prod.str. för
NP-art. Ch-nr/
L-/S-
MBE Material-BEredning
Art.info fr FRED
Art.progn
Var./ u-art./ Jippo-S/
Kundinfo/ kar.adress/ change
Ledtidsart./
Order/ orderdat
FPL Förstärkt PLanering
Cosfil, order före def. till Skövde/
Order/
GUDRUN Grafisk orderplanerin
Variant
PBE Produktions-BEredning
Mont.inst
Andr. mtrl-
Uppdatera
Order tom
Mtrl-str för
Mont.tider för
Pris fr
Art.info fr FRED
BVK BasVagns-Kalkylering
Buff.art. / fabrik
Underkalky
Kalkyl -
Kalkyl - PSC
Däckre
TIKA Tid KAlkyl
kalkylbeg./
Part
Art-/AO-
Hålritn.
FROGS Dokumentation
Håldat
Total hålstr
Stansfil
NS Ramstansnin
AO-inf-
Ch.spec Sadef-
Rulltest
Testins
Testprogra
Skyltstan
Skylt
An
Vikte
Ch.spe
Ch.inf
QPD Quality Product
Behov/
B239
Lev.plan Lev. volym (ERIC-
GPS Global Purchasing
Köprapp./ord
Lev.precisi
Art.inf
Lev. volym
Lev.pla
Hem.ta.kva
PLUPP Leveranspläner
Str.kodetike
KANBAN Behovsberäkn.
Kanban-
Art.inf
Kanbanbe
EKO Styrning av buffertartiklar
Kod
Saldoju
Packreg
Kanbanrek
Mtrl-
F-nr
SMURF Adm. CKD-mtrl
Packdo
FRED Förråds-REDovisning
Mtrl bes
KD-
MH-
Plockkvitte
MH Förrådsstyrning
Plockko
Kv.ko
Plockkvitte
FSS FörrådsStyrn.-System
Kanbanrek
Godk. parti
PPL Produktions-PLanering
Rekv./ ch.nr-
Sekv./dir.-lev.
Var.fil-Weibulls-
Prel.
MPL Material-PLanering
Avrop.ch.
Rekv. Rekvirent
Rekv. Rekvirent b. Prel.rekv.
KD-BUFF. Buff.sändningar KD-marknader
FSS
Koda
Ploc k-
Spec
Def.plan. ch. Statusar
VUP VagnsUPPföljni
Lagerstatu
TULL-REST.
Åtg./ch
VDB
VDA
Tillv.nr
Art.n
Spe
Orderinfo fr
"Rampåsa
EPU Ekonomisk Prod.Uppföljni
Budgettid
Inv.
Ch.-komp
Inlev. grön OK
Skövde Köping
Pris/
Utfall
Bokföring enl.
Bokförin
Kundfodr. /Frakter/ Div.-
I-body invoice
Bokning/ byte
Omk.budg
ERIC EDI-faktura-kontroll
Pris fr
Fakturabilaga fr Köping
Kontroll EDI-faktura
BAX-
EXOS EXternal Order
Bax-
Partiinfo,
LINS Avisering/ godsmottagni
Avisering, inrapp. Godk.parti för MH-mtrl.
Förrådsplats
SAP R/3 Redovisning Adm. fakturor
Kostn /
CPT Capacity Planning Tool
Kreditering av Ordernr,
Förs.statisti
Koncernanp.
Lev.faktur
EDI-faktura fr Skövde/ Meritor/ Weibulls
Mtrl-utfall fr
Sundry fakt. -kund
VEGA Koncern-redovisning
Bokf.ord
Förs.påläg
FRESTA Försäljn.REdov. /STAtistik
Invoices: Tullfakt. med frakt Ch-info-fakt.pris-
Uppdat. Bodycos
Inlev. på PBD + I-signal alt.
PLI Price List Invoicing
I-
CBA Complete Bus Administration
Fraktlis
Tull-/ Proforma-
Invoiced
Prislista,
Orderinfo, PFD/ PBD/ CAB
Tran.bokn.inf
Invoiced ch.
A4D Application For Delivery
Transportväg
Trsp.do
Ber. av orderdata, RFD
BEBIS
TIR
Orderinfo, ch-nr
R/3
Tidrapport
Order
Tidanlys
Ansl. tid/ avrapp.
Timpåläg
KLARA
Timp.
Statusrap
Stämplin
TIDINFO Registrering arbetstider
STAR Kontering arbetstider
Arbetad
PA80 Lönesystem
Personuppgif
Bokförin
=BUMMS, AS400/ egenutv.
=LV-system/ andra
=Övriga syst.

9.2 Appendix B

Identifiering av verksamhetens primära Intressenter

Vilka är verksamhetens primära intressenter?
Vad anser ni att era intressenters förväntningar på denna verksamhet är?
Vad levererar denna verksamheten till sina intressenter?

Funktionella Aspekter

Beskriv din del av processen?
Vilka arbetsuppgifter ingår för att utföra din del av processen?
Vilka hjälpmedel har du för att klara dina arbetsuppgifter?
På vilket sätt stödjer IT ditt dagliga arbete?
Vilka IS finns? Vilka funktioner fyller de?
På vilket sätt har IT bidragit till verksamhetens processer?
På vilket sätt påverkar verksamhetens IT din arbetsvardag?

Strukturella Aspekter

Vem påverkar utformningen av verksamhetens processer?
Vilka olika ansvarsområden har ni i verksamheten(internt, externt)?
Hur fungerar kommunikationen dem emellan?
Hur ser samarbetet ut mellan olika avdelningar som berörs av verksamheten?
Vem ansvarar för informationskvaliteten?
Vilka bidrag har IT lämnat till Intressenternas information och tjänster?
Vilket bidrag har IT gett till kvaliteten på information och tjänster i verksamheten?

Infologiska Aspekter

Vilka olika slags kommunikationsformer är tillgängliga för dig?
Vilka problem upplever du med informationsförsörjningen?
Hur är informationen anpassad till dina arbetsuppgifter?
Vilken slags kunskap behöver du för att kunna använda verksamhetens informationssystem?
Hur viktig är den personliga kommunikationen i verksamheten?
Vilka aktiviteter i verksamheten kräver personlig kommunikation?
Vilka informella informationsvägar finns?

Sociokulturella Aspekter

Hur uppfattar ni organisationskulturen?
Hur upplever du din arbetsmiljö?
Vad tycker du är kännetecknande för verksamheten?

IS/IT miljö

Hur många system stödjer verksamheten och hur är dessa sammankopplade?
Vilka IT baserade tjänster har ni?

I vilken omfattning används dessa?
Vilka andra organisationer har ni samarbete med?
Hur mycket av detta samarbete är IT-baserat?

Syn på framtiden

Hur ser du på utvecklingen av IS-arkitekturen?
Vad vet du om framtida utveckling av IS-arkitekturen?
Hur ser du på framtiden och de konsekvenser som ett ökande i användningen av IT för med sig?